

REVIEW

DERLEME

ACUTE STROKE NURSING: STANDARDS AND PRACTICAL APPLICATIONS*

TURKISH CEREBROVASCULAR DISEASE SOCIETY AND THE SOCIETY OF NEUROLOGICAL NURSING JOINT STRATEGY PROJECT

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ABSTRACT

Intravenous thrombolysis and acute neurointerventional therapies such as or neurothrombectomy / aspiration should be completed by two approaches in order to achieve meaningful success in acute stroke clinical practice. The first is the "acute stroke system of care" that will ensure the timely and safe transfer and triage of acute patients to the centers, and the second is the management of these patients in the hospital stay during the acute period. In-hospital acute stroke practice is a comprehensive process that begins in neurological intensive care or stroke units, and the results are directly affected by the level and quality of stroke nursing practice. Acute stroke nursing consists of, but not limited to, effective and safe application of stroke-specific treatments; management of blood pressure, blood sugar, swallowing, nutrition and hydration; patient's posture, mobilization, early physical therapy and rehabilitation plan; monitoring of consciousness and

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neurological examination; venous thromboembolism, gastric ulcer and infection prophylaxis; prevention of complications such as KIBAS, infection, respiratory failure and bleeding and intensive care unit management and very effective patient, patient relative and team interaction and communication. This manuscript presents the fundamental practices and metrics adapted for our country from many current guidelines of acute stroke nursing.

Keywords: Stroke nursing, thrombolysis, thrombectomy, stroke unit, complication, quality, metric.

İNME HEMŞİRELİĞİ: STANDARTLAR VE PRATİK UYGULAMALAR KILAVUZU

TÜRK BEYİN DAMAR HASTALIKLARI DERNEĞİ VE NÖROLOJİ HEMŞİRELİĞİ DERNEĞİ ORTAK STRATEJİ PROJESİ

ÖZ

Akut inme klinik pratiğinde intravenöz tromboliz ya da trombektomi / aspirasyon gibi nörogirişimsel tedavilerin başarıyı yakalayabilmesi için iki uygulama ile desteklenmesi gerekir. Bunların ilki akut hastaların merkezlere zamanında ve güvenli triyajını sağlayacak olan “akut inme sevk ve idare sistemi”, diğeri ise bu hastaların akut dönem hastane kalışındaki uygulamalarıdır. Hastane uygulamaları nöroloji yoğun bakım veya inme ünitelerinde başlayan bir süreç olup sonuçları hemşirelik uygulamalarının kalitesinden doğrudan etkilenir. Akut inme hemşireliği inme spesifik tedavilerin etkin ve güvenli uygulaması, kan basıncı, kan şekeri, yutma, nütrisyon ve hidrasyonun yönetimi; hastanın postür, mobilizasyon, erken dönem fizik tedavi ve rehabilitasyon planı; bilinç ve nörolojik muayenenin takibi; ayrıca venöz tromboembolizm, gastrik ve enfeksiyon profilaksisi; KIBAS, enfeksiyon, solunumsal yetmezlik ve kanama gibi komplikasyonların önlenmesi ile yoğun bakımda hasta takibi ve çok etkili hasta, hasta yakını ve takım etkileşimi ve iletişimini içerir. Bu derleme akut inme hemşireliğinin birçok güncel rehberinin ülkemiz için adapte edilmiş temel uygulama ve metriklerini sunar.

Anahtar Sözcükler: İnme hemşireliği, tromboliz, trombektomi, inme ünitesi, komplikasyon, kalite, metrik.

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1. STROKE: A SHORT REVIEW

1.1. The epidemiology, importance, and the global burden of stroke, and future strategies

The term "cardiovascular diseases" includes coronary heart diseases, cerebrovascular diseases, hypertension, peripheral artery disease, rheumatic heart diseases, congenital heart diseases, heart failure, and cardiomyopathies.

The cerebrovascular disease category including stroke is the third most common disease group in the world. Today; seventeen million people have a stroke and six million people lose their lives from this disease every year. Based on statistical data reported from the United States, stroke holds the rank as a cause of death after heart diseases among all types of cardiovascular diseases. The prevalence of stroke has been reported as 2.7 percent in America. The prevalence of stroke increases with age in both sexes. Every year in the United States, 795,000 people have a stroke either for the first time in their lives (610,000 people) or as a recurrent stroke (185,000 people). Of all strokes, 87 percent are ischemic and 10 percent are hemorrhagic strokes. The remaining 3 percent are subarachnoid hemorrhages. One individual has a stroke every 40 seconds. The risk of lifelong stroke will decrease eliminating cardiovascular risk factors (1).

The projections made by the European Stroke Organisation (ESO) demonstrate that these observations will remain unchanged or aggravate. It is forecasted that the proportion of old individuals in Europe will increase by 35 percent by the year 2050. Based on this forecast, the economic burden of cardiovascular disease is estimated to reach 1.1 trillion US Dollars. It is predicted that the prevalence of stroke will increase to 3.8 percent by 2030. The preventable curable nature of stroke offers an important opportunity for health authorities to reduce the burden of stroke. In its stroke action plan, ESO aimed a decline in stroke rates by 10 percent in 2030 and described strategic objectives accordingly (2).

The aging population in our country and changing lifestyle patterns have resulted in an increase in the rates of chronic diseases. The Turkish Statistical Institute (TUIK) reports that 35,000-40,000 people died of a stroke in the years 2015-2017 despite all efforts.

Every acute stroke patient needs multidisciplinary care delivered by specialists in a stroke unit; however, some patients need further interventions with advanced technological methods. Current literature indicates the utility of stroke units and stroke centers for this purpose. These centers are designed to be equipped with adequate infrastructure, experienced personnel, and standard procedures to treat the majority of stroke patients (3). Studies demonstrate that more favorable outcomes are achieved in ischemic stroke patients treated in well-equipped centers with higher endovascular treatment rates with intravenous (IV) recombinant tissue plasminogen activators (rtPA) compared to those treated in public hospitals with no specific stroke units. Developed as a consequence of years of work; the directive on the provision of health services for acute stroke patients paved the way to establish an effectively operating organization and a patient referral chain, achieving a major step for the treatment and transport of such patients to stroke units and stroke centers managed by neurologists (4). It is aimed to increase the number of the stroke units and centers rapidly, aiming to have at least 90% of stroke patients treated in such stroke units and centers in the year 2030 in line with the ESO targets. It is critical for the stroke units and centers to have experienced and competent healthcare professionals on board; as well as to be equipped with adequate infrastructure and technical instruments to treat and manage stroke patients (5). Another major contributor to the increased treatment success and improved quality of life of patients is to have experienced and competent nurses in the stroke team.

1.2. Current standards for the treatment of acute ischemic stroke: Intravenous thrombolysis and thrombectomy

Acute ischemic stroke is still the leading cause of disability in the world. However, the incidence of acute ischemic stroke is decreasing gradually owing to the innovative treatment methods developed over the last two decades. An ischemic stroke due to untreated large vessel obstruction causes two million nerve cells to lose function every minute. This is an important piece of information to understand the concept of 'time is brain' and the standards of treatment.

Recanalization and reperfusion are the main

targets of acute stroke treatment. Achieving these targets result in a reduced area of infarction and may reverse neurological deficits. The treatment of acute ischemic stroke has evolved over the last three decades. The introduction of the intravenous (iv) thrombolysis was followed by mechanical thrombectomy with proven efficacy. Currently, stroke is a treatable disease with the use of iv thrombolysis and mechanical thrombectomy either alone or in combination. However, the time-dependent attributes of these treatments should not be overlooked.

The NINDS (National Institute of Neurological Disorders and Stroke) study about the use of alteplase; a tissue plasminogen activator (tPA) was published in 1995, starting a new period in acute ischemic stroke treatment (6). That randomized-controlled study demonstrated the 90-day favorable efficacy of tPA on daily functional outcomes (7). The following efficacy results from the ECASS-III (European Cooperative Acute Stroke Study-3) study were favorable too, allowing for a wider time window of 3-4.5 hours to apply iv tPA. This study investigated standard doses of iv tPA use, reporting good functional outcomes in 418 patients [modified Rankin Scores (mRS) of 0-1 in 52.4% vs 45.2%; Odds ratio: 1.34; 95% Confidence Interval (CI): 1.01-1.76] despite a slight increase in hemorrhage rates (symptomatic intracerebral hemorrhage rates: 2.4% in the tPA group and 0.2% in the placebo group). The mortality rate was not different (7.7% vs 8.4%) (8).

An analysis of data from 2775 patients; pooled by including the participants of the NINDS rtPA study and other patients from other randomized studies, demonstrated that the efficacy increases parallel to the earlier start of the treatment. The treatment was observed to be most efficacious in patients; who received the medication in the first 90 minutes of the event. It was also observed that the administration of the treatment was useful until the 6th hour of the event although the benefits of the treatment were alleviated by time (9). To achieve a cure (full remission on the 90th day of the event) in a patient; it requires to treat 4.5 patients within the first 1.5 hours, 9 patients within the 1.5-3 hours, and 14 patients within the 3-4.5 hours of the event (10).

tPA is a serine protease in the endothelial membrane. It is normally synthesized by the endothelial cells. tPA catalyzes the conversion of

plasminogen to plasmin. Plasmin degrades fibrin, displaying a fibrinolytic or thrombolytic effect in the vessels. Furthermore, a tissue phase of the tPA-plasmin system exists. Since tPA shows 1000 times or more affinity for fibrin-dependent plasminogen, it has "fibrin selective" and "local thrombolytic" effects; for example, different from urokinase. Obtained by recombinant DNA technology, the tPA is used systemically in the treatment of many acute thrombotic/thromboembolic events. Of the calculated dose, 10% was administered as bolus and the rest is administered during one hour of infusion. Informed consent should be obtained from patients to be treated with iv tPA similar to obtaining informed consent before surgical treatment. Naturally; the patient has the right to refuse treatment, analogous to vital surgery. However, one should make sure that the patient understands what he or she refuses (11). The use of iv rtPA for the treatment of acute ischemic stroke was licensed in 2006 in Turkey (12).

Symptomatic intracerebral hemorrhage is the most feared complication of such treatment. Symptomatic intracerebral hemorrhage refers to a hemorrhagic transformation developing within the first 36 hours of the event, resulting in neurologic injury. A score of 4 or higher in the NIHSS (National Institutes of Health Stroke Scale) indicates neurological deficits. It is relieving that many later studies found hemorrhage rates lower than the 6.4% rate reported in the NINDS rtPA study. The fewer the protocol deviations, the lower is the risk of hemorrhage (11,13,14).

A neurologist should spend every effort to treat an acute ischemic stroke patient with intravenous thrombolytic therapy. Intravenous thrombolytic therapy is performed in centers; where 24-hour working neurologist teams, brain tomography, laboratory facilities, and inpatient services are available. Also, these centers should have intensive care facilities meeting the standards. An ideal organization setup should address planning for hospital operations, establishing stroke units, liaising with emergency physicians, and building stroke teams (12,15).

Severe disability resulting from acute ischemic stroke occurs at a rate of 20-25% associated with major cerebral artery stenoses. Partial recanalization is observed with iv thrombolysis in acute stroke patients with occlusions of major cerebral arteries. Recanalization is observed in the middle cerebral

artery and basilar artery at rates of 30% and it is observed in the internal carotid artery at a rate of 10% (16).

Therefore, modes of invasive endovascular therapy have been a major subject of debate over the past 15 years. Interventional treatment with the use of old-generation devices and techniques for acute ischemic stroke treatment was found not superior to intravenous thrombolysis (17,18). Furthermore, recent studies; employing new-generation technology and devices (stent-retrievers, balloon guide catheters, etc.) and improved organizational capacity for patient transport (short time elapsing from the time of symptom emergence until the angiography), have revealed the benefits of endovascular therapy (19-23). Current modes of endovascular treatments allow for obtaining high recanalization and survival rates along with low rates of complications.

The results of multicenter randomized trials were reported in the period between November 2014 and April 2015, demonstrating the effectiveness of endovascular treatment. MR CLEAN (19), ESCAPE (21), EXTEND-IA (20), SWIFT PRIME (23), and REVAS-CAT (22) studies demonstrated the superiority of endovascular therapy over iv tPA therapy when either of these treatments was used alone in acute ischemic stroke patients due to acutely disrupted anterior cerebral circulation (24).

A cure is accepted as a one-point reduction in the Rankin score of the study patients and it is reported that only 2.6 patients needed neurothrombectomy based on a meta-analysis of the 5 abovementioned studies performed by the HERMES group (25,26).

The consistent results obtained from numerous studies and diverse patient populations led to the class-I recommendation with A-level evidence in the American Heart Association (AHA) 2015 treatment guidelines, stating that endovascular treatment with stent-retrievers was recommended for patients meeting described criteria (27).

The major factor acting on the treatment success of the endovascular treatment is the elapsing time. The immediate removal of the clot and the restoration of the blood perfusion at the affected area will improve the rates of functional recovery. Other components contributing to treatment success include the stroke severity and

the presence of penumbra; which is still the salvageable tissue detected with advanced imaging techniques. If penumbra is present, patients can benefit from treatment administered later than 6 hours of the event.

Based on these findings; a class-IA recommendation is made in the treatment guideline, recommending that current endovascular treatment techniques (thrombectomy with modern retrievable stents) can be applied within the 6 hours of the start of symptoms (from the time when the patient was last observed healthy or normal). After confirming the vascular occlusion with appropriate imaging studies (computed tomography and computed tomography angiography), patients; who were started intravenous thrombolytic therapy should be taken directly to the angiography unit without waiting for any response to the tPA therapy. Patients; for whom tPA therapy is contraindicated, should be taken directly to the angiography unit after the imaging studies so that the endovascular interventions could be started (28).

The success of the stroke treatment depends on the transport of the patient to a stroke unit swiftly, the early utilization of multimodal imaging methods, and the immediate start of the treatment. All cases in the stroke spectrum; suffering from minor symptoms to major ones, can end in catastrophic outcomes. Therefore, treatment should start immediately. Planning, organization, collaboration, and jobshare will all end in an increasing number of patients benefiting from treatment.

1.3. Current treatments for acute intracerebral hemorrhage

Intracerebral hemorrhage is a leading cause of mortality and morbidity in the world. Although clinical trials and treatment guidelines about intracerebral hemorrhage appear to lag behind those performed and developed for ischemic stroke and aneurysmal subarachnoid hemorrhage, studies in the fight against intracerebral hemorrhage have increased significantly over the past decade. Community-based studies demonstrate that survival with a minimal disability is possible for many patients (29,30).

Acute intracerebral hemorrhage cases can be subgrouped under two categories; which are hemorrhages of primary and secondary causes. Primary causes include hypertension, cerebral

amyloid angiopathy, anticoagulant/fibrinolytic use, antiplatelet use, drug dependency, and bleeding diatheses. Secondary causes include vascular malformations, aneurysms, tumors, hemorrhagic transformation of the cerebral infarct, and hemorrhages developing secondary to cerebral venous thrombosis (31).

Computed tomography (CT) and/or magnetic resonance imaging (MRI) should definitely be performed in patients with suspected intracerebral hemorrhage to make a differential diagnosis from ischemia. When necessary; CT-angiography, CT-venography, and CT-perfusion imaging can also be performed besides CT imaging. The most important prognostic factor in intracerebral hemorrhage is the volume of the hematoma. The volume of the hematoma increases particularly within the first four hours in the majority of the patients, causing clinical deterioration and unfavorable prognosis (32,33).

In cases of a hematoma in the posterior fossa or a hematoma with an extra-axial location, or in cortical subarachnoid hemorrhages; magnetic resonance imaging (MRI), fluid-attenuated inversion recovery (FLAIR), susceptibility-weighted imaging (SWI), and gradient echo sequences are useful to detect small hematomas in the acute stage when CT is not sufficient (34).

The treatment of intracerebral hemorrhage requires complex strategic planning as a combined procedure of patient management with hemostatic, surgical, and neuroprotective methods; as well as administering antihypertensive therapy (35). This patient management process is of prognostic importance; especially when the patient is treated within the first 24 hours by an experienced team, favorably in a stroke unit if available or in a neurological intensive care unit. In patients with intracerebral bleeding; critical factors include airway and mechanical ventilation management, checking glucose levels, prevention and effective treatment of infection, maintenance of normothermia, meticulous fluid-electrolyte management, management of epileptic seizures, management of proper nutrition in the acute stage, prevention of deep vein thrombosis, gastrointestinal prophylaxis, and early mobilization of the patient (30,36-38).

It is recommended that elevations of intracranial pressure should be prevented and osmotic therapy with mannitol and hypertonic 3%

NaCl solution should be administered (39).

One of the major etiological factors in the etiology of intracerebral hemorrhage is elevated blood pressure; which should be controlled in the acute phase because it can increase the volume of the hematoma. Based on the INTERACT-2 study results, the current American Heart Association-American Stroke Association (AHA/ASA) guideline state that reducing the blood pressure to 140 mmHg or lower is safe and may improve functional outcomes (29). Treatment with esmolol, labetalol, nicardipine, sodium nitroprusside, nitroglycerin, or oral captopril can be administered (29,36).

In warfarin-induced bleeding cases; the administration of vitamin K, fresh frozen plasma, and more importantly prothrombin complex concentrates (PCC) contribute to both the normalization of INR values and the prevention of the expansion of the hematoma (35).

In intracerebral hemorrhage cases associated with standard heparin use, protamine sulfate (20 mg/min) should be administered as antidote therapy (40).

Studies continue to investigate potential agents to be used for the treatment of intracerebral hemorrhage due to factor Xa inhibitors Apixaban, Edoxaban, and Rivaroxaban, and due to Dabigatran; which is a direct thrombin inhibitor and a non-vitamin K antagonist oral anticoagulant (NOACs). The only approved treatment option today is Idarucizumab, which binds to Dabigatran reversing its effects. Studies continue, investigating the use of andexanet alfa for the treatment of Factor-Xa induced bleeding (41,42).

Evacuation of hematomas and decompression surgery is recommended for 3 cm or larger cerebellar hematomas based on some nonrandomized studies, which report favorable outcomes. External ventricular drainage can be performed for the treatment of intraventricular hematomas. Although benefits of decompressive surgery have not been established yet; it may reduce mortality, especially in patients with clinical deterioration and increased intracranial pressure (29,43).

In conclusion, there are many promising new developments in the treatment of intracerebral bleeding but mortality and morbidity rates remain to be critical. Therefore, the management of these patients by an experienced stroke team can

prevent potential complications and contribute to a favorable prognosis.

1.4. Acute stroke management systems: Stroke units and stroke centers

Stroke is the second leading cause of death (44), and the third leading cause of permanent disability (45). However, the likelihood of recovery is high with early treatment. On the other hand, delays in starting the treatment curb the chances of recovery and contribute to elevated rates of disability.

The principles of acute stroke management have completely evolved after the demonstration of the efficacy of an iv tPA; which was administered in the first three hours of stroke onset (6). Randomized controlled studies investigating the efficacy of endovascular therapy in acute stroke and the reports about the clinical outcomes of those studies maintain the continuing evolution of acute stroke management. In the light of the growing number of clinical studies and accumulating clinical experience about acute stroke treatment, these patients started to be managed in stroke units with specially trained personnel, applying a multidisciplinary approach. The most common causes of the decline in stroke-associated mortality observed over the last decades include the strategic management in stroke units and the organized approach in stroke treatment (46).

Many observational and controlled studies and metaanalyses demonstrated the favorable impact of stroke units on cases of acute ischemic stroke, hemorrhagic stroke, and transient ischemic attacks (TIAs) (47). The involvement of stroke units in the management of acute stroke cases is associated with 3-28 % reduction in specific mortality, 8-11% reduction in the length of hospital stay, and more importantly, 7-19% increase of hospital discharge of disability-free patients compared to patient management in general inpatient units (47,48).

Certification studies of stroke units and of comprehensive stroke units licensed to administer invasive endovascular therapies are ongoing both in our country and the world to ensure the standardization of services and improve the quality.

Topçuoğlu et al. outlined the physical conditions, minimally required attributes of architecture and infrastructure of stroke units in

Turkey along with the basic requirements of staff competencies, basic therapeutic interventions, and standards of care in their article "Stroke Unit: General principles and standards" published in 2015 in Turkish Journal of Cerebrovascular Diseases (47). The Directive on Health Services to be Provided to Acute Stroke Patients was issued on 18/07/2019 with the number 80118214 by the Republic of Turkey Ministry of Health, General Directorate of Health Services, Department of Health Services For Specialty Planning. The directive stipulated procedures and principles about the following issues; including the regulation of the provision of healthcare for the management of acute stroke patients; the organization of the manpower, medical equipment, physical conditions, and service criteria in the prospectively established stroke units; the development of the referral and transfer criteria for stroke patients; and the registration, inspection, and decertification of stroke units when necessary (4).

2. TREATMENT AND CARE FOR ACUTE STROKE

2.1. Intravenous thrombolytic therapy for hyperacute ischemic stroke

The iv administration of t-PA is the only approved pharmacological treatment by the Republic of Turkey Ministry of Health for the treatment of acute ischemic stroke. The treatment effects are time-bound. The administration of the treatment within 4.5 hours of the emergence of stroke symptoms or within 4.5 hours after the last normal observation of the patient affects clinical outcomes favorably. It is recommended that the time elapsed from the emergency service admission of the patient to the administration of treatment should not be longer than 60 minutes (11,49).

2.1.1. Final checks before tPA administration

Blood-pressure should be effectively regulated. If systolic blood pressure (SBP) is <185 mmHg and diastolic blood pressure (DBP) is 110 mmHg in an acute ischemic stroke patient, IV tPA therapy can be applied. Extra interventions are not necessary in those cases; however, the patient should be followed-up closely. In patients with SBP values of 185-220 mmHg and DBP of 110-120 mmHg, the blood pressure values should be medically reduced to fall in the appropriate range before the iv administration of rt-PA. The algorithm for blood

pressure management in patients to be treated with iv tPA has been adapted and published by the Cerebrovascular Diseases Working Group of the Turkish Neurological Society (50).

Two separate iv lines should be established for vascular access in those patients.

Consent forms should be obtained. Sample consent forms are provided on the website of Turkish Neurological Society and supplementally in the "Pocket Guide to Intravenous Tissue Plasminogen Activator Use For the Treatment of Acute Stroke" published by the Society (50).

Blood samples should have been collected. The laboratory tests should include the assessments of basic biochemistry parameters, complete blood count, blood groups, aPTT, and INR. However, bedside measurement of INR levels in patients receiving warfarin and bedside measurements of blood glucose levels is sufficient.

ECG tracings and lung X-rays should be obtained but these tests should not cause a delay to start iv tPA.

The National Institutes of Health Stroke Scale (NIHSS) should have been scored. The exclusion criteria for starting iv tPA therapy should be checked. These criteria are summarized in Table I. The "Pocket Guide to Intravenous Tissue Plasminogen Activator Use For the Treatment of Acute Stroke" published by the Society and other relevant guidelines developed by the society can be used as references (11,49,50).

If semi-invasive interventions such as urinary catheterization or insertion of a nasogastric catheter are necessary, it is recommended that they should be performed before tPA administration. Also, these procedures should not cause a delay to start iv tPA.

Table I. Absolute exclusion criteria for iv tPA administration in acute ischemic stroke.

IV rt-PA therapy is not administered
<ul style="list-style-type: none"> • If the treatment cannot be started within 4.5 hours after the onset of symptoms • Any type of acute (intracerebral, subarachnoid, subdural) hemorrhage in imaging tests • A demarcated and wide hypodense area in CT • Systolic blood pressure >185 mmHg or diastolic blood pressure >110 mmHg • Thrombocytopenia <100,000/mm³ • INR >1.7 • aPTT >40 seconds

2.1.2. Preparation and administration of the medicine

2.1.2.1. Points to consider before preparing thrombolytic therapy (Actilyse®)

- The lyophilized substance should be protected from light.

- It should be stored at temperatures lower than 25°C.

- The reconstituted solution can be stored in the refrigerator for up to 24 hours and can be stored in ambient temperatures of not higher than 25°C for up to 8 hours.

- Actilyse® solution for use should be reconstituted only with the sterile water provided in the original package of the medicine.

- No other fluids should be used.

- The solution should not be shaken at all (foaming should be avoided).

Each dose calculation should be checked twice. (Table II).

Any remaining medication surplus should be withdrawn from the vial of rt-PA and disposed of in medical waste containers.

- Actilyse® should always be administered through a separate iv line.

Table II. Dose table for iv rt-PA therapy.

Patient's weight	Total dose	Bolus dose	Infusion dose
40	36	3,6	32,4
43	38,7	3,6	34,8
46	41,4	4,1	37,3
49	44,1	4,4	39,7
52	47,7	4,8	42,9
55	49,5	5,0	44,5
58	52,2	5,2	47
61	54,9	5,5	49,4
64	57,6	5,8	51,8
67	60,3	6,0	54,3
70	63	6,3	56,7
73	65,7	6,6	59,1
76	68,4	6,8	61,6
79	71,1	7,1	64
81	72,9	7,3	65,6
84	75,6	7,6	68
87	78,3	7,8	70,5
90	81	8,1	72,9
93	83,7	8,4	75,3
96	86,4	8,6	77,8
99	89,1	8,9	80,2
>100	90,0	9,0	81,0

2.1.2.2. Preparing the tPA, infusion, and dosing

The tPA dose is 0.9 mg/kg for the treatment of acute stroke. The maximum dosage should not exceed 90 mg. Of the calculated dose, 10% was administered as a bolus and the rest is administered over a 60-minute infusion. While removing the bolus dose from the vial, air should not be injected into the vial. Using a 10 mL syringe, a 10% bolus dose is removed from the vial. For example, a 10% bolus dose corresponds to 6.8 mg or 6.8 ml for a total dose of 68 mg to be administered. The 10% bolus dose is infused over one minute. Care should be exercised during the reconstitution of the medicine. Phases of reconstituting the medicine are presented in detail in Figure I.

The patients should be monitored for hemorrhage and angioedema during and after an iv Actilyse® infusion.

During an iv Actilyse® infusion; the following should be monitored every 15 minutes for the first 2 hours: "blood pressure", "consciousness" (NIHSS items 1a, b, and c, Table III), and "motor deficits" (NIHSS items 5 and 6, Table III).

If a new neurological disorder emerges or any clinical deterioration occurs during the iv Actilyse® application; the infusion should be stopped, the physician should be informed, and the patient should swiftly be transported for a CT scan.

After the Actilyse® infusion is completed, the iv line should be flushed with 3-5 ml of 0.9% NaCl.

Any use of acetylsalicylic acid or iv heparin should be avoided within the first 24 hours of Actilyse® therapy.

2.2. The first 24 hours after IV tPA: Monitoring of the patient, blood pressure monitoring, neurological examination follow-up, NIH stroke scale, and potentially common complications, bleeding, and orolingual edema

2.2.1. Patient monitorization

During an iv Actilyse® infusion; the patient should be monitored every 15 minutes for the following: blood pressure (Table IV), consciousness (NIHSS items 1a, b, and c, Table III), motor deficits (NIHSS items 5 and 6, Table III), major and minor bleeding, orolingual edema, and increased intracranial pressure (IICP). Any emergence of symptoms or suspicion requires urgent reporting to the physician. The rtPA infusion is stopped in those cases.

After completing the IV tPA infusion, the

patient should be followed up in the stroke unit or in the neurological intensive care unit for at least 24 hours.

After the iv rt-PA infusion is completed, the patient should be monitored "every 30 minutes" for 6 hours and "every 60 minutes" for 16 hours for neurological changes (consciousness, pupillary light reaction, and motor deficits), major and minor bleeding symptoms, blood pressure, symptoms of increased intracranial pressure (IICP), and the symptoms of hypersensitivity and angioedema.

Before starting anticoagulant or antiplatelet therapy; as a standard practice, the physician should be consulted to obtain a control CT scan (or MRI) at the end of the 24 hours.

The patient should be monitored and necessary interventions should be performed for the potential complications of the iv rt-PA therapy; as well as for the vital signs, blood glucose levels, and fluid resuscitation (Table V).

2.2.2. Blood pressure control

Invasive monitoring with arterial catheterization is not recommended unless absolutely necessary after the administration of iv tPA. Blood pressure is monitored noninvasively "every 15 minutes" during the rt-PA administration and in the following 2 hours. Then, it should be monitored "every 30 minutes" for the next 6 hours and "every 60 minutes" for the next 16 hours.

Before the iv rt-PA administration, the blood pressure should be reduced to values less than 185/110 mmHg (Table IV). Also, the patients not receiving rt-PA therapy should be treated for blood pressure levels higher than 220/120 mmHg. For blood pressure management before and after iv tPA therapy, the algorithm; which has been adapted for use in Turkey by the Cerebrovascular Diseases Working Group of the Turkish Neurological Society, is recommended to be used. The algorithm can be found in the "Pocket Guide to Intravenous Tissue Plasminogen Activator Use For the Treatment of Acute Stroke"; which was developed by the Turkish Neurological Society (49,50). A short summary is provided in Table IV.

2.2.3. Neurological follow-up

The neurological status of the patient undergoing IV rt-PA therapy should be followed-up for 24 hours complying with standards of

care. For this purpose; the pupillary light reflex, consciousness (NIHSS items 1 a, b, and c, Table V), motor deficits (NIHSS items 5 and 6, Table V), and epileptic seizures should be followed up routinely.

2.2.4. The National Institutes of Health Stroke Scale (NIHSS)

NIHSS is summarized in Table V. Basic principles should be followed to score NIHSS: Scoring is always performed following the original order of ranking of the NIHSS items. No assistance is offered to the patient or no clues are provided. The scores should always be attributed to the first attempts of the patient. Furthermore, only the actual performance of the patient should be scored. Consistency should always be maintained. All types of deficits in the patient should be scored regardless of whether they are new or occurred previously (15,50,51).

2.2.5. tPA-associated hemorrhage

The most feared adverse effect of the iv rt-PA therapy is hemorrhage. Hemorrhage can be either a major or a minor bleeding. Major bleeding includes cerebral hemorrhage, retroperitoneal hemorrhage, gastrointestinal system (GIS) bleeding, and genitourinary system bleeding. Minor bleeding includes gingival bleeding, nosebleed, hemoptysis, bleeding and ecchymoses at the site of iv intervention, and subcutaneous bleeding.

The most common type of major bleeding is intracerebral hemorrhage. The emergence of any sudden or unexpected elevations of the blood pressure, impaired consciousness, increased motor deficits, increased NIHSS scores, and a newly emerging headache or nausea and vomiting should suggest tPA-associated intracranial bleeding.

In these cases the tPA infusion is stopped. The physician should be informed. Blood samples are immediately submitted to laboratory to test for complete blood count, INR, aPTT, and cross-match. The patients is swiftly prepared for a CT scan and immediately transferred to the CT room as soon as the request is approved. Vigilance should be exercised for physician orders. To be ready for physician orders, the availability of cryoprecipitate and tranexamic acid are maintained. The orders for hematology and neurosurgery consultations

should be followed up. The blood pressure, IICP symptoms, -if possible - cerebral perfusion pressure, the mean arterial pressure, body temperature, and blood glucose levels should be followed up (50).

2.2.6. Management of orolingual edema

Infusion is stopped in patients; who developed orolingual edema. Orolingual edema is a common complication in patients taking angiotensin-converting enzyme inhibitors. In these cases, the physician should be informed immediately. The airway patency should be maintained. If the edema is limited to only the anterior part of the tongue and to the lips, endotracheal intubation may not be necessary. However; the rapid spread of the edema to the larynx, the floor of the mouth, the palate, and the oropharynx may require endotracheal intubation. The nurse should be ready for this intervention. Because nasal intubation can cause epistaxis after an iv rt-PA infusion, the most appropriate method can be "awake fiberoptic intubation".

In these cases, iv rt-PA infusion is stopped and everything should be all set for the physician's orders. Probably; methylprednisolone 125 mg iv, diphenhydramine 50 mg iv will be ordered along with ranitidine 50 mg iv or famotidine 20 mg iv. The physician may order a subcutaneous injection of 0.3 ml of 0.1% epinephrine or 0.5 ml nebulizer in cases with aggravating orolingual edema.

The patient should be followed up for dyspnea and anaphylaxis. rt-PA infusion can be continued under close monitoring of the patient if symptoms are very mild or stable. Everything should all be set for any interventions for anaphylaxis. If anaphylaxis occurs in a patient in the inpatient service, the patient should immediately be transferred to the neurological intensive care unit. If anaphylaxis symptoms emerge, everything should all be set up for the physician's orders. In summary, a 0.5-1 cc dose of adrenaline 1:1000 via intramuscular or subcutaneous injection to the vastus lateralis muscle is ordered. The adrenaline injection should not be administered intravenously. The dose can be repeated every 5 to 15 minutes depending on the patient's responses. A combination of parenteral antihistamine therapy and salbutamol 5 mg nebulizer is administered (11,50).

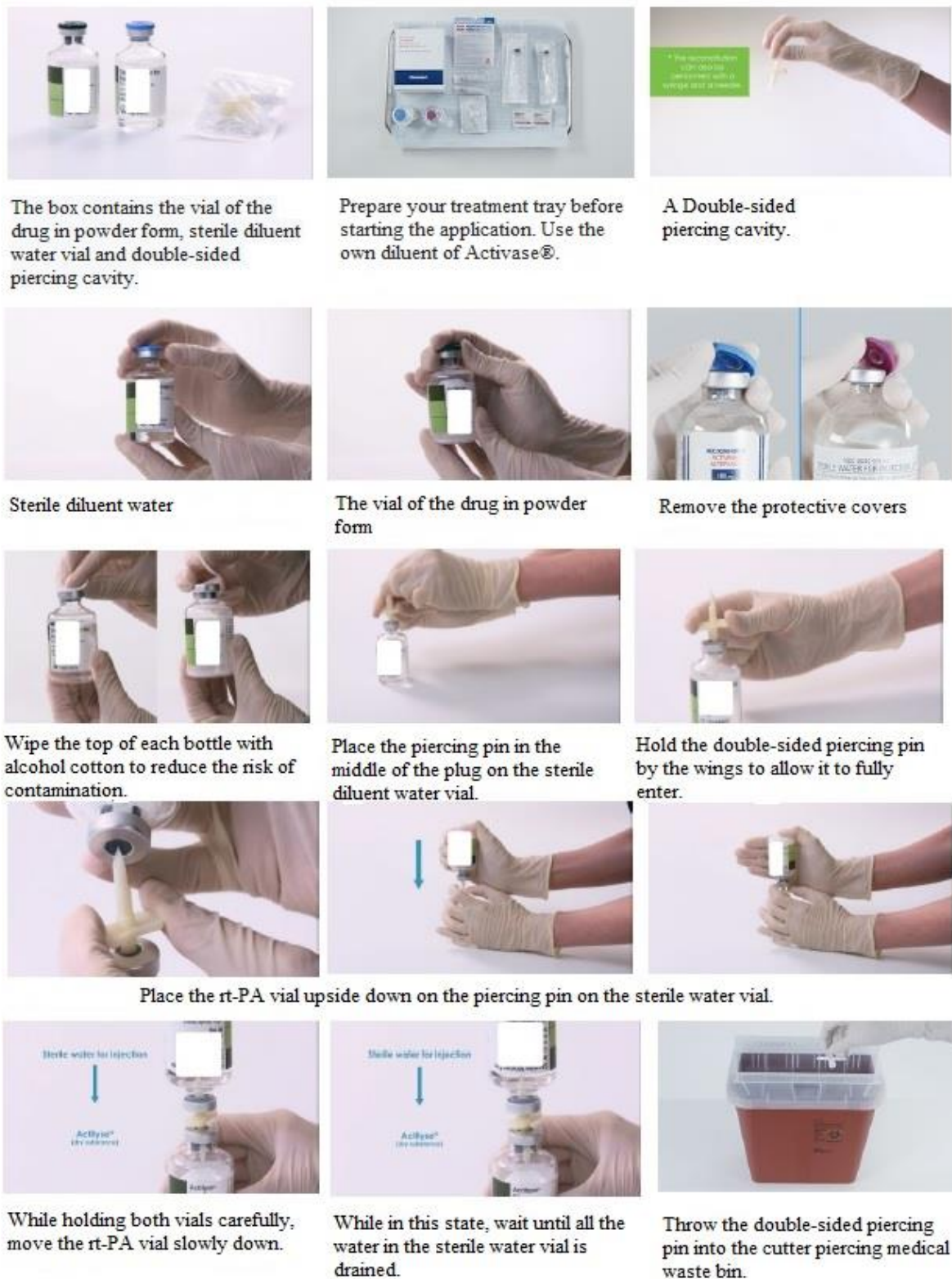


Figure 1. tPA preparation steps and details.



Mix rt-PA solution in circular motions as shown in the figure. Never shake and foam.



Wait a minute or two to prevent bubble formation. Observe the drug that has become a solution in terms of discoloration and particles.



Calculate the dose you will use, discharge the excess amount.



Withdraw 10% of the calculated total dose to the injector.



NEVER give air to the syringe while taking the medicine.



Apply bolus dose within 1 minute. Be careful not to apply any other medication into the same vein.



The dose left in the vial is the infusion dose and set the drug with infusion sets.



Do not forget to set the infusion device so that the medicine left in the vial is sent in **60 minutes**.



During the rt-PA application, observe and control the patient (explanation is given in the text).

Figure I cont. tPA preparation steps and details.

Table III. The National Institutes of Health Stroke Scale (NIHSS).

The parameters in the scale		Principles of practice
1a. LEVEL OF CONSCIOUSNESS	0 = Alert 1 = Arousable by minor stimulation to respond. 2 = Requires strong or painful stimulation to make movements 3 = Responds only with reflex motor effects or totally unresponsive.	Although the evaluation of the patient is difficult due to an endotracheal tube, tracheostomy, language problems, or orotracheal trauma/bandage; scoring should be performed appropriately. A score of 3 should be attributed only if patient is unresponsive to painful stimuli (reflex responses and posturing may occur).
1b. LEVEL OF CONSCIOUSNESS QUESTIONS	0 = Answers both questions correctly. 1 = Answers one question correctly (or intubated, dysarthric, or does not speak the language). 2 = Answers neither question correctly. The patient is aphasic or in coma.	The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Patients unable to speak due to endotracheal intubation, language barriers, orotracheal trauma/bandages, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be accepted correct. No clues are provided to the patient.
1c. LEVEL OF CONSCIOUSNESS COMMANDS:	0 = Performs both tasks correctly. 1 = Performs one task correctly. 2 = Performs neither task correctly.	The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. Another one-step command is substituted if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to the command, the task should be demonstrated to him or her so that the patient can repeat it. Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored. Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis in the oculomotor, trochlear, or abducens nerves; the score will be 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a score will be attributed.
2. BEST GAZE: Extraocular muscle functions	0 = Normal 1 = Partial gaze palsy; gaze palsy is present in one or both eyes 2 = Forced deviation, total gaze paresis (not overcome by the oculocephalic reflex).	Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat. If the patient looks at the side of the moving fingers appropriately, this can be scored as normal. If there is a unilateral defect, the intact eye is evaluated alone. Score 1 only if a clear-cut asymmetry is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11.
3. BEST VISION: Vision is tested on both visual fields with simultaneous finger movements.	0 = No visual loss. 1 = Partial hemianopia. 2 = Complete hemianopia. 3 = Bilateral hemianopia or blindness (including cortical blindness).	The patient is asked to show teeth or raise eyebrows or close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly non-comprehending or unconscious patient.
4. FACIAL PALSY (Score grimaces in response to noxious stimuli in the unconscious patient).	0 = Not present. 1 = Minor paralysis, flattened nasolabial fold, asymmetry on smiling. 2 = Partial paralysis of lower face (total or near-total paralysis). 3 = Complete paralysis of one or both sides in the upper and lower face or coma.	
5- MOTOR (ARMS) The limb is extend in the air 90 degrees (if sitting) or 45 degrees (if supine) for 10 seconds .	0 = Normal 1 = The patient can hold the limb but not completely (the arm drifts down but it does not hit the bed). 2 = The patient cannot resist against gravity (the arm drifts down and hits the bed). 3 = The level of movements is minimal.	5 and 6. Motor response: The arm and the leg are examined for muscle strength in the appropriate position. The arms are extended with palms down at 90 degrees (if sitting) or 45 degrees (if supine). The patient is asked to hold the leg at 30 degrees (always tested supine). Drift (1 point) is scored if the arm falls before 10 seconds and the leg falls before 5 seconds.
5a. Motor (Left Arm) 5b. Motor (Right Arm)	4= No movement. X= Amputation	The aphasic patient is encouraged using pantomime. Noxious stimuli are not used. The examination starts with the non-paretic arm. Each limb is tested in turn.
6-MOTOR (LEGS) The leg is placed and hold at 30 degrees in the air for 5 seconds.	0 = Normal 1 = The patient can hold the limb but not completely (the leg drifts down but it does not hit the bed).	

Table III cont. The National Institutes of Health Stroke Scale (NIHSS).

6a. Motor (Left Leg)	2 = The patient cannot resist against gravity (the leg drifts down and hits the bed).	
6b: Motor (Right Leg)	3 = The level of movements is minimal. 4= No movements at all. X= Amputation	
7. ATAXIA:	0 = Absent (including aphasic and hemiplegic patients). 1 = Present in one limb. 2 = Present in both the upper and the lower limb. X = Untestable.	This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defects, ensure testing is done in the intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides. Ataxia is absent in the patient who cannot understand or is paralyzed. Untestable in the case of amputation or joint fusion.
8. SENSORY	0 = Normal 1 = Mild-to-moderate unilateral sensory loss but the patient is aware of being touched or the patient is aphasic or alertness is impaired. 2 = Total unilateral sensory loss (patient is not aware of being touched) or has bilateral sensory loss or unresponsive or quadriplegic.	The patient feels pinprick, reacting with a positive sensory response or a grimace. Avoiding the noxious stimulus should be evaluated in a patient with aphasia or altered consciousness. Only sensory loss attributed to stroke is scored. The examiner should test as many body areas (arms, legs, trunk, face) as needed to accurately check for hemisensory loss. A score of 2 should only be given the loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation receives 2. The patient who does not respond and is quadriplegic is given a score of 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item.
9. BEST LANGUAGE	0 = Normal 1 = Mild-to-moderate aphasia (conversation is difficult but partial exchange of information occurs). 2 = Severe aphasia (no information exchange at all). 3 = No usable speech or auditory comprehension.	For this scale item, the patient is asked to describe what is happening in the attached kitchen picture, to name the items on the attached picture, and to read from the attached list of sentences. Comprehension is judged from responses here. If visual loss interferes with the tests, the patient is asked to identify objects placed in the hand. Also, the patient is asked to repeat and produce sentences. Intubated patients are asked to write. Patients in a coma (item 1a=3) are automatically given a 3 on this item.
10. DYSARTHRIA:	0 = Normal 1 = Mild-to-moderate dysarthria; the patient can be understood. 2 = Unintelligible articulations, the patient is mute/anarthric.	ASK THE PATIENT TO REPEAT THE ITEMS FROM THE LIST BELOW: FATHER EXACTLY THE SAME WEEK BY WEEK TARIFF BROWN A FOOTBALL FAN
11. NEGLECT	0 = No abnormality (if visual loss is present, sensory extinction should not be present). 1 = Extinction only in one of the sensory modalities. 2= Extinction to more than one modality.	Sufficient information to identify neglect is obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and if sensory extinction is not present; the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosognosia is evidence of abnormality.
Total Score (0-42)		

Table IV. Protocol for the Regulation of Blood Pressure In Acute Ischemic Stroke*

Before iv tPA administration	
If systolic blood pressure >185 mmHg or diastolic blood pressure >110 mmHg	
Metoprolol, iv, 2.5-5 mg bolus (maksimum 15 mg)	
Esmolol, iv, 500 µg/kg/minute bolus dose, 50-300 µg/kg/minute maintenance infusion	
Nicardipine 5 mg/hour iv infusion is started; the dose is increased by 2.5 mg/hour every 5 minutes; the maximum infusion rate is 15 mg/hour	
Nitroglycerine, transdermal, 5-10 mg flaster.	
IV tPA infusion in the first 24 hours.	
Diastolic blood pressure >140 mmHg	
Nitroprusside, iv, 0.5-10 µ gr/kg/minute infusion	
Systolic blood pressure >230 mmHg or diastolic blood pressure: 121-140 mmHg	
Esmolol, iv, 500 µg/kg/minute bolus dose, 50-300 µg/kg/minute maintenance infusion	
Nicardipine 5 mg/hour iv infusion is started; the dose is increased by 2.5 mg/hour every 5 minutes; the maximum infusion rate is 15 mg/hour	
Nitroprusside, iv, 0.5-10 µ gr/kg/minute infusion	
Systolic blood pressure: 180-230 mmHg or diastolic blood pressure: 105-120 mmHg	
Esmolol, iv, 500 µg/kg/minute bolus dose, 50-300 µg/kg/minute maintenance infusion	
Nicardipine 5 mg/hour iv infusion is started; the dose is increased by 2.5 mg/hour every 5 minutes; the maximum infusion rate is 15 mg/hour	
Follow-up strategy	
Invasive monitoring with arterial catheterization is not recommended unless absolutely necessary.	
Blood pressure is monitored noninvasively "every 15 minutes" during the rt-PA administration and in the following 2 hours. Then, it should be monitored "every 30 minutes" for the next 6 hours. Then, the follow-up is performed "every 60 minutes".	

*The algorithm has been adapted by the Cerebrovascular Diseases Working Group of the Turkish Neurological Society.

Table V. Supportive treatment after iv rt-PA therapy.

Blood pressure	should be maintained at levels lower than 180/105 mmHg. If blood pressure remains high, increase the frequency of blood pressure measurements. To keep blood pressure at or below these levels, it should be prepared for the physician's order for the start of antihypertensive drugs [Table IV].
Blood glucose	The aim should be to main blood glucose levels in the range of 140-180 mg/dL for the first 24 hours. Hypoglycaemia [<60 mg/dl] should be treated immediately. For this purpose, 25 ml of 50% dextrose can be administered intravenously [Table VII].
Body temperature	If hyperthermia [>38°C] occurs, foci of infection should be found and treated. Antipyretics [paracetamol] and cold compresses are started urgently to lower the body temperature.
Oxygen saturation	The airway patency should be maintained (aspiration, airway, etc.). If saturation is <%92, O ₂ should be administered at a rate of 2-4lt/minute via a nasal cannula. The patient should be placed in the supine position with the head in the neutral position in respect to the body [the head should be prevented to fold on the affected side]. Depending on the situation, the head of the bed can be elevated at 15-30°. In the hyperacute period in stroke, the head of the bed should be kept in the neutral position.
Fluid replacement therapy	Euvolemic patients at admission are given isotonic saline at a rate of 30 ml/kg/day, maintaining the vascular access.
Cardiac monitorization	Cardiac monitoring should be performed for at least 72 hours in order to be able to follow up the cardiac rhythm, to treat potential arrhythmias, or to detect paroxysmal atrial fibrillation that may cause stroke.

2.3. Nursing management for neurointerventional procedures for the treatment of the acute stroke patient: Basic principles of patient follow-up after angiography and the treatment of major complications

Today, two reperfusion techniques are available with proven efficacy. These are the intravenously administered Actilyse® therapy and mechanical thrombectomy. Despite the demonstrated high efficacy of rt-PA in clinical studies, it has been found out that the outcomes in

large vessel occlusions are not as much satisfying as the ones achieved in distal occlusions.²⁴ Mechanical thrombectomy is considered an effective treatment option for stroke patients with proximal occlusions in major intracranial arteries.

Mechanical thrombectomy (endovascular revascularization with retrievable stents or aspiration) aims to remove the thrombus mechanically to restore the blood circulation and minimize the permanent tissue injury. Therefore; endovascular methods allowing for the direct mechanical removal of the thrombus come to the

forefront for patients with large vessel occlusions and for patients; in whom rt-PA therapy is contraindicated (52).

The year 2018 AHA/ASA guidelines recommend mechanical thrombectomy with retrievable stents as a Class-I recommendation with A-level evidence for patients meeting the listed criteria below (52,53):

- A modified Rankin scale score of 0-1 before stroke
- M1 occlusion of the internal carotid artery (ICA) and/or the middle cerebral artery (MCA).
- Age \geq 18+ years
- An NIHSS score of \geq 6
- An ASPECT (The Alberta stroke programme early CT) score of \geq 6
- The time elapsed from the emergence of

symptoms to the inguinal puncture is <6 hours

Some problems or complications may emerge "before", "during", and "after" mechanical thrombectomy (Table VI). Some of these complications are listed below:

- Problems in the access site (injury to vessels or nerves, access site hematoma, or inguinal infections),
- Complications associated with the device (vasospasm, arterial perforation and dissection, device detachment/misplacement),
- Symptomatic intracerebral hemorrhage, subarachnoid hemorrhage,
- New embolus formation at the target site
- Other complications include: Anesthetic/contrast agent-associated postoperative bleeding, extracranial bleeding, and pseudoaneurysms.

Table VI. Potential situations and related interventions by the stage of thrombectomy.

Before the procedure	During the procedure	After the procedure
	Contrast allergy	
	Check the airway, provide oxygenation and ventilation	
	Hypertension and non-stable blood pressure	
	Hyperglycemia and hyperthermia	
	Arterial access-site complications	
	Vascular injury, vasospasm	Stenosis
		Hemorrhage and edema
	Irregular body temperature, arrhythmias	
		Infection (pneumonia/UTI*), stress ulcers, pressure ulcers, peripheral venous thrombosis, risk of falling
		Timing of extubation, tracheostomy, PEG*; Prognosis and rehabilitation

*PEG= Percutaneous endoscopic gastrostomy;

*UTI= Urinary tract infection.

2.3.1. Management of the care during the neurointervention

- Maintenance of the airway patency
- Monitoring the blood pressure and necessary interventions (Actilyse® administered or not administered)
- Maintenance of the airway patency
- Follow-up of IV / IA rt-PA therapy-associated angioedema and performing necessary interventions
- Interventions for contrast agent allergy
- Follow-up of early hemorrhagic transformation after iv rt-PA administration (intracerebral hemorrhage)
- Follow-up of any symptoms indicating neurological deterioration (changes in consciousness, pupilla reactions, worsening of motor deficits, etc.).

- Follow-up of the patient specific to the sedation / anesthesia method applied
- Stabilization of the head and its maintenance

2.3.2. Basic principles of follow-up and approaches after angiography

2.3.2.1. Follow-up of the consciousness and neurological status

- Monitoring the patient with Glasgow Coma Scale (GCS) scores, NIHSS scores, and cardiac monitoring is a routine procedure.
- Report any deteriorations in the motor status or any 2 point-deteriorations.

2.3.2.2. Cardiac Monitoring

Cardiac monitoring should be continuous. Any abnormalities or suspected conditions should be recorded and reported.

2.3.2.3. Follow-up of the puncture site after angiography

- Are lower extremity pulse palpable? (Palpation of pulses are examined on the dorsum of both feet. Any other body regions requiring further attention are examined, too. Figure II).
- Is the site of puncture dry? (The puncture site is followed up to detect any bleeding).

Is the extremity undergoing the intervention normal regarding its color, motions, and sensation? (Both extremities are examined comparing one to the other).

- The patient is prescribed bed rest (the site of intervention should be stabilized).

2.3.3. General nursing follow-up / care (54)

- Oxygen saturation is followed up with a pulse oximeter. The oxygen saturation levels are aimed to be > 95%.
- Body temperature is followed up. Paracetamol is administered when the blood pressure is measured > 37°C.

Blood glucose levels are followed up. Blood glucose levels should be < 180 mg/dl. If indicated, iv insulin is administered based on the physician's orders.

- Prophylaxis for deep vein thrombosis is performed. An ideal approach is the use of intermittent pneumatic compression devices.
- If the patient tolerates, early mobilization will be attempted within 24 hours.
- The benefits and risks of every invasive procedure (urinary catheterization, nasogastric tubing, intravenous catheter placements) should be considered attentively. These procedures should be performed at least one hour after the rt-PA infusion if indicated.
- The risk of falls is assessed. Precautions must be taken like raising the side rails.
- If iv rt-PA therapy was given; aspirin, clopidogrel, dipyridamole or anticoagulants should not be administered in the following 24 hours. Antiplatelet agents or anticoagulants can be started after ruling out cerebral hemorrhage with brain CT scans taken 24 hours after the procedure.
- Oral intake should be stopped until the swallowing function of the patient is examined.

2.3.3.1. Report the following conditions to the physician when they emerge/are observed

- Alterations in the neurological status or changes in GCS scores

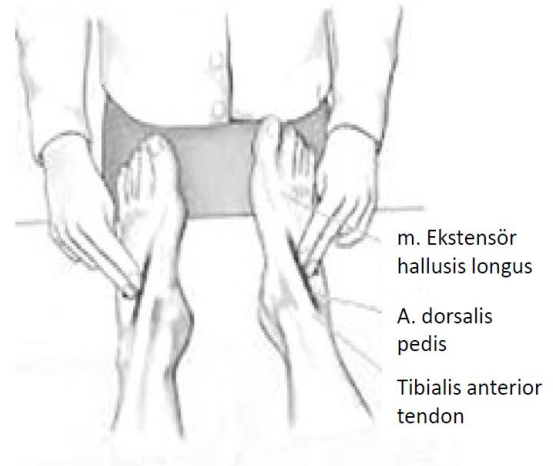


Figure II. Pulse examination of lower extremity.

- Any bleeding from any body region or bleeding at the puncture site
- Absent pulses in the lower extremity
- Systolic blood pressure (SBP) >180 mmHg or <100 mmHg
- Diastolic blood pressure (DBP) >105 mmHg or <50 mmHg
- Cardiac beat >120/minute or <50/minute
- Respiratory rate >24/minutes or <8/minutes
- Body temperature >38°C
- Urine output of <30ml/hour

2.3.3. Basic approaches to complications after angiography

2.3.3.1. Intracerebral hemorrhage

Any emerging signs and symptoms of intracerebral hemorrhage is followed up. Any emergence of new findings are reported. Major signs and symptoms of intracerebral hemorrhage include a new or deteriorating severe and acute headache or a headache of increasing severity; acute hypertension with a SBP of >180 mmHg or a DBP of >105 mmHg; nausea and vomiting; agitation, seizures, deterioration of GCS scores (a 2 point or more reduction), elevation of NIHSS scores by 4 or more points, and newly emerging motor deficit symptoms.

In case of a suspicion of intracerebral hemorrhage non-contrast CT scan should be repeated urgently. Blood samples should be collected and submitted to the laboratory urgently to test for INR, aPTT, fibrinogen, complete blood count, blood group typing, and cross-match. Consultation with neurosurgery should be performed.

Everything should all be set to receive the physician's orders. These include;

- In patients; who received iv tPA, 10 U (0.15 U/kg) iv cryoprecipitate increases fibrinogen levels by around 50-70 mg/dL when the fibrinogen level of the patient is found <100 mg/dL. When fibrinogen level is measured <100 mg after 1 hour, the cryoprecipitate dose is repeated. Again, in patients; who received iv tPA, fibrinogen (Haemocomplettan®) can be prescribed.
- Thrombocyte suspension can be prescribed to be usually administered at least 4 units. Because tPA therapy is associated with impaired thrombocyte functions, thrombocyte suspension is administered even thrombocytopenia is not detected (49,50).
- If available, anti-fibrinolytic therapy with epsilon-aminocaproic acid (Amicar®) is administered at an iv dose of 5 mg over 15-30 minutes. In cases of massive bleeding, Amicar® can be administered at higher doses (10 g in 250 cc physiological saline iv over 1 hour)
- Tranexamic acid (Transamin®) is available in Turkey. After a loading dose of 1 gr is administered via iv infusion over 10 minutes 1 gr is administered via iv infusion over 8 hours.

2.3.3.2. Hypertension

The blood pressure is followed up non-invasively, aiming to prevent any elevations over 180/105 mmHg. Everything should all be set for the physician's orders (Please see Table IV).

2.3.3.3. Seizures

Nursing management of generalized tonic-clonic seizures or convulsive status epilepticus is summarized as follows:

- Airway patency is assessed and the patency is maintained.
- Oxygen is administered at high concentrations.
- Cardiac and pulmonary functions are examined.
- Blood glucose levels are monitored.
- An intravenous line is established.
- The healthcare team should be informed urgently.
- Everything should all be set for the physician's orders.
- The standard approach is to administer lorazepam iv (diazepam iv in Turkey).

2.3.3.4. Increased Intracranial Pressure (IICP)

The nurse should follow up the patients for the signs and symptoms of IICP. These include

altered consciousness, headache (the most common sign), nausea and vomiting (projectile vomiting), disorders of orientation and cooperation, lethargy, delirium, anisocoria (a sign of cerebral herniation), and diplopia (double vision).

Abnormal respirations, agitation, and the manifestations of the Cushing's triad should be reported to the physician when detected. Cushing's triad refers to the following symptoms associated with brain stem compression including bradycardia, hypertension, and abnormal respirations.

2.4. Perioperative and intraoperative neurology nursing in neurointerventional vascular procedures

Successful recanalization procedures significantly affect clinical outcomes and mortality in acute ischemic stroke. Besides the significance of neurointerventions; acknowledging the intraoperative and postoperative complications of acute ischemic stroke, taking precautions against them, or the early identification and treatment of unpreventable complications are critical factors for prognosis (55,56).

Maintenance of the airway patency: The respiratory rate and oxygen saturation levels should be followed up closely. Frequent aspirations reduce the rate of ventilator-associated pneumonia in intubated patients.

Oxygen therapy: Oxygen saturation levels should be maintained at levels more than 94% during and after endovascular interventions. Oxygen therapy should not be delayed in patients with desaturation. Blood gas saturations should be followed up and oxygen therapy should be started in patients with respiratory distress. The treatment is detailed below (Section 3.2).

Heart rate and blood pressure: Hypotension should be avoided in acute ischemic stroke in order to achieve optimum blood pressure values and maintain cerebral perfusion. After endovascular treatment; blood pressure monitoring should be performed every 15 minutes in the first two hours, every 30 minutes for 6 hours, and hourly in the following 16 hours. If blood pressure levels are not more than 180/105 mmHg, reductions in blood pressure levels should be avoided (Table IV).

Regulation of blood glucose levels: Hypoglycemia and hyperglycemia are unfavorable

factors for prognosis after acute ischemic stroke. High levels of blood glucose aggravate neural injury in the ischemic penumbra. Current guidelines recommend to maintain blood pressure levels in the range from 140 to 180 mg/dl (Table VII).

Body temperature: Body temperature of patients should be monitored. A body temperature of 35-37 °C should be aimed (Section 3.1).

Physical examination: Alterations of pulses and temperature, and emergence of pain should be followed up in the extremity undergoing the femoral catheterization. Vigilance should be exercised to detect potentially developing local hematomas, retroperitoneal hematomas, and pseudoaneurysms. If the patient is not hemodynamically stable after the procedure, complete blood count and aPTT values should be followed up. If signs and symptoms of hypovolemia is detected, intravenous fluids and erythrocyte suspension should be administered. Abdominal ultrasonography or abdominal CT scanning can be ordered to reveal the causes of hemorrhage.

Neurological examination: The consciousness of the patient and muscle should be examined in detail and followed up. Elevations in NIHSS scores should be accepted to indicate clinical deterioration and neuroimaging should be performed. Anisocoria and respiratory distress in unconscious patients can indicate cerebral herniation; therefore, they are important clinically.

Anesthesia: The selection of conscious sedation or general anesthesia to perform endovascular surgery is critical for clinical outcomes. Both methods have advantages and disadvantages compared to the other. The preparatory phase is short in conscious sedation. A neurological examination can be performed during the procedure. Difficulties in manipulation of the wire due patient movements, intracranial hemorrhage due to perforations caused by the wire, and difficulties in the maintenance of the airway patency can occur during the conscious sedation of the patient. General anesthesia can be selected because it allows for stabilizing the patient, maintaining the airway patency, and controlling the pain effectively. However, the length of the procedure is longer, delaying recanalization. Because the blood pressure drops suddenly, collateral circulation is impaired and the volume of the ischemic area is enlarged. It should be

remembered that general anesthesia is associated with several variables related to physician and institution factors.

Adverse effects due to contrast agent use: Allergic reactions such as urticaria and anaphylaxis may develop due to the use of contrast media. Antihistamines and corticosteroids can be administered before the procedure to patients with known allergies to contrast agents. Care should be exercised to detect any potentially developing contrast nephropathy and acute renal failure. Administration of 1 ml/kg/h isotonic saline before and after the procedure reduces the risk of contrast nephropathy.

Contrast media can show neurotoxic effects. Encephalopathy developing after endovascular treatments may be associated with focal neurological deficits, cortical blindness, and epileptic seizures, and contrast encephalopathy.

Approach to complications associated with bleeding: Heparin use requires urgent administration of protamine sulfate if bleeding occurs during the procedure. Treatment of bleeding occurring after thrombolytic therapy is summarized above.

Treatment of cerebral edema: Irritability, changes in consciousness, bradycardia, Cheyne-Stokes respiration, and anisocoria are signs indicating cerebral edema. Mannitol and hypertonic fluids are used for the treatment of cerebral edema. Decompression surgery should be performed in suitable patients. Comprehensive explanations are presented in the respective sections of this guideline (Section 2.9).

Vasospasm: Retrievable stents used in thrombectomy can cause cerebral vasospasm. Because prolonged vasospasm can cause ischemic changes, it should be treated urgently. Inducing hypervolemia, elevation of the blood pressure, and the administration of nitrates and calcium channel blockers can be tried for the treatment.

2.5. Posture, mobilization, and early-stage physical therapy and rehabilitation in the acute ischemic stroke patient

2.5.1. Mobilization

Early mobilization includes the following interventions: Assisting the patient to sit upright, ambulation of the patient within 24 hours, physiotherapist's evaluation of the patient within 8-24 hours, having the patient sit up and walk within 24-72 hours.

Table VII. Protocol for blood glucose level control in hyper-acute stroke.**Neuro-intensive care protocol for monitoring blood glucose levels***

If blood glucose level is > 150 mg / dL, the protocol is started.

The blood glucose level is measured with a glucometer. Laboratory validation is required for values > 400 mg/dl and <40 mg/dl.

Necessary preventive measures are implemented at the same time.

A maximum of 1 unit of regular insulin in 1 cc SF is administered via an infusion pump.

The unit of the infusion rate is unit/hour.

The protocol is recommended for use for the first 72 hours. It may be continued based on patient needs.

It is not valid for patients; who received glucose solutions continuously or who take corticosteroids.

Starting the infusion

Blood glucose (mg/dL)	iv bolus	No diabetes or non-insulin-dependent diabetes mellitus	Insulin-dependent diabetes mellitus
110-150	0	0	0
151-180	4	2	3.5
181-240	6	3.5	5
241-300	8	5	6.5
301-360	12	6.5	8
>360	16	8	10

The time to check the next blood glucose level

Half an hour	A blood glucose level of >200 mg/dL or <100 mg/dL
later	If infusion has been stopped or a dose change of >50% has been made or bolus insulin has been administered; If vasopressors (noradrenaline, adrenaline) have been titrated rapidly
Hourly	Values in the range between 100-200 mg/dL (limit levels are included)
Every 2 hours	Values in the range between 125-175 mg / dL and infusion rate has not changed for 4 hours and if blood glucose variability is <15 mg / dL

Control of blood glucose levels

If the infusion has been stopped due to hypoglycemia, the blood glucose levels are checked every half an hour until a blood glucose level exceeds the lower limit of the range (e.g., a level of 175 mg/dl for the 175-200 mg/dl range). When level exceeds the lower limit, the infusion is started at half the rate of the previous infusion.

If the infusion has been stopped due to hyperglycemia, the blood glucose levels are checked every half an hour until the blood glucose level is reduced to 200 mg/dl.

Blood glucose	*blood glucose level: mg/dL and *Infusion rate: unit/hour
<40	Insulin infusion is stopped. A 25 cc volume of 50% Dx or its equivalent is administered intravenously.
41-70	Insulin infusion is stopped. A 15 cc volume of 50% Dx or its equivalent is administered intravenously.
70-100	Insulin infusion is stopped. If the previous level is < 120; a 15 cc volume of 50% Dx is administered.
101-124	Compared to the previous blood glucose level; if the blood glucose level is higher; reduce the infusion rate by 0.3. If lower (≥ 30); stop the infusion. If lower (15-30); reduce the rate by half. If lower (7-14); reduce the rate by 0.5. If equal or <7; reduce the infusion rate by 0.3.
125-175	Compared to the previous blood glucose level; if the blood glucose level is higher; increase the infusion rate by 0.5. If equal or ± 10 ; maintain the infusion rate. If lower (10-19); reduce the rate by 0.5. If lower (21-39); reduce the rate by half. If lower (≥ 40); stop the infusion.
175 - 200	Compared to the previous blood glucose level; if the blood glucose level is higher (>50); increase the rate by 2. higher (20-50); increase the rate by 1. higher (>1-20); increase the rate 0.5. If equal or lower (1-20); maintain the rate. If lower (21-40); reduce the rate by 1. If lower (41-60); reduce the rate by half. If lower (>60); stop the infusion.
201-225	Compared to the previous blood glucose level; if the blood glucose level is higher (>30); increase the rate by 2 and administer 4 u bolus. higher (1-30); increase the rate by 1 and administer 3 u bolus. If equal/lower (1-20); increase the rate by 1 and administer 2 u bolus. If lower (20-50); maintain the rate. If lower (51-80); reduce the rate by half. If lower (>80); stop the infusion.

Table VII cont. Protocol for blood glucose level control in hyper-acute stroke.

225 - 250	Compared to the previous blood glucose level; if the blood glucose level is higher (>20); increase the rate by 3 and administer 6 u bolus. higher (1-20); increase the rate by 2 and administer 4 u bolus. If equal/lower (1-30); increase the rate by 1 and administer 2 u bolus. If lower (30-80); maintain the rate. If lower (>80); reduce the rate by half.
250-300	Compared to the previous blood glucose level; if the blood glucose level is higher, the same, or the reduction is <50; administer 6 u bolus and increase the rate of infusion by 2. If the reduction is 50 - 100; maintain the infusion rate. If the reduction is >100; reduce the rate by half. * If blood glucose levels are > 250 in 3 consecutive measurements, twice the amount of the previous bolus dose (maximum of 24) is administered and the infusion rate is doubled (maximum of 20 u/hour) and consultation is requested.

*Adapted from the Portland protocol for blood glucose level targets of 125-175 mg/dL post-thrombolysis [see. <https://oregon.providence.org/forms-and-information/p/portland-diabetes-project-frequently-asked-questions/>]. Please see the original protocol for patients staying at the inpatient service.

Early mobilization is a critical factor for preventing deep venous thrombosis, pulmonary embolism, malnutrition, pressure ulcers, pneumonia, contractures, and urinary infections. Early mobilization practices are listed as headlines below⁵⁷:

"Intense" ambulatory activities are not recommended for acute stroke patients within the first 24 hours.

If not contraindicated (e.g., receiving end of life care) in stroke patients, mobilization (out-of-bed activities) should start within 48 hours after the start of stroke.

- The individual with stroke should be assisted to mobilize by a nurse and a physiotherapist in the early period.
- Early mobilization is effective in preventing pulmonary venous thromboembolism (PTE).
- Deep vein thrombosis (DVT) is a risk factor for pulmonary embolism (PE).
- To reduce the risk of DVT, intermittent pneumatic compression (IPC) may be recommended in addition to routine care in immobile patients without contraindications.
- The available data on the effectiveness of elastic compression stockings is insufficient in acute ischemic stroke. Moreover; adverse effects such as impaired skin integrity, blistering, skin necrosis, and ulcers have been reported. Therefore, they are not preferred for use.

Out-of-bed activities performed at frequent intervals are recommended for patients with mild and moderate stroke. However, no consensus has been achieved yet about when to start these activities within the first 48 hours after a stroke.

- To strengthen the extremities on the affected side, exercises to increase muscle strength are

recommended.

- Electrical stimulation can be used to increase muscle strength. Early mobilization is an effective method to prevent stroke-related spasticity.

- The patient should be evaluated early for spasticity. The effectiveness of joint range exercises and splints in the prevention of spasticity has been demonstrated.

2.5.2. Posture

- It is important to maintain the correct body posture when positioning a stroke patient.
- When positioning the patient, extremities should be properly supported to preserve their functions.
- The extremity on the affected side should not be positioned before supporting that extremity.
- Care should be exercised so that the arms of the patient will not be stuck under the body while turning the patients over.
- Feet should always be supported with footboards to prevent foot drop.
- To prevent contractures and to maintain/increase muscle strength; active and passive range of motion joint exercises should be practiced on the extremities of the unaffected and affected sides, respectively.
- The range of motion joint exercises should be performed under the supervision of a physiotherapist.
- Maintaining the range of motion in joints is the responsibility of the nurse.
- While positioning the patient, measures against the development of pressure ulcers should be taken.
- Materials to reduce pressure and friction should be used.
- The position of the patient should be changed

every two hours.

- The supine position is not recommended.

2.5.2.1. If the patient will be turned to lie on the affected side;

- The head should be supported with one or two pillows underneath.
- The affected shoulder should be extended forward.
- The unaffected leg should be extended forward with a pillow underneath.
- The patient's back should be supported with pillows.
- The patient should not be positioned to lie on the hemiplegic side for more than 20 minutes.

2.5.2.2. If the patient will be turned to lie on the affected side;

- The head should be supported with one or two pillows underneath.
- The affected shoulder should be extended forward with a pillow underneath.
- The affected leg should be extended backward with a pillow underneath.
- The patient's back should be supported with pillows.

2.5.2.3. Sitting position on the chair;

- The patient should sit exactly on the seat with his/her back should rest against the back of the chair.
- The arm of the patient on the affected side is placed on a pillow on the table in front of the patient.
- Feet should be placed flat on the floor.
- Knees are placed in a straight position parallel to the feet and the patient is assisted to maintain this position while sitting.
- Patient should be assisted while sitting on the chair and standing up.

2.5.2.4. Upright sitting position in the bed;

This position is not advised much unless it is absolutely necessary. The necessary conditions to be met are listed below:

- The patient is seated in an upright position with his back supported by pillows.
- A pillow is placed under the arm on the affected side. The legs of the patient are straightened out.
- The patient should be given the prone position for 15-20 minutes in a day.
- To prevent flexion contractures, the patient

should not sit for long periods.

- A hand ball can be used for maintaining the functional position of the patient's hand.

2.5.3. Physical therapy and rehabilitation in the early period

Early physical therapy and rehabilitation should be planned according to the patient's condition and the targeted achievements.

- Tailor-made rehabilitation programs and exercises should be applied to stroke patients to improve their cardiopulmonary functions.
- Patients should be encouraged to perform regular physical activities depending on their disability levels.
- The rehabilitation program should be planned to include occupational therapy as well as physiotherapy if possible.
- Besides the physiotherapy applied in the hospital/institution; stroke patients should be encouraged to continue physiotherapy with self-discipline, receiving support from family and friends.
- To achieve an active rehabilitation; physiotherapy and occupational therapy is recommended to be performed for at least an hour daily five days a week.
- Physiotherapy to increase cardiopulmonary strength is recommended for patients having sufficient strength in the large muscle groups of lower extremities.
- Patients should receive at least two hours of intensive physiotherapy every day for two weeks to maintain the extension of finger and wrist joints.
- Long-term use of splints or leaving the limb in extension for long periods is not recommended in patients with contractures or at risk of developing contractures.
- In patients with contractures or at risk of developing contractures, applying electrical stimulation can be advised to increase muscle strength.
- For patients with shoulder subluxation, a consensus has been reached for the training of nurses, other members of the medical team, the patient, patient relatives, and caregivers to position the patient appropriately and assist the patient to perform appropriate motions.
- Physiotherapy programs should be developed for the recovery of lost functions and the enhancement of motor strength to have the patient

gain functions to compensate for the new situation.

- Physical therapy and rehabilitation programs should be planned to enable patients to independently perform activities of daily living such as bathing, eating, and dressing.
- Behavioral modifications should be aimed to prevent the recurrence of symptoms.
- Treatment adherence should be ensured.
- If the patient smokes, smoking cessation should be promoted.
- Methods should be taught to the patients to avoid and cope with stress.
- Recommended changes in the diet should be adopted.
- Special training, encouragement, and motivation should be provided in line with patient needs.
- A tailor-made workout program, specifically developed to meet patient needs, should be applied on the affected and unaffected sides of the body.
- Speech therapy should be provided depending on the patient needs.
- The program for the provision of care should be regularly reviewed to assess whether the targeted improvements are achieved. Necessary revisions should be implemented in the program according to these assessments.
- Support and counseling should be provided for the family, too, considering the needs of the family.
- Guidance and support should be provided for both the patient and family members to cope with the new situation.
- Family members should be informed about the likelihood of sudden unexpected mood changes in the patient, such as crying, laughing, and getting angry incongruently.
- Individuals with a high risk of falling should undergo a standard risk assessment.
- Fear of falling should be evaluated in stroke patients because it may unfavorably affect their mobilization.
- Stroke patients prone to a high risk of falling should be engaged in balance and coordination workout programs to perform at least twice a week.

2.6. Nursing practice in the hyperacute period of intracerebral hemorrhages and subarachnoid hemorrhages: Follow-up of the posture, blood pressure, neurological examination, and consciousness

2.6.1. Posture

- The patient is prescribed absolute bed rest.
- In order to keep the patient calm and keep the blood pressure under control; a silent environment with minimal stimuli should be ensured.
- The posture of the patient should not interfere with the maintenance of the airway patency. The patient should be positioned appropriately.
- Care should be exercised not to flex the neck and to keep the head and body at the same level so that intra-aortic pressure increases can be prevented and venous return can be facilitated.
- The patient should be repositioned every two hours.
- To protect and maintain the skin integrity, the patient should be positioned appropriately and support surfaces and materials should be used.
- Any repositioning that will increase the intra-abdominal pressure should be avoided.
- Coughing, sneezing, vigorous nasal blowing, and straining should be avoided as these can increase the intracranial pressure.
- Physical and mental activities; which may cause an increase in the blood pressure, should be avoided.

2.6.2. Blood pressure

- Blood pressure should be checked every two hours for the first 24 hours and, then, should be checked every four hours for 48 hours.
- In patients with intracerebral hemorrhage, the target systolic blood pressure value should be around 140 mmHg.
- In subarachnoid hemorrhages, the targeted blood pressure should be less than 160/90 mmHg until the aneurysm is treated by endovascular interventions or surgery.

2.6.3. Neurological examination and consciousness monitoring

- Vital signs and neurological findings should be checked frequently (every 15 minutes initially and every four hours after the clinical condition of the patient is stabilized) and compared with previous findings.
- Pupil size and response to light should be evaluated.
- Motor and sensory functions should be examined.
- Presence of headache should be determined. If the patient suffers from headache; the type, location, and specific attributes of headache

should be evaluated.

- Cranial nerve functions (ptosis, blink response, impaired facial expression, etc.) should be evaluated.
- A sensory examination should be made to evaluate any developing loss in visual, auditory, and tactile senses.
- Aphasia should be evaluated.
- Other types of neurological impairment should be assessed.
- Meningeal irritation findings (photophobia, neck stiffness) should be evaluated.
- Necessary protective measures should be taken and maintained against the possibility of seizures.
- During a seizure, the patient should be observed and the findings should be recorded.
- Anxiety level of the patient should be evaluated.
- Change of consciousness should be checked.
- The orientation level of the patient should be evaluated.
- The amount of fluid intake and output should be monitored.
- Standard neurological examination should be performed and relevant scales and tools should be used to detect hypoxia, bleeding recurrences, subdural hematomas, hydrocephalus, immobility, and weakness.
- The consciousness state of the patient should be evaluated with the Glasgow Coma Scale. In hemorrhagic stroke, GCS scores of 7 and less indicate coma. These patients receive care for comatous states.

2.7. Major problems and nursing practices in patient follow-up after subarachnoid hemorrhage

Subarachnoid hemorrhage (SAH) is the infiltration of the blood into the subarachnoid space, which is normally filled with cerebrospinal fluid and located between the arachnoid and the pia mater. The most common cause of SAH is trauma. Of the non-traumatic SAHs, 80% occurs due to the rupture of an saccular aneurysm. SAH is associated with high morbidity and mortality. Bed rest is necessary in patients with SAH. These patients should be followed up in neurological intensive care units (58).

Close monitoring is necessary to prevent possible complications in such patients. The intensive care nurses should monitor the cardiovascular and respiratory parameters along with the neurological status of the patient.

2.7.1. General nursing approach in SAH

Patients with SAH are generally considered to be fragile patients. In these patients, it is necessary to keep the patient away from emotional or physical stressors besides bed rest after the acute phase. Otherwise, it should be remembered that elevations in blood pressure may occur. A close communication should be established with the patient to alleviate his/her anxiety. It is important to provide a silent room and a stress-free environment. Also, it is important not to allow for visitations other than those by family members. The head of bed should be elevated 15–30 degrees. Considering that any activity will cause a sudden increase in the blood pressure or obstruct the venous return, patient should avoid moving. Patients should avoid Valsalva maneuvers or straining. External stimuli should be minimized. Because Valsalva maneuvers or straining increase the cerebral blood pressure and intracranial pressure, laxatives should be prescribed to the patient for prevention.

2.7.1.1. Intravenous fluid therapy: Volume overload or dehydration should be avoided. The patient's intake and output of fluids should be monitored. The patient should be euvolemic. If necessary, isotonic NaCl solution should be given to the patient.

2.7.1.2. Fever: Subfebrile fever can occur in SAH patients. In the acute period, it is recommended to maintain the normothermia. Superficial cooling should be applied and antipyretics should be prescribed. Any suspicion of infection requires investigation to find out foci (59) (Section 3.1).

2.7.1.3. Regulation of the blood pressure: Because the likelihood of bleeding again is high in early phases, the blood pressure should be maintained at normal or moderately high levels. In the acute period when the aneurysm has not yet been treated, antihypertensive therapy should be started for conditions; in which the mean arterial pressure is > 110 mm Hg and the systolic blood pressure is > 160 mm Hg. The intravenous administration of labetalol or esmolol is the most appropriate treatment options.

2.7.1.4. Blood glucose: Blood glucose levels should be maintained at values of <200 mg/dl. Hypoglycemia (<80 mg/dl) should be avoided.

2.7.1.5. Lower extremities should be examined for the signs and symptoms of any developing deep vein thrombosis manifesting with redness, elevated temperature, edema, and tenderness.

2.7.2. Complications of SAH and nursing practices

The first 2 weeks following SAH is the period with the highest mortality and morbidity. A new bleeding, vasospasm, or cerebral ischemia may occur during the follow up of the patient as complications in SAH cases caused by an aneurysm (59).

2.7.2.1. A new bleeding: The main cause of mortality and morbidity is a new bleeding in patients; who did not undergo the obliteration of the aneurysm. The time interval with the highest likelihood for re-bleeding after aneurysmal hemorrhage is the first 48 hours. In this period, the rate of re-bleeding is 4%. Absolute bed rest in a silent room along with the administration of analgesia and sedation is important to prevent re-bleeding. Because the pain can elevate the blood pressure, the risk of re-bleeding may increase. For this purpose; short-acting and potent analgesics should be selected. Symptoms include a sudden severe headache, nausea, vomiting, decreased consciousness, and the emergence of neurological deficits. Therefore, the vigilance of nurses is important in the patient follow-up.

2.7.2.2. Vasospasm and cerebral ischemia: It often occurs a few days after the operation, most commonly on the 4th-11th days. Patients should be followed for signs and symptoms of a developing vasospasm. Inadequate cerebral perfusion causes the development of ischemia symptoms. Strict control of blood pressure helps avoid any untoward complications of vasospasm. Nurses monitoring such patients in the neurological intensive care units should follow up the patient for alterations in consciousness, speech, motor activity, and pupillary light reflexes. When necessary, neurological assessments should be performed. Calcium channel blockers and volume expanders should be prescribed. Oral nimodipine therapy at a dose of 4x60 mg should be started and continued for 21 days.

2.7.2.3. Hydrocephalus: It is caused by problems in the CSF circulation within the ventricular or

subarachnoid distance. The patient develops impaired consciousness, increased sleepiness, vomiting, and a limited upward gaze. The patient should be closely followed up to detect any developing symptoms and signs of hydrocephalus symptoms. The CSF pressure should be reduced by performing an external ventricular or lumbar drainage.

2.7.2.4. Hyponatremia: Hyponatremia (serum sodium levels of <135 mEq / L) develops in almost 30% of patients. A persisting low sodium level for 24 hours should suggest inappropriate ADH syndrome, or more commonly, cerebral salt-wasting syndrome. A restriction of the intake of fluids is not recommended in hyponatremia.

2.7.2.5. Epileptic seizures: They are common in early periods of SAH. The patient should be followed up for the emergence of seizures. Vital signs of the patient should be checked frequently. Early-phase epileptic seizures are usually associated with increased intracranial pressure. Although there is an opinion that antiepileptics should not be started unless there is a seizure, some recommend to start antiepileptic therapy for 3-7 days until the aneurysm is treated. Electroencephalography (EEG) should be performed to rule out nonconvulsive status epilepticus in patients with unexplained deterioration in consciousness and the neurological condition.

2.8. Neurological deterioration in an acute stroke patient: Follow-up, frequently encountered conditions, and treatments

During the first 72 hours of stroke, the nurses have important responsibilities in following up patients and providing care and treatment. The evidence-based provision of care by nurses improves outcomes in stroke patients. Most of the evidence-based practices in the provision of care to stroke patients are initiated, implemented, and coordinated by nurses. The use of clinical guidelines and stroke management protocols improves compliance to evidence-based practices and improves patient outcomes (60,61).

Approximately 25% of patients with stroke show neurological deterioration in 24-48 hours after a stroke. Therefore; it is necessary to closely follow up the neurological conditions of stroke patients and evaluate the treatment efficacy. This

way, neurological and medical complications can be prevented. To achieve this, the nurse should:

- follow the vital signs of the patient after the acute revascularization treatment. The vital signs should be checked every 15 minutes for the first two hours, every 30 minutes in the following 2-to-6 hours, and every hour during the following 6 hours.
- follow the neurological examination findings of the patient after the acute revascularization treatment. The neurological examination should be performed every 15 minutes for the first two hours, every 30 minutes in the following 2-to-6 hours, and every hour during the following 6 hours.
- score the patient's neurological state in the NIHSS scale to evaluate the efficacy of treatment and care.
- monitor the cardiac rhythm in the first 24 hours to detect any cardiac rhythm abnormalities. The nurse should inform the neurology specialist of any abnormal findings (5,62).

2.8.1. Management of cerebral edema

Brain edema may usually develop with different manifestations mostly on the 2nd to 5th days after ischemic stroke, causing deteriorations in the patient's neurological condition and even death resulting from cerebral herniation.

Cytotoxic edema develops due to hypoxia due to ischemia (blood flow rate of <12 mL/100 gm/minute) and the resulting disturbances in the Na⁺-K⁺-ATPase pump. Sodium influx into the cell and potassium efflux out of the cell occurs and this is followed by fluid entry into the cell via passive diffusion. Massive astrocytic swelling develops in 3 hours-to-3 days after a stroke and does not respond to anti-edema drug therapy. Vasogenic edema develops resulting from increased capillary permeability due to the disruption of the blood brain barrier (63). Due to the increased permeability in the blood brain barrier, water and solutes enter the brain tissue. Because of the tight junctions, only fat-soluble substances can freely cross the cell membrane. Elevations in the intracranial pressure may result in herniation. Fatal cerebral edema and malignant MCA syndrome occur more frequently in young patients. The medical aspects are discussed in the next section. The nurse;

- raises the bed head by 20-30 degrees as it facilitates venous return into the head.

Furthermore it decreases the intracranial pressure by increasing CSF outflow from the brain. To achieve these, the nurse brings the patient to the semi-sitting position.

- avoids the administration of hypo-osmolar solutions, such as 5% dextrose and 0.45% NaCl, to the patient because such solutions aggravate cerebral edema.
- prepares the patient to receive osmotherapy. - prepares the osmotherapy solution (mannitol, hypertonic saline solution) upon the physician's order and follows the patient up.
- prepares the patient for therapeutic hypothermia at 32-34°C if it is approved by the neurologist. Then, the nurse follows up the processes.
- prepares the patient for surgical decompression in order to reduce intracranial pressure upon the physician's discretion of indications (54).

2.8.2. Maintenance of the airway patency

The nurse has important responsibilities in the control of intracranial pressure. These include especially focusing of the nurse on the maintenance of the airway patency and the maintenance of respiration and circulation so that the aggravation of cerebral edema can be prevented.

Airway management and ventilator support are recommended for the treatment of stroke patients with altered consciousness or bulbar dysfunction that affects respiration. Airway management and ventilatory support is absolutely necessary for unconscious patients and compromised airway patency. To prevent hypoxia and further aggravations of the neurological injury, it is extremely important to maintain tissue oxygenation during acute ischemia. Furthermore, endotracheal intubation should be performed if indicated (61).

The nurse can maintain the airway patency and, therefore, can prevent elevations in the intracranial pressure. For these purposes;

- The nurse monitors the factors; which increase the intracranial pressure. These factors include hypoxia, hypercarbia, and hyperthermia. If they develop, they should be recorded and reported to the physician.
- The nurse evaluates respiratory sounds and their speed and rhythm, and records them on the nurse observation form.
- The nurse monitors arterial blood gases to determine hypoxia and the effectiveness of

breathing.

- The nurse exercises care to keep the O₂ saturation levels more than 96%.

The adaptation of the patient with mechanical ventilation is evaluated.

- Before the aspiration, the nurse provides adequate oxygenation to the patient and, then, aspirates the airways by keeping the aspiration cannula not longer than 14 seconds in the airways. This way, further elevations of the intracranial pressure can be prevented.

- The nurse administers oxygen to the patient in the intervals between the aspiration sessions.

- The nurse collaborates with the physiotherapist to ensure the drainage of secretions.

- The nurse administers mucolytic, bronchodilator, and oxygen therapy, etc. when ordered by the physician.

- The nurse monitors, records, and evaluates the body temperature and performs the necessary approaches (Please see the nurse's responsibilities in body temperature control).

2.8.3. Responsibilities of the nurse in the control of the blood pressure

Increased blood pressure in stroke patients is a common condition. Both very high and low levels of blood pressure unfavorably affect the prognosis in ischemic stroke patients. A very high level of blood pressure in a stroke patient can cause high-risk complications such as encephalopathy, cardiac complications, and kidney failure. Although it occurs less commonly; hypotension can unfavorably affect perfusion of the penumbral region, resulting in increased area of cerebral injury. Therefore, the effective management of the blood pressure regulation and the maintenance of adequate blood pressure levels is critical for stroke patients to manage many neurological complications, including brain edema and hemorrhagic transformation particularly. However, one should not overlook that moderate hypertension can improve perfusion in the ischemic tissue. During this whole process, the nurse has important responsibilities in the management of the stroke patient's blood pressure.

The nurse manages these processes in compliance with the physician's order and the treatment guidelines about the management of blood pressure in the stroke patient. These require the nurse to perform the practices listed below:

- The nurse follows up the blood pressure every 15 minutes in the first 2 hours, every 30 minutes for the following 6 hours, and hourly in the following 16 hours in patients receiving reperfusion therapy.

The treatment protocols adapted for our country can be found in the Turkish Neurological Society (TNS) guidelines developed for the management of patients both before and after the iv tPA administration. The nurse gives the medical therapy to the patient as prescribed by the physician and in compliance with these guidelines (Table IV).

- The nurse measures the patient's blood pressure three times at 5-minute intervals before the treatment. A blood pressure value of <185/110 mm Hg is noted and the nurse informs the physician of this blood pressure value. Then; based on the physician's orders, the nurse prepares the patient to undergo treatment as stated in the blood pressure treatment protocol for patients receiving intravenous thrombolysis therapy; which is outlined in Table IV requested. The orders of the neurologist are administered to the patient (50).

- In patients; who are scheduled to undergo mechanical thrombectomy, it is appropriate to maintain the blood pressure below 180/105 mmHg during the procedure and within the first 24 hours of the procedure unless lower values are not ordered by the physician. However, the targeted blood pressure range after the procedure needs to be stated as a written order.

- Hypotension and hypovolemia should be corrected immediately to restore systemic perfusion necessary to maintain the functions of the organs.

- It can be beneficial in controlling the blood pressure in the long run to start antihypertensive therapy or continue the existing therapy in patients with blood pressure levels of >140/90 mmHg, who are neurologically stable during the hospital stay.

2.8.4. Responsibilities of the nurse in the control of the blood glucose levels

Although hypoglycemia is less common in the first 72 hours after a stroke, both hypoglycemia and hyperglycemia are common complications that can deteriorate the neurological condition of the patient.

During the provision of care to the stroke patient with hypoglycemia, the nurse;

- should follow up autonomic findings such as

sweating, tremor, and anxiety, and follow up the findings of hypoglycemia such as disorientation, dizziness, and speech difficulties. The nurse should record the findings on the nurse observation sheet and informs the physician.

- should follow up the blood glucose levels every 6 hours for 72 hours if not ordered otherwise by the physician.

- should note the blood glucose values, inform the doctor and prepare the patient for the treatment of hypoglycemia quickly when the blood glucose is <60 mg / dL in an acute ischemic stroke patient. According to the physician's orders, the patient receives 25 ml of 50% dextrose solution or an equivalent via iv infusion. If the patient does not have difficulty swallowing and if the physician orders, oral glucose solutions may also be a treatment option.

- should evaluate and record whether the blood glucose is normal or not during the follow up of the patient and laboratory findings.

During the provision of care to the stroke patient with hyperglycemia, the nurse;

- follows up the signs and symptoms of the patient; including dry mouth, loss of skin turgor, dry and red skin, dehydration, weakness, fatigue and drowsiness, and blurred vision.

- checks and notes the vital signs (blood pressure, pulse, respiratory rate, and body temperature) of the patient.

- checks the blood glucose levels. If the blood glucose level is higher than 240 mg/dl, the nurse should prepare the patient to test ketones.

- follows up blood glucose levels, since the blood glucose levels in the range from 140 to 180 mg/dL are optimal to stabilize the cerebral injury.

- notes the changes in blood glucose values on the nurse observation paper; informs the doctor about the situation, and prepares the patient to administer the hyperglycemia treatment protocol specified in the Turkish Neurological Society guidelines as outlined in Table VII (50).

2.8.5. Responsibilities of the nurse in the management of epileptic seizures

The most common cause of epileptic seizures is stroke in adults (11%) and especially in old individuals (45%). Seizures within 15 days after a stroke are "early" seizures. Seizures occurring after the 16th day of stroke are accepted as "late" seizures.

The nurse should perform the following to manage epileptic seizures in a stroke patient (64,65):

- Follows up and notes the epileptic seizures for the type, frequency, and duration.

- Ensures the safety of the patient with seizures, raised the bedside rails.

- Turns the patient's head to the side to facilitate the flow of secretions and prevent the tongue from blocking the airway.

- Gives the anticonvulsant/antiepileptic drugs to the patient as prescribed by the physician.

- Monitors and records the vital signs, especially follows up the respiratory rate, rhythm, and type.

- Does not leave the patient alone during a seizure.

- Follows the patient up for status epilepticus

Prepares the set up to provide intensive care to the patient when status epilepticus develops.

2.9. Medical treatment and nursing approaches in brain edema and increased intracranial pressure in ischemic and hemorrhagic stroke

Brain tissue is very sensitive to volume changes because it is located in an unexpandable anatomical structure that is the skull. The intracranial pressure (ICP) is ≤ 20 cmH₂O under normal conditions and it is maintained in a narrow physiological range. ICP rapidly increases in volume-increasing pathological conditions; including ischemic and hemorrhagic stroke. When increased pressure and the shift of the injured tissue towards the undamaged side cannot be prevented and treated, these may disrupt the perfusion in the intact areas in the brain unaffected by the primary pathology, causing further injuries. Consequently, this results in a vicious cycle; which may end in "brain death".

Increased intracranial pressure syndrome (IICPS) is one of the most important factors responsible for early mortality and morbidity after a stroke. IICPS can occur in many different manifestations of stroke. The major determining factors in IICPS are the extent and location of the injury. The likelihood of IICPS is high during ischemic processes affecting the entire middle cerebral artery area; which is also known as malignant middle cerebral artery infarction. Furthermore, the likelihood of IICPS is also high in intracerebral hemorrhages larger than 30 mL of volume, wide areas of ischemia in the cerebellum, and cerebellar hemorrhage. Severe vasogenic

edema in the ischemic area resulting from the disrupted blood brain barrier is responsible for the developing IICPS after ischemic stroke. This edema usually maximizes on the 3rd and 5th days after the stroke. Both the volume effect of the hemorrhage and the edema around it contribute to the elevation in intracranial pressure in intracerebral hemorrhages. The major principles in the management of IICPS include identifying high-risk patients before they develop significant elevations in intracranial pressure, avoiding conditions that may elevate the intracranial pressure, and starting indicated treatments without delays if the signs of IICPS occur. Therefore, it is necessary that stroke patients at risk of IICPS should be identified by the physician and nurse team at the time of admission. Clinical harbingers of IICPS include deteriorations in consciousness and focal neurological examination findings, anisocoria, a tendency for increased systemic blood pressure as a component of the reflex to improve cerebral perfusion, and bradycardia as another component of the same reflex. However, serial radiological imaging tests are recommended in addition to the clinical follow-up of high-risk patients because the clinical findings are not sensitive enough and these findings can also occur due to reasons other than IICPS.

Although methods are available for direct monitoring of intracranial pressure; the benefits of them have not been clearly demonstrated, yet.

Standard principles of care to be followed in patients with IICPS or at risk of developing IICPS can be summarized as follows: First of all, the patient's head should not be placed at an angle narrower than 30° to the horizontal plane so that cerebral venous drainage can be maintained readily. Again, the patient's head should be kept in the midline to prevent a potential unilateral venous compression. The patient should be kept at absolute bed rest. Coughing or straining should be prevented. In case of necessity, the prescription of laxatives can be considered. The patient's body temperature should not be allowed to remain high and the patient should be kept normothermic. Any pain should be effectively treated. The fluid intake and output of the patient should be closely monitored. Placing a urinary catheter to the patient is a must. Administration of hypotonic solutions, such as 5% dextrose, to the patient should be avoided. Due to the negative effects of

hypercapnia on intracranial pressure, the airway patency should be ensured and the patient's breathing efforts and pattern should be closely monitored (66).

If IICPS develops despite all efforts, the patient should be intubated without delays, sedated, and hyperventilated to reduce the PaCO₂ pressure in the range from 25 to 30 mmHg. Although hypertonic solutions (20% mannitol, 3% sodium chloride, etc.) are commonly used in the treatment of cerebral edema and IICPS, the evidence for their benefits is insufficient. It should be noted that these treatment modalities (sedation, hyperventilation, hyperosmolar therapy) provide only short-term reductions in the intracranial pressure, saving time until the start of an effective treatment such as surgery. Otherwise, these treatment modalities cannot permanently control the intracranial pressure elevations. Corticosteroids; on the other hand, do not affect the stroke-related edema at all. Due to their potential side effects, they are not recommended for the treatment of IICPS in stroke patients. Suboccipital craniectomy in patients with cerebellar hemorrhage and ischemia, and hemispheric craniectomy in malignant middle cerebral artery infarcts are the most effective treatment options for IICPS (67).

2.10. Postoperative patient follow-up in the neurology intensive care unit (care after decompressive craniectomy, aneurysm surgery, and hematoma surgery)

Patients who are followed up postoperatively in the neurology intensive care unit usually undergo decompressive craniectomy or surgery for the treatment of cerebral-subarachnoid hemorrhage.

Following subarachnoid and cerebral hemorrhages, sudden elevations of intracranial pressure occur. In these patients, the aim is to reduce intracranial pressure by evacuating the hematoma, perform an aneurysm repair, and prevent secondary tissue damage.

Craniectomy is the process of removing a part of the skull to control brain edema and increased intracranial pressure. Depending on the size of the bone removed, a 15-85% reduction in intracranial pressure is achieved following the operation. The removed bone tissue can be kept in the subcutaneous adipose tissue of the anterior abdominal wall or in the deep freezer until it will

be placed again.

There are six physiological parameters; which can be used as an early warning system in the postoperative and clinical follow-up of patients. These are the respiratory rate, oxygen saturation, body temperature, systolic blood pressure, pulse rate, and the level of consciousness. Furthermore, patients should be closely monitored for infection, sepsis, shock, and the effects and side effects of analgesic and anesthetic therapy. Besides the vital sign monitoring, it is critical to record these data. The physician should be informed immediately in case of clinical deterioration and abnormal vital signs (58).

2.10.1. Airway and respiration: The airway patency, the respiratory rate, and the depth of respiration should be closely monitored; care should be exercised to ensure sterility during the aspiration of the airways of intubated patients, and patients' vomiting and aspiration should be prevented.

2.10.2. Oxygen therapy: Oxygen therapy should be started as prescribed and it should be documented. Humidification should be ensured to prevent drying of mucous membranes during continuous oxygen therapy.

2.10.3. Pulse oximeter: The cleanliness of the probe should be ensured. The probe should be repositioned at regular intervals to prevent compression on the patient's fingers. It is recommended that the oxygen saturation should be maintained at 95% or more.

2.10.4. Heart rate and blood pressure: Heart rate, cardiac rhythm, alterations in the color and temperature of the extremities as indicators of peripheral perfusion, and the blood pressure should be closely followed up. Hypertension should be avoided.

2.10.5. Body temperature: Body temperature of patients should be monitored and maintained high temperatures should be reduced to normal levels.

2.10.6. Consciousness: The consciousness state of the patient and his/her communication capacity should be examined in detail.

The fluid intake and output balance, vomiting-nausea, and the nasogastric tube drainage material of the patients should be closely followed and recorded. Urine output should not be less than 0.5 ml/kg/hour.

The daily calorie requirement of the patients should be calculated and enteral nutrition should start in the early period. The places of the nasogastric tubes should be checked frequently. Care should be exercised not to start oral feeding without evaluating the swallowing function of the patient.

The head of the patient should be elevated to 15–30 degrees. Care should be exercised while positioning the patient's head. The head of the patient should be supported with towels, pillows, and inflated head and neck supporters. Warning notes should be placed appropriately at the bedside of the patient to inform other healthcare professionals about the bone defect of the patient; who has undergone decompression surgery.

Peripheral venous catheters should be checked daily. Catheters; which remained for more than 72-96 hours, should be removed. Catheter entry sites should be checked for signs of infection and phlebitis such as redness, swelling, edema, and increased temperature.

The incision sites in the head and the anterior abdominal wall should be followed closely for signs of infection such as discharge, redness, and hemorrhage in patients undergoing decompression surgery. The dressings of the patient should be changed and wound care should be provided at regular intervals. The volume of the drained fluid should be noted.

All activities that increase intracranial pressure or prevent venous return (straining, etc.) should be prevented. Necessary measures should be taken to prevent constipation. The pain of the patients should be managed.

Body and mouth care should be provided at regular intervals. All hygienic measures should be taken to reduce the risk of infections in the urinary tract, lungs, and wound site.

In order to prevent bed sores, patients with improved consciousness and stable hemodynamics should be brought to the sitting position with their backs supported with pillows in the bed; as well as, frequently turning the patient over. The plegic extremities should be positioned appropriately.

Limb movements and respiratory exercises with deep breathing and coughing exercises should be started in the early period in order to reduce the risk of systemic embolism. Patients should wear anti-embolic socks or compression sleeves. Early mobilization of patients should be ensured and rehabilitation treatment should be started in order to prevent complications. Low molecular weight heparin can be started in patients; whose bleeding is under control.

The sleep-wake cycles, sleep apnea, anxiety, agitation, hallucination, depression, and mood alterations should be closely followed up. The number of visitations should be limited; however, patients should be allowed to see family members (68).

2.11. Intra-hospital transfer of acute neurological patients

The nurse has important responsibilities in transferring the stroke patient from one clinic to another, to diagnostic units, to the stroke unit or the neuro-intensive care unit, or to external institutions for emergency interventions, examinations, and treatment. During the transfer, the nurse should prioritize the patient's safety and develop a plan to maintain the provision of care. To accomplish the abovementioned action points, the nurse (54,69-72);

- communicates with the relevant units, prepares the patient, and sets the conditions in place to achieve the following: The physical examination of the patient at the time of the admission to the emergency unit (the first examination at admission) should last only less than 5 minutes; the length of the first neurological examination (from the time of admission to the neurological examination by the neurologist) should be less than 15 minutes, and the time between the emergency unit admission to the first neuroimaging (from admission-to-cranial CT interpretation) should last less than 45 minutes.
- administers the physician's prescription. The time elapsing from the emergency unit admission to the start of the iv thrombolytic therapy (from admission to the injection) should be less than 60 minutes. Turkish Cerebrovascular Diseases Society advises to keep this period as short as possible, targeting a period of less than 30 minutes (47).
- organizes the transfer of the acute stroke patient to the stroke unit or to the neuro-intensive care unit appropriately after the first intervention in

the emergency unit. The transfer should take place in less than three hours.

- communicates with the unit, to which the patient will be transferred, before the transfer and informs the staff in charge in relevant departments.
- identifies the necessary equipment for the transfer of the patient; checks the equipment (monitor/defibrillator, portable mechanical ventilator, pulse oximeter, oxygen cylinder, resuscitation bag with sufficient amount of drugs and materials, infusion pump, etc.), and gets the equipment ready for the transfer.
- orders the lift to be ready to ensure the transfer as soon as possible.
- ensures that the patient is transported from the bed to the stretcher/wheelchair by using the appropriate techniques.
- ensures a safe transport for the patient. The side rails should be raised if the patient is transported by a stretcher.
- accompanies the patient and the personnel transferring the patient to the clinic/unit.
- sets up a transfer team consisting of at least two transport personnel, a nurse, and a physician if the general condition of the patient is critical.
- brings the patient to an appropriate position to maintain the airway patency, oxygenation of the patient, and the cerebral circulation (the patient's head should be elevated at a 20-30 degrees angle from the stretcher).
- closely monitors the patient's general condition, vital signs, and consciousness state and records the findings if necessary.
- fills in two "patient transfer forms" and signs them to be documented by the transferring and admitting nurses.
- brings the necessary medicines, radiological images, medical equipment, and necessary documents during the transfer of the patient to the stroke unit or the neuro-intensive care unit.
- collects all examination and laboratory test results; prepares the patient file; and delivers them to the secretary of the unit that the patient is transferred.
- informs the patient and the family about the indications for the transfer and about the unit that the patient will be transferred in order to alleviate their anxiety.
- maintains the patient's privacy during the transfer process.
- The nurse in the stroke unit or the intensive care

unit admits the patient and takes the patient from the stretcher/wheelchair safely to the bed.

- The nurse accompanying the transfer removes the patient's identification bracelet. The admitting nurse signs the necessary documents; takes the delivery of the patient's file, medicines, and belongings, and documents the delivered items appropriately.

3. GENERAL PROVISION OF CARE AND MANAGEMENT OF SYSTEMIC PROBLEMS

3.1. Management of fever and the body temperature in the stroke patient

The body temperature starts to rise in the first hours in approximately 1/3 of stroke patients. Disorders of the body temperature regulation center in the hypothalamus of patients with cerebral hemorrhage can secondarily elevate the body temperature. It is important to determine the etiology of the hyperthermia in acute ischemic stroke patients because it unfavorably affects the prognosis. Possible causes of hyperthermia such as infective endocarditis, pneumonia, and sepsis should be ruled out and treatment should be started as indicated.

The nurse has important responsibilities in reducing the fever and controlling the body temperature; which is a factor that aggravates ischemic brain damage. To accomplish the abovementioned action points, the nurse (53,54,60,61);

- closely monitors the body temperature and other vital signs,
- airs the patient's room and dress the patient lightly,
- applies cold compresses to reduce the body temperature,
- carefully administers antipyretic therapy prescribed by the neurologist as stated in the 2018 AHA/ASA guidelines (52,53) when the body temperature of the patient is measured $>38^{\circ}\text{C}$.

Protects the patient against nosocomial infections. For this purpose;

- applies invasive interventions using aseptic techniques,
- exercises care and uses appropriate techniques while washing hands before giving care to the patient,
- provides daily care and maintenance for iv catheters and foley catheters,
- closely monitors the signs and symptoms of infection (fever, redness at the catheter entry site,

discharge; change in urine color, smell, and appearance, and elevated leukocyte counts),

- follows up the results of laboratory tests (like he/she follows up leukocyte counts),
- administers systemic antibiotic therapy as prescribed by the physician if the cause of hyperthermia is infection.

3.2. Oxygen therapy in the acute stroke patient

A patient with an acute stroke usually has a patent airway and can breathe without support. However, some patients do not fall into this general categorization. Respiratory problems may arise in brainstem infarctions, middle cerebral artery infarctions, large hemispheric lesions, brainstem hemorrhages, and stroke-related epileptic seizures. Some conditions may require deep tracheal aspiration and/or early intubation, monitoring, and mechanical ventilator support when the external oxygen supply is not sufficient. It should be remembered that the patient should be conscious to apply non-invasive mechanical ventilation without intubation. Non-invasive mechanical ventilation is generally provided to conscious stroke patients after they were weaned from the mechanical ventilator. Stroke patients are usually old individuals. The respiratory reserve is low in these patients and the elasticity of their lungs are impaired, which are highly important two factors for inspiration and expiration. Although the cerebrovascular injury alone may impair respiration, it is very important to know the patient's existing lung and respiratory system disorders. This is very important for the patient follow-up. The obesity and smoking are important factors as much as current lung diseases. As they may impair pulmonary functions in the follow-up period, the medical team should be informed about them. Pneumonia is the cause of mortality in 15-29% of post-stroke deaths. The most common underlying reason is the pulmonary aspiration of the oropharyngeal content. The high volume and the bacterial load of oropharyngeal secretions result in aspiration-related pneumonia in this group of patients with impaired immune functions. Dysphagia, intraoral abscess, sinusitis, and antibiotic resistance increases the risk of infection caused by pathogenic organisms. Such disorders should be noticed and care should be exercised in their treatment and follow-up during the follow up of the patient. The reduction of bacterial load in

oropharyngeal secretions is associated with the effectiveness of aspiration and oral care. These practices are very important in the airway management of stroke patients.

Evaluation of respiratory distress requires clinical and laboratory examinations. Tachypnea, dyspnea, orthopnea, nasal speech, a weak cough (expiratory muscle weakness), abdominal breathing and retraction of the accessory muscles of respiration (inspiratory muscle weakness) are the clinical indicators of respiratory distress. The laboratory tests to evaluate respiratory distress include arterial blood gas tests (pH, PaO₂, PaCO₂, HCO₃, O₂ saturations) and pulmonary function tests (PFT). PFT is not a routinely used test in acute stroke patients. PaO₂ levels less than 80 mmHg is called hypoxemia. The severity of hypoxemia is graded. PaO₂ in the range from 60-80 mmHg is "mild" hypoxemia. The values in the range between 40-60 mmHg indicate "moderate" hypoxemia and values less than 40 mmHg indicate "severe" hypoxemia. When PaO₂ values are less than 60 mmHg in acute respiratory distress, O₂ saturation values are around 90%. It is very important to maintain tissue oxygenation. The sigmoidal shape of the oxyhemoglobin dissociation curve demonstrates that the oxygen saturation will significantly decrease if the oxygen pressure drops further. This finding indicates that tissue oxygenation will be impaired further. In such a condition, oxygen should be administered to the patient. The value of PaO₂ should be increased to levels more than 60 mmHg and the O₂ saturation should be increased to values around 90%. Low and high-flow systems can be used to deliver oxygen. Low-flow systems include nasal cannulas, simple face masks, partial rebreathing masks, and nonrebreathing masks. Systems that deliver high-flow oxygen are Venturi masks and mechanical ventilation. A nasal cannula is the most commonly used oxygen delivery system. It allows for the oxygen delivery from the nose to the nasopharynx at a flow rate of 1-6 liters/minute. This flow rate accounts for values in the range of 0.24-0.44 FiO₂. Every 1 liter increase in oxygen is estimated to increase the FiO₂ levels almost by 4%. Simple face masks that cover the nose and mouth can deliver oxygen concentrations of up to 60%. To prevent the accumulation of CO₂ in the mask, the oxygen flow should be 4-8 liters/minute. When it is necessary to give more than 60%; a reservoir is attached to the face mask, allowing for a

continuous oxygen delivery. The reservoirs without a one-way valve are called partial rebreathing masks. Reservoirs with a one-way valve and containing 100% oxygen are called partial nonrebreathing masks. The one-way valve in these masks prevents the patient from breathing the air in the room and allows the patient to breathe only the air in the reservoir. This type of a mask allows for oxygen delivery at FiO₂ ranges from 0.7 to 1. The adverse effects of oxygen therapy include oxygen toxicity and CO₂ retention. High doses of oxygen should be given for a long time for the development of oxygen toxicity caused by free oxygen radicals. Oxygen therapy is administered when indicated and when its benefits outweigh its risks. Nevertheless, long-term administration of high doses of oxygen should be avoided. To prevent CO₂ retention, low-flow oxygen therapy can be started. The O₂ saturations should be maintained at levels of 90-92% and the PaO₂ should be maintained at values around 65 mmHg. Oxygen parameters should be regulated with close monitoring of arterial blood gases (73).

3.3. Evaluation of the swallowing function in the stroke patient

Although 90% of patients can develop a safe swallowing function 2 weeks after the stroke, dysphagia persists in a small number of patients (74,75). Dysphagia is associated with increased rates of aspiration pneumonia, malnutrition, dehydration, prolonged hospitalization, longer need for rehabilitation and care, impaired quality of life, and mortality (76,77,78).

3.3.1. Evaluation of the swallowing function: How and when?

Guidelines recommend using a validated bedside screening test to make a swallowing assessment (79). A review article about nursing, including patients with acute ischemic stroke advises that swallowing assessment should be made with a valid screening test within 24 hours after admission in patients with acute neurogenic dysphagia, including patients with acute ischemic stroke. The same review reports that the frequencies of pneumonia and mortality can be reduced by training nurses to practice dysphagia screening tests to assess swallowing functions of patients (80).

Screening tests evaluate the swallowing

function by observing the patient while swallowing water, beverages with variety of fluidity, and solid foods. Several assessment tools can be used for dysphagia screening; including "Toronto Bedside Swallowing Screening Test" (81), "Gugging Swallowing Screen" (82), "Mann Assessment of Swallowing Ability" (MASA), modified MASA (83), and "Barnes Jewish Hospital Stroke Dysphagia Screen" (84). No studies have yet demonstrated the superiority of one of these tests to another. Also, no common opinion exists as to which test is the best. Any of these tests can be selected and used in routine practice (76). For example, "Barnes Jewish Hospital Stroke Dysphagia Screen" is a very simple test to administer and it is available on the internet.⁸³ In the first stage of this two-stage test; Glasgow coma scores of <13, facial asymmetry/weakness, tongue asymmetry/weakness, and palatal asymmetry/weakness are screened. When any of these is detected, the rater proceeds to the assessment of dysphagia. When none of these are detected, a swallowing test is made with "3-oz (90 cc) water (84,85). The patient is asked to drink 90 cc water without interruption. The rater should proceed to swallowing assessment once more when the patient is unable to do so or when the patient starts coughing, aspirates, displays voice changes, or develops wet hoarseness during the test or within one minute after the test is completed. The water swallow test can be made in different ways. For example, the patient is first asked to drink 5 mL of water for 3 times and each gulp is observed. Then, the patient is asked to drink 50 mL of water and observed again (76). Since the likelihood of the improvement of dysphagia is high in the first weeks, it is appropriate to evaluate patients at least twice a week to determine the time to start oral intake. Oral intake can be started carefully in patients who pass the test; however, those patients should be observed for the risk of aspiration (76).

A video fluoroscopic swallowing exam (VFSE) and fiberoptic endoscopic evaluation of swallowing (FEES) are specific techniques used for the advanced assessments of dysphagia. Screening tests may fail to detect silent aspirations. Moreover, a study demonstrated that screening tests failed to identify aspirating patients at rates of up to 40% (86). However, the critical significance of clinically detected asymptomatic

small abnormalities in tongue movements and silent aspirations found in FEES are not widely recognized (77).

3.3.2. Rehabilitation of the patient with dysphagia

The treatment for dysphagia should be carried out by a team of neurologists, physiotherapists, speech-language therapists, swallowing therapists, dieticians, occupational therapists, and stroke nurses (76).

No accepted medical treatment options are available for dysphagia developing after a stroke (77). The favorable effects of maintaining oral hygiene with oral and dental care have been shown in stroke patients (87,88). Head flexion, turning the head to the weak pharyngeal side (hemiplegic side), and "chin tuck" are the examples for postural arrangements. Multiple swallow, effortful swallow, supraglottic swallow, supersupraglottic swallow, Mendelsohn maneuver, and laryngeal elevation are the examples for compensatory maneuvers (89,90). These aim to improve swallowing safety and prevent aspiration. Dietary adjustments, dietary enrichments, thickeners, enteral tube feeding, and percutaneous endoscopic gastrostomy (PEG) are the adaptive methods of feeding. The data about the aspiration-reducing effects of thickeners are not sufficient. Moreover, it has even been shown that the use of thickeners can lead to a reduction in fluid intake.⁸⁰ Sensorimotor exercises, tongue-chin resistance exercises, chewing exercises, and laryngeal adduction exercises can be used as corrective methods to improve impaired swallowing functions. To improve swallowing; biofeedback systems and oral thermal, electrical, and vibratory sensory stimuli can also be used.^{19,80} Despite the demonstration of positive results with all of these applications, randomized controlled studies are still warranted (91).

Finally, the use of the pharyngeal electrical stimulation (PES) method has been shown to be safe as a promising option but it was not found effective in the treatment of dysphagia in patients with subacute stroke. The study argued that that result was obtained because more than half of the patients received suboptimal stimulation (92). In another study, it was shown that PES significantly increased the chance of decannulation in stroke patients with tracheotomy (93).

3.4. Hydration and nutrition in the stroke patient

3.4.a. Evaluation, starting oral / non-oral feeding, monitoring, and calorie and protein supplements

Stroke patients are at risk of malnutrition and dehydration due to impaired consciousness, swallowing problems, decreased mobilization, and depression (94). While the rate of malnutrition in stroke patients is 5-32% at the time of hospital admissions, this rate increases further with the length of hospital stay (95,96). Ensuring proper hydration and nutrition after a stroke is important to achieve clinical recovery. The development of dehydration and malnutrition after a stroke increases mortality, morbidity and costs of care. It is accepted that the correction of nutritional parameters contributes positively to clinical prognosis in general in stroke patients (76).

Nutritional status and hydration of stroke patients should be evaluated at regular intervals both at the time of admission and afterward to develop the most appropriate diet for the patient (96). Clinical scales, laboratory tests, and anthropometric measurements can be used to evaluate the nutritional status (97). Routine use of oral nutritional supplements is not recommended in stroke patients. However; oral nutritional support can be started in patients with malnutrition risk or with malnutrition; as well as in patients; whose protein and calorie needs cannot be met with a normal eating plan. It is important for the patients to achieve their protein and calorie intake goals as soon as possible. After the acute stroke treatment and the achievement of hemodynamic stabilization; enteral feeding should be started as early as possible in the absence of severe nausea, vomiting, or bowel distension, or a severe metabolic disorder such as diabetic ketoacidosis or hepatic coma, or hemodynamic instability requiring large volumes of fluid replacement. Early enteral nutrition is important for the integrity of the intestinal mucosa, maintenance of the barrier function, and body defense systems (98). Parenteral nutrition is used only when oral or enteral feeding is contraindicated or when these interventions fail to meet nutritional goals in stroke patients (99,100).

Patients should be followed up for the maintenance of adequate hydration and nutrition during the inpatient period (76,96). Follow-up, especially during the first week, is important for

patients starting enteral feeding. The urine output should be checked regularly. Close blood glucose monitoring should be performed; biochemical parameters should be checked daily, and body weight should be followed up at reasonable intervals (101). Every stroke patient; who cannot be fed orally due to impaired consciousness and difficulty swallowing, is at risk for malnutrition and dehydration. Regardless of the underlying cause and in the absence of contraindications; enteral nutrition should be started in all stroke patients; who are unable to have oral intake. A feeding tube is used for enteral feeding in stroke patients. Enteral tube feeding can be provided by maintaining a continuous infusion with special pumps or bolus volumes can be administered intermittently. Continuous infusion is preferred in hospitalized stroke patients because it reduces the risks of aspiration, pneumonia, and diarrhea; as well as reducing the rate of contamination in the products (101). To reduce the risk of aspiration during the infusion of the nutritional product, the patient's head should be elevated at a 30-45 degrees angle from the bed. It is not recommended to measure the gastric residual volume (GRV) in every patient. Follow-up of GRV is performed only in patients; who cannot tolerate enteral nutrition, who suffer from nausea and vomiting, who have gastric distension, and who have decreased bowel sounds (76).

In stroke patients, the daily calorie requirement can be practically calculated as 20-30 kcal/kg based on the calorie calculations for the ideal body weight. The daily protein need can be calculated as 1-5 kcal/kg/day. Especially in stroke patients in need of intensive care, the protein need can be up to 2 g/kg/day. Feeding should start with a 20 mL/hour rate and the targeted dose should be reached within 48-72 hours at the latest. The daily necessary fluid intake can be calculated as 30 mL/kg/day. In order to achieve this goal and prevent dehydration, it should be considered free water is present in the nutritional products at a rate of 69-86%. Polymeric standard nutritional products are preferred for use in stroke patients. Diabetic products can be used in patients with uncontrollable blood glucose levels, high-fiber products can be used in patients with diarrhea and constipation, high-calorie products can be used in patients requiring restrictions of fluid intake and when energy needs cannot be met, and high-protein products can be used when protein

deficiency is detected (76).

3.4.b. Hydration and nutrition in the stroke patient: Nursing practices

Swallowing is one of the essential functions for survival. Swallowing is performed voluntarily to eat and reflexively to clean the airways, and it is regulated by a complex neurophysiological mechanism (102-104). Dysphagia is observed in the first 3 days of stroke in approximately 42-67% of patients due to a defective mechanism. Like other problems, the severity of this problem gradually decreases over time. At the end of the first week, 70% of patients recover; however, dysphagia continues for a long time (> 6 months) in 11-19% of patients (105,106). It should be noted that studies report stroke-associated dysphagia as a dynamic problem that can follow a course with fluctuations (105). Aspiration occurs in about half of patients with dysphagia in the acute phase with one-third developing pneumonia. Dysphagia can cause aspiration, resulting in pneumonia. Also, it can limit oral intake, leading to dehydration and malnutrition (107).

In order to notice dysphagia and prevent its untoward consequences, it is recommended to screen swallowing functions of patients (a preliminary evaluation) in the early period of stroke (52,79,107). Patients should be screened for their ability for swallowing in the emergency unit or in the stroke unit within the first 24 hours of admission and the results of the examination should be recorded in the patient file (52,79,107).

Before starting the oral intake (eating, drinking, and oral medicine intake), screening of stroke patients for the swallowing function is recommended (107).

One should be vigilant during the follow up of patients at high risk for dysphagia (patients with abnormal gag reflex, inability to cough, hoarseness, inability to close the mouth and lips completely, severe neurological deficits, and cranial nerve paralysis) (60).

It is recommended to use bedside swallowing tests with proven validity and reliability during screening (52,108). One of the most commonly used bedside tests is the GUSS test. The results of GUSS test were evaluated whether they are congruous with the results obtained with FEES and VFS; which are the gold standard techniques in the assessment of the swallowing function. Consequently, GUSS is found to be a reliable tool

for detecting swallowing problems (82,109).

It should be remembered that the patient should be conscious, cooperable, and can sit to administer this type of tests. Water and the types of foods are administered to the patient by gradually increasing the thickness of the food (first water is administered, then pure/yogurt, then banana/pudding, and normal food is administered depending on whether the patient can swallow the food in the previous stage). The patient is asked to drink a tablespoon of water and signs of dysphagia (cough, wet hoarding, delayed swallowing, ability to swallow the food in the mouth completely, and hypoxia as measured with a pulse oximeter) is observed. Oral intake is not allowed when one or more of the above-mentioned symptoms are observed (102).

A swallow screen can be performed by a language and speech therapist or by nurses trained appropriately (52,108). Nurses can safely perform bedside tests after passing an exam that measures success at the end of training.

Patients; who fail in the swallow screen should be evaluated by the language and speech therapist (98,107).

Instrumental evaluation can be performed in patients with high fever, persistent fatigue, recurrent infections, and weight loss suggesting silent aspiration and in patients with suspected aspiration. This evaluation will determine the presence/absence of aspiration, as well as, the disturbed regulation mechanism of swallowing in the patient. The findings contribute to the treatment plan. There is no clear conclusion about which method to use. Both FEES or VFS can be used for instrumental evaluation according to their availability (107).

The use of other methods such as neuromuscular electrical stimulation, pharyngeal electrical stimulation, or acupuncture etc. are sometimes used in stroke patients with dysphagia; however, their routine use is not recommended (52).

Swallowing exercises (to increase oropharyngeal muscle strength, etc.) and maneuvers (turning the head to the plegic side, Mendelssohn maneuver, etc.) may be useful in patients with swallowing difficulties (107).

Also, behavioral approaches have been suggested in dysphagia. These include taking necessary precautions for safe swallowing (98,102,107).

- Meal times should not be skipped, a distraction-free environment should be ensured, and the patient should not be in a rush.
- Regardless of the route of feeding (oral or nasogastric or PEG); the head of the patient should be kept elevated during and after feeding (for 30-40 min) and the patient should sit upright.
- Hyperextension of the head should be prevented during swallowing [the head should be maintained in this position during feeding by lowering the chin anteriorly and downward - (chin-chest position); for example, flexion of the head can be facilitated by cutting the rim of a cardboard cup to prevent encumbering by the nose, etc.]].
- Spoons and cups can be used for fluid intake and early pipette use should be avoided.
- Patients should be fed with small bites should be advised (large if apraxia) and the other bite should not be given before one bite is completely swallowed.
- The consistency of food can be modified (so that the patient can swallow safely based on the bedside swallowing test results. When necessary, the viscosity of fluids can be increased with thickeners. Because adopting thickeners in the diet scheme may not be easy, one should remember that such patients will be at risk of dehydration. Patients should be fed with food in the consistency and homogeneity of yogurt/pudding. Food processors can be used for this purpose. Solid and liquid foods should not be consumed together).
- It may be suggested to drink fluids after the meal so that the mouth and vallecula can be cleaned.

The application of the oral hygiene protocol is recommended to reduce the risk of post-stroke pneumonia. This recommendation takes place in international guidelines based on several studies published in recent years, reporting that intensive oral hygiene protocols reduce the risk of aspiration pneumonia in stroke (87,88,110). Oral hygiene was provided with chlorine hexidine mouthwash and oral care + antibacterial gels in these studies.

In patients with difficulty swallowing, nasogastric tube feeding should be started in the early phase of stroke (within the first 7 days) to ensure nutrition (53).

When it is predicted that difficulty swallowing will be long-term (>2-3 weeks), PEG is used (27). In patients with PEG, problems such as diarrhea, vomiting, entry site infection, leakage, infection in the stoma region, granulation, and

stenosis of the tube may occur (105).

Before feeding the patient via the tube, one should make sure that the tube is in place (by pH measurements in the gastric aspirate or the use of graphics). Intestinal auscultation should be performed to ensure the presence of gastrointestinal motility. The head of the patient should be elevated during feeding and in the following 30-45 minutes after the feeding (102,105).

When patients are discharged from the hospital with nasogastric tubes or PEG, these patients and their relatives should be trained on tube feeding and catheter care in advance. Contact details of the nutrition support nurse can be provided to the patient and relatives (105).

The administration of nutritional supplements can only be considered in patients with malnutrition or at risk of developing malnutrition (107).

Hypovolemia may develop in patients with dysphagia due to the restriction of the fluid intake, especially of non-viscous liquids like water. Since hypovolemia can cause hypoperfusion, aggravate ischemic brain damage, and increase the myocardial load; the maintenance of euvolemia is critical in these patients. Fluid replacement for euvolemic patients at admission should aim to maintain euvolemia. Unless there are unexpected losses, the daily fluid requirement in adults is 30 ml per kg. The volume of fluid replacement is calculated according to this ratio. Fluid loss should be replaced in hypovolemic patients at admission. However, caution should be exercised against volume loading, especially in patients with heart or kidney failure. Conditions that will increase the volume of fluid replacement (fever, etc.) should be taken into consideration. Isotonic solutions (0.9% NaCl) should be preferred for fluid replacement therapy instead of hypotonic and hypertonic solutions (65).

3.5. Follow up of blood glucose levels in the stroke patient

Hyperglycemia is a complication seen in approximately half of all stroke patients in the acute period regardless of having the medical history of diabetes mellitus (111,112). The occurrence of hyperglycemia in acute-phase stroke patients with no history of diabetes and normal HbA1c levels suggests the role of acute stress as a factor (113). The physiological stress response of

the body to a catastrophic event such as stroke can cause the release of stress hormones like cortisol, catecholamines, and proinflammatory cytokines, leading to hyperglycemia. It is reported that an undiagnosed glucose metabolism disorder may take a part in in non-diabetic patients, causing hyperglycemia. While 20-35% of stroke patients have history of diabetes, blood glucose values more than 110 mg/dL and no medical history of diabetes are found in more than half of stroke patients (111,114).

Regardless of the presence of diabetes, unfavorable effects of high blood glucose levels in acute stroke are known. Hyperglycemia has been demonstrated to increase morbidity and mortality by aggravating acute ischemic brain injury (brain edema, herniation, and infarct size) and by impairing the repair processes in the brain (by suppressing the brain-derived neurotrophic factor -BDNF-) (112,115,116). A study conducted on nondiabetic acute stroke patients found higher fasting plasma glucose levels in patients in poor neurological status compared to those in good neurological status. With every 18 mg/dL increase in fasting plasma glucose, the neurological outcome worsens by 8.5% (117). Although the number of studies on hyperglycemia in acute hemorrhagic stroke is limited, hyperglycemia is reported as a predictor of poor prognosis in these patients (112). Poor prognosis due to hyperglycemia is not a stroke-specific condition but it is a problem reported in other critical care patients, too (118).

Another negative effect of hyperglycemia is that it reduces the beneficial effects of iv thrombolysis and mechanical thrombectomy in acute ischemic stroke (112,119). Endovascular thrombectomy has been reported to be more effective, especially at low glucose levels (<90-100 mg/dL). However, tight glycemic control should be performed with intensive care to ensure the safety of the patient (120). In order to protect patients from the untoward effects of hyperglycemia, intensive treatment modalities aimed to aggressively reduce blood glucose levels were studied. No beneficial effects of intense iv insulin therapy, aiming a tight glycemic control, have been demonstrated on the functional status and survival. On the contrary, it was found that it increased the risk of hypoglycaemia (121). It is known that hypoglycemia increases mortality in critical care patients. Mortality is reported to be

high in patients with moderate (54-40 mg/dL) or severe (<40 mg/dL) hypoglycemia or in patients with multiple hypoglycemic attacks. Values less than 67 mg/dL occurring in the first 24 hours have been shown to correlate with poor functional status. Since the primary energy source of the brain is glucose and the need for energy increases after damage, the brain becomes extremely sensitive to glucose deficiency after a stroke. Therefore, lowering blood glucose even to values that can be considered normal in a healthy person causes a glucopenia and metabolic crisis in a brain damaged from stroke (112). Therefore, it is very important to avoid hypoglycemia in a stroke patient.

Considering the negative effects of hyperglycemia in stroke patients, ischemic stroke patients with hyperglycemia should be included in a treatment program targeting the standard glycemic levels as all other critical care patients. Recommendations based on expert opinion are to avoid intensive treatment to prevent the risk of hypoglycaemia and to treat patients with IV insulin to maintain the blood glucose levels in the 140-180 mg/dL range (blood glucose levels can be reduced to 110 mg/dL in nondiabetic patients as long as hypoglycemia is avoided) (112,122,123). The same recommendations are relevant for hemorrhagic stroke, too.

Since the manifestations of both hypoglycemia and hyperglycemia can be confused with those of acute stroke, blood glucose measurements should be performed in all stroke patients before starting thrombolytic therapy (iv alteplase) so that a rapid differential diagnosis can be made. In order to apply iv alteplase therapy, blood glucose levels should not be less than 50 mg/dL or more than 400 mg/dL at admission (53).

Management of hyperglycemia in stroke is important not only in patients with diabetes but in nondiabetic patients as well. Regardless of whether patients have diabetes or not, the risk of death after a stroke is 3 times higher in patients found hyperglycemic at admission compared to euglycemic patients. Therefore, blood glucose levels should be closely monitored in all stroke patients with or without diabetes (108).

- During admission to the hospital or acute stroke unit, blood glucose levels should be measured. It is suggested that this first measurement should be performed with a glucometer by using a venous blood sample instead of using a blood sample from

a fingertip.

- After the admission to the stroke unit, blood glucose levels should be measured in the fingertip blood with a glucometer within 2 hours.
- In the first 72 hours after a stroke, blood glucose levels should be measured from the fingertip with a glucometer at intervals ranging from 1 to 6 hours based on the previously measured values.
- If the blood glucose level at admission is between 44-198 mg/dL and the patient is diabetic or between 144-288 mg/dL and the patient is not diabetic, a 6-hour normal saline infusion should be started.
- If the blood glucose level in the first 72 hours is measured at any time ≥ 198 mg/dL and the patient is diabetic or ≥ 288 mg/dL and the patient is nondiabetic, insulin infusion should be started.

Persistent hyperglycemia seen in the first 24 hours after acute ischemic stroke is associated with poor outcomes. Therefore, hyperglycemia needs to be treated maintaining blood glucose levels in the range of 140-180 mg/dL. The patient should be closely monitored to prevent hypoglycemia during the treatment (52).

Even if the patient is normoglycemic at admission, hypoglycemia may still occur especially at night (124). One should be vigilant to detect hypoglycemia (blood glucose levels of < 60 mg/dL) in an acute ischemic stroke patient. Such levels should be treated urgently (52).

It has been demonstrated in studies that mortality and functional dependence rates can be reduced by the close nursing follow-up of the patient for fever, hyperglycemia, and swallowing problems and by the early initiation of treatment in line with the relevant protocols in the hyperacute period of stroke (108,125,126). Therefore, it may be suggested to develop protocols and train nurses to manage potential major issues such as hyperglycemia, occurring especially in the hyperacute and acute periods of stroke.

3.6. Oral care, airway management, oxygen therapy, and pneumonia prevention and treatment in the stroke patient

Nursing practices should include prophylactic measures including the maintenance of airway patency, oxygen delivery, proper oral care, and the prevention of pneumonia so that adequate oxygenation and normal respiratory functions can be maintained and that the brain tissue can be

preserved in the acute ischemic process. When the stroke patient meets the nurse for the first time, the nurse should evaluate the patient for oral hygiene, airway management, and the need for oxygen support and pneumonia prophylaxis. Pathological findings should be recorded in the nurse observation form. Care plans should be prepared by informing the relevant physician. The defined parameters to be followed should be monitored according to the care plan.

3.6.1. Oral care

Poor oral hygiene is known to unfavorably affect the quality of life after a stroke, resulting in serious mental, physical, and social consequences (87,127). One of the major causes of aspiration pneumonia is poor oral hygiene (128,129). The prevention of pneumonia is of great importance to prevent all medical complications and the mortality after a stroke (130,131).

Stroke guidelines state that oral care is a component of standards of care in the stroke unit and that the provision of oral care should continue until the patient gains independence. A proper physical examination is the basis for the start of the provision of adequate oral care. The physical examination of the mouth is the responsibility of the nurse. The type of the examination and the examining frequency vary depending on patient needs. If no specific examination sets are available; the nurse should examine the voice quality, smelling and swallowing functions, as well as, examining the lips, mucous membranes, the tongue, gums, and teeth. Also, intraoral secretions should be examined and quantified. Findings should be noted on the nurse observation form. There are no specific tools available developed for the intraoral examination of intubated patients. A similar systemic approach is applied as described above.

During the initial evaluation of the acute stroke patient, intraoral secretions and food residues should be examined. Dentures of all acute stroke patients should be removed, considering that surgery or interventional procedures may be necessary. The head of the patient should not be at an angle less than 30-45 degrees from the bed against the risk of tracheal aspiration.

If the patient is able to perform oral care for himself/herself, he/she should brush his/her teeth at least 4 times a day. If he/she cannot do this alone, oral care should be provided for the patient

by the nurse 4 times a day. In unconscious, dysphagic, and intubated stroke patients and in stroke patients who are not able to have oral intake for any reason; oral care is provided with chlorhexidine gel/solution every 4 hours.

In patients with high quantities of oral secretions or in intubated patients, secretions are aspirated before the provision of oral care. The hygiene of the oral mucosa should be appropriate. The humidity and integrity of the mucosa should be maintained. Any debris and plaques should be removed properly.

All surfaces of the gums, teeth, mucosa of both cheeks, the palate, and the ventral and dorsal surfaces of the tongue should be cleansed by softly brushing them with short, horizontal or circular movements and with no compression by using a toothbrush, sponge stick, or tongue depressor. Each surface of these instruments should be used only for one area and any instrument should be replaced as it gets dirty. Lips of the patient should be moisturized to prevent the lips from drying out after the oral care (132).

3.6.2. Airway management and oxygen support

Stroke nursing practices include adequate oxygen support and the maintenance of normal respiration in order to preserve the ischemic brain tissue in the acute ischemic process.

The stroke patient should be monitored with a pulse oximeter in the acute period. Besides measuring and tracing the oxygen saturation levels, the patient's respiration should be assessed; including its mode, depth, and rate. Also, the skin color should be evaluated.

An intraoral examination should be made in stroke patients to evaluate whether there are any materials left inside the mouth, such as crusts or food residues that may cause airway obstructions. Effective oral care should be provided and the patient's head should be elevated to stand at an angle of 30-45 degrees from the bed. Oral, nasal, and tracheal secretions should be cleansed out. The airway patency should be maintained by bringing the patient to a proper position, aspirating the secretions, and improving his/her voluntary cough effectiveness.

Supplemental oxygen administration is not recommended in stroke patients unless hypoxia develops in the acute phase. Even if the hypoxemia is mild, oxygen should be delivered at 2 liters/minute via a nasal cannula and the oxygen

saturation should be maintained at a level of > 94% (52).

To prevent mucous membranes from drying out, the delivered oxygen should be humidified. The humidifier is filled with sterile water up to the 2/3 of its volume. Then, it is connected to the flowmeter attached to the oxygen cylinder. Unused and oxygen humidifiers should be kept clean and dry. When the water volume in the oxygen humidifier decreases, extra water should not be added to complete the volume (133).

Ventilator and advanced ventilation support materials should be available at the bedside since ventilation support may be needed in patients with significantly impaired respiratory functions.

Hyperbaric oxygen therapy is not recommended in patients with acute ischemic stroke unless an air embolism is diagnosed (53).

3.6.3. Prevention and treatment of pneumonia

The first step to prevent the development of pneumonia in a stroke patient is to maintain hand hygiene. Chlorhexidine solution is used as a component of standardized oral care protocols in patients with dysphagia, in intubated patients, or in patients receiving enteral feeding in order to reduce the risk of post-stroke aspiration pneumonia. The dose of the solution should be adjusted according to the risk and potential degree of aspiration in patients with difficulty swallowing. Chlorhexidine is used at concentrations of 0.2% and 0.12% to provide oral care to individuals connected to mechanical ventilators.

Patients with acute stroke should be screened for difficulty swallowing by a trained healthcare professional preferably within the first four hours of admission before having any oral food, liquids, or medications.

If invasive mechanical ventilation is provided in an intubation stroke patient; secretions should be aspirated every two hours, the cuff pressure of the tube should be monitored, and it should be maintained in the range of 20-30 cmH₂O. The practices of cuff rest or cuff extinguishing have been abandoned.

A new disposable catheter should be used for each aspiration session. At each session of aspiration; the subglottic area should be aspirated first in order to prevent the patient from aspirating accumulated secretions in the mouth and on the endotracheal tube cuff. No fluids should be introduced routinely into the tube

during the endotracheal aspiration unless it is indicated. Disposable breathing circuits and humidifiers should be used. Reusable circuits can only be used again if they are disinfected in automated devices. If not contraindicated, the use of heat and moisture exchangers are recommended instead of heated humidifiers. The use of vapor producing devices should be avoided due to the high risk of infection. If not contraindicated, active-passive movements within the bed should be started within the first 24 hours in order to prevent stasis pneumonia. If the patient is able to, he/she should start breathing exercises. Patients should be encouraged to engage in such exercises (134).

Although it is still controversial in some respects, it is recommended that every stroke patient should be seated in a chair on the first day if it is not contraindicated and if the neurological and systemic condition of the patient good enough to tolerate it (135,136). The stroke patient should be brought to the vertical position at least once a day or, otherwise, 2 times a week if the former is not possible. In order to prevent tracheobronchial aspiration in stroke cases, the head of the patient should be elevated to an angle of 45 degrees if possible. If this is not possible, it should be elevated at least 30 degrees from the bed. This is critically important for enteral feeding. However, the neurologist may order to keep the patient's head flat in "ischemic" stroke patients within the therapeutic window (often in the first 48-72 hours) as it can improve the blood supply to the penumbra. In this case, the patient should lie flat (137).

The stroke patient should be evaluated for his/her capacity for oral intake within the first 24 hours. If appropriate, oral intake should be started. If this is not possible, enteral feeding will be adequate (76).

If a functionally dependent stroke patient is followed up in the stroke unit or the neurology intensive care unit, it may be necessary to give the patient a chlorhexidine bath or a wipe bath to prevent recurrent hospital infections (138).

Since fever is an important indicator of pneumonia, the body temperature should always be monitored. Because of the unfavorable effects of fever on the brain metabolism, the body temperature should be reduced to normal levels immediately after collecting samples for culturing. Cold compresses should be applied externally

based on the physician's orders if paracetamol is not sufficient.

3.7. DVT/PTE prophylaxis in the stroke patient

Deep Vein Thrombosis (DVT) is an important complication that has a negative impact on stroke prognosis, both by causing life-threatening pulmonary thromboembolism (PTE) and by delaying recovery after a stroke. Prophylactic measures should be taken to prevent the development of DVT/PTE resulting from the continuous immobility due to stroke. These preventive measures include pharmacological and standard non-pharmacological methods based on the physician's discretion. Pharmacological prophylaxis involves administering prophylactic doses (usually enoxaparin ≤ 0.5 U/kg or equivalent) of low molecular weight heparins (LMWH).

In patients with acute ischemic stroke, it is recommended to start prophylactic LMWH, usually within the first 24-48 hours. On the other hand; in patients with intracerebral hemorrhage, -pharmacological prophylaxis can often be considered after 48-72 hours and after hematoma size stabilization although evidence is limited (52).

External compression should be applied to the lower extremity veins with graduated compression stockings or intermittent pneumatic compression devices in immobile stroke patients. Intermittent pneumatic compression devices can be used in combination with LMWH therapy. If pharmacological DVT prophylaxis is contraindicated, they can be used alone. Skin injuries may occur due to the use of intermittent pneumatic compression devices. The skin integrity should be evaluated daily when intermittent pneumatic compression devices are used. If DVT is developed, the use of pneumatic compression in the acute period is terminated. If DVT is present, leg elevation and wet compresses are applied.

If it is not contraindicated, early mobilization of the acute stroke patient is recommended to contribute to the DVT/PTE prophylaxis. Patient selection for mobilization and the length of mobilization is based on the neurologist's order.

Elastic compression stockings should not be used in acute ischemic stroke (139).

The patient's legs should be examined daily for DVT symptoms. The examination should include checks for the blood circulation, edema,

redness, and diameter differences between the legs.

To prevent DVT and PE, the patient should be appropriately hydrated if fluid intake is not restricted. The patient should be encouraged to drink an appropriate volume of fluids. If the patient is functionally dependent or if oral intake is not allowed, the patient should be hydrated based on the physician's orders.

3.8. Pressure ulcer in the stroke patient: Risk, prevention, and treatment

3.8.1. Incidence and risk factors

The prevention and treatment of pressure ulcers require a multidisciplinary team work with a holistic care approach (140). The protection and maintenance of skin integrity should be the primary responsibility of the nurse, who has important roles in the multidisciplinary team (140).

The critical responsibilities of the nurse include the identification of individuals at risk, writing risk diagnosis, taking initiatives and measures to eliminate factors that will contribute to the development of pressure ulcers, and providing care for pressure ulcers in patients who develop pressure ulcers despite the measures.

A pressure ulcer is a localized injury resulting from compression or from friction, lacerations, and ruptures accompanying the compression on the skin and deep tissues covering bone protrusions (141).

Both intrinsic and extrinsic factors are involved in the development of pressure ulcers. While intrinsic factors include tissue hypoxemia, hypovolemia, advanced age, sensory disorders, altered consciousness or stroke; extrinsic factors include long hospital stays (142). The major cause of pressure ulcers is impaired mobility or immobilization despite many other contributing and confounding factors (141).

Pressure ulcers are one of the most common (about 1/5) medical complications in the hospital after a stroke, requiring the attention of the patient, relatives, nurses, and the medical team (143). If pressure ulcers occur, the treatment and the care will be challenging. Pressure ulcers lead to further complications, increase mortality, and prolong the length of hospital stay. Moreover, patients often suffer from severe pain and sadness (144).

Low body mass indices and low serum

albumin levels in patients with acute neurological diseases indicate a prevailing catabolic state, contributing to the risk of developing pressure ulcers (145). Stroke patients particularly experience difficulties in maintaining their balance and position, resulting in problems with walking and moving. Furthermore, 1/3 of stroke patients have cognitive problems such as disordered speech and comprehension deficits (146). These are important risk factors that lead to the development of pressure ulcers.

The incidence of pressure ulcers is considered an indicator of the quality of the provided care (141). The prevalence of pressure ulcers in stroke patients is calculated as a quality indicator in the guidelines for the clinical treatment of stroke and clinical protocols for stroke developed by the Ministry of Health (5,147). This figure is calculated using the formula; which divides the number of patients developing pressure ulcers in the first four weeks of hospitalization by the number of hospitalized stroke patients aged 18 and over multiplied by 100. The aim is to achieve a value of $\leq 30\%$.

3.8.2. Etiology

Pressure, ruptures, tearing, rubbing, and moisture are the factors leading to the development of pressure ulcers (144). The major cause of pressure ulcers is compression. Three major factors; which are involved in the development of pressure ulcers, are the intensity and duration of compression and the durability of the tissue (140,141,144). Compression usually affects the skin and subcutaneous tissue covering bony protrusions, such as the heel and the sacrum (140,144). The pressure exerted on the near-surface areas of the bony protrusions; which stay under the body in the lying or sitting positions, disrupts the regional blood supply and unfavorably affect cell metabolism and the vital function of cells. Ischemia and necrosis or in other words tissue necrosis develop due to prolonged or repeating compression; resulting in complete obstruction in capillaries in the skin and the subcutaneous tissue and stagnation of the blood circulation in the area (140,144). Pressure ulcers develop as an intrinsic response to an external mechanical load. It should be remembered that pressure ulcers will not only manifest on the outside of the body or on the skin surface but also there will be internal responses to mechanical load

(141). Factors facilitating the development of pressure ulcers include skin wetness, loss of sensation, immobility, impaired blood circulation, malnutrition, edema, infection, elevated body temperature, psychosocial condition, and old age (140). Since these factors are common in stroke patients, pressure ulcers become an important issue in stroke patients.

3.8.3. Classification of pressure ulcers

The "National Pressure Ulcer Advisory Panel" (NPUAP) and the "European Pressure Ulcer Advisory Panel" (EPUAP) systems describe and categorize pressure ulcers under four stages from stage 1 to stage 4 based on the severity of injury in the skin and the subcutaneous tissue. Additionally, two categories have been added, which are "unstageable" and "suspected deep tissue injury" because the depth of tissue and skin damage is not known (140,141).

Category / Stage I: The skin is usually intact with non-blanchable redness of a localized area over a bony prominence.

Category / Stage II: An open ulcer with a red pink wound bed is observed. There is not a mass of dead tissue but a partial loss of dermis. The pressure ulcer in this stage may also present as an intact or open/ruptured serum-filled blister.

Category / Stage III: A full-thickness loss of tissue is observed. Bones, tendons, or muscles are not exposed but subcutaneous fat may be visible. The ulcer may include slough, undermining, and tunneling.

Category / Stage IV: Full thickness tissue loss is observed and bones, tendons, or muscles are exposed. Slough or eschar may be present on the wound bed. The wound bed often includes undermining and tunneling.

Unstageable: Full thickness tissue loss is observed. The base of the ulcer is covered by slough (in yellow, tan, gray, green, or brown color) and/or eschar (in tan, brown, or black in color).

Suspected Deep Tissue Injury: Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear (140,141).

3.8.4. Diagnosis

Risk diagnosis is critical as it involves the identification of individuals at risk of developing pressure ulcers; as well as, the prevention from pressure ulcers and the development of adequate

management plans (140). The first stage of preventing pressure ulcers is to diagnose the individual's risk and to identify the risk factors early. A plan should be developed to reduce or eliminate the identified risk factors. A structured risk diagnosis is performed as soon as possible (no later than eight hours after the proposed hospital admission) to identify individuals at risk of developing pressure injuries (141).

All patients are at risk of developing pressure ulcers (148). Patients with significant limitations of mobility, patients unable to position for themselves, patients with cognitive impairment and loss of sensation, patients with new or existing skin ulcers, and patients with nutritional deficiency are at risk (148).

Skin diagnosis includes the identification of changes in skin color and temperature; as well as, detecting spots, erythema, redness, sclerosis, wetness, and altered integrity of the skin in the body areas under compression. Whether erythema or a skin spot is non-blanchable is tested by palpation and pressing over the lesion. When erythema is non-blanchable, preventive interventions are practiced and diagnostic examination is performed every two hours until the problem is resolved (148).

Primarily; "Braden", "Norton", and "Waterlow" scales are used among many scales developed for predicting the risk of developing pressure ulcers. Regular risk prediction with objective scales, such as the Braden scale, is recommended for skin ulcers during the hospital stay and the rehabilitation period (52).

A risk prevention plan should be developed and implemented for individuals at risk of developing pressure injuries. Diagnostic scales provide general information about the risk status and risk levels; however, their use alone is not adequate for risk prediction. The risk prediction process is repeated as often as necessary, taking individual patient needs into account. Any changes in the individual's condition requires to review risk predictions. All risk diagnostics are recorded and reported so that all team members are informed about changes in the individual's status (141).

A structured risk-diagnostic approach is used, which includes an assessment of the activity capacity, mobility, and the skin condition of the individual. In individuals with stage I pressure ulcers, the lesion is considered at risk of

progression. Patients with poor perfusion and oxygenation and patients with malnutrition are at risk for developing a pressure ulcer. Patients with existing pressure ulcers (in any category or stage) are also at risk for developing new pressure injuries. Elevated body temperature, advanced age, sensory or perceptual problems, abnormal blood values (creatinine levels more than 1 mg / dL, low albumin and hemoglobin levels, etc.), and deterioration of the general condition are other risk factors (141).

3.8.5. Prevention

It is recommended to minimize or eliminate skin friction, minimize compression on the skin, provide suitable support surfaces, prevent excessive wettening of the skin, and maintain adequate nutrition and hydration so that disruptions in the skin integrity can be prevented (52).

Regular positioning, turning the patient at regular intervals, maintaining good skin hygiene, and the provision of special supportive surfaces (mattresses, wheelchair cushions, and seats) are recommended for use until the the restoration of mobility.

3.8.5.1. Protective measures to protect and maintain skin integrity, movement, and position change

After predicting the risk of developing pressure ulcers, a plan should be developed to position the patient covering the 24 hours in the day. The length of the intervals to position an immobile individual may vary depending on his/her capacity to move and perceive and his/her daily routines. Therefore, the 1.5-2 hour basic length of positioning interval may not be effective in preventing the development of pressure ulcers in some patients. When the patient is brought to a new position, bony protrusions should be protected/supported with adequate tools. In order to prevent friction and tearing injuries; one should avoid dragging the individual while changing position. The patient should be positioned by using appropriate turning and lifting techniques and by utilizing movement aids and transport tools compatible with the principles of body mechanics (140).

In the Wound, Ostomy and Continence Nurses Society (WOCN) guidelines, experts recommend a 30° degree lateral side-lying

position to prevent pressure sores. Also; in the 30 degree lateral side-lying position, the extremities should be supported with pillows to prevent extremities from crossing the body midline (149).

Considering nutritional or digestive problems and the medical condition of the patient, it is recommended that the head of the patient should not be raised at an angle more than 30 degrees. If the patient does not mind, the patient is encouraged to have his/her head at a 30-40 degree side-lying position to sleep or to lie in the supine position. If there are no contraindications and if the individual can tolerate, an immobile patient can be brought to a 30 degree side-lying (alternately, right side, back, left side) or prone position (141). The length of sitting in the bed may vary depending on the individual's skin tolerance and medical condition. The knees of the patient can be flexed appropriately and the arms can be supported by pillows so that sliding down in the bed can be prevented (140,141).

The pressure on the sit bone / ischial tuberosity is greater in the sitting position than that exerted in the supine position. If the patient is able to change position, he/she should be reminded to change positions -the direction of the body load- every 15 minutes. Besides using a foam, gel or air mattresses; changing the body weight load of the patient sitting on such mattresses will further contribute to the distribution of the direct pressure on the sit bone. The use of hard supporters or socket seat cushions can reduce the blood return, cause the ischemic area to expand further (140).

The use of foam cushions/mattresses that reduce or redistribute the pressure is effective in preventing the development of pressure ulcers in high-risk patients (145,148). It is recommended to use special mattresses such as airbeds, waterbeds, or latex foam mattresses and/or to support the extremities with foam, gel, and feather cushions in patients at high risk of developing pressure injuries (148). If the individual is able to move, walking should be promoted. Range of Motion (ROM) exercises should be performed on the patient every 8 hours to prevent joint contractures (140).

3.8.5.2. Skin Care

Skin examination should be made at admission and, then, at least once a day. However, skin diagnosis should be performed more

frequently in high-risk individuals, specifically in every shift. The skin of high-risk individuals, especially bone protrusions, should be examined at least once a day (140).

The patient's skin should be kept clean and dry (141). pH balanced (4.0-7.0) cleansers should be used and the use of hot water should be avoided in skin cleaning. The frequency of skin care and the products to be used should be selected based on the individual's needs. Too much skin care may cause the skin to dry out due to damage to the natural protective layers of the skin. Skin, especially the skin folds, should be thoroughly wiped dry after cleaning (141). Skin massage or scrub is not recommended to avoid pressure ulcers (148). Bone spurs and reddened areas should never be massaged (140). The patient's clothes and sheets are changed as they get wet. If wetness cannot be eliminated completely due to incontinence, excessive exudation, or excessive sweating; materials made of 100% cotton should be used to absorb the wetness and keep the skin dry (140). Skin barriers/protective creams are used in patients with incontinence-related dermatitis. Skin damage and friction should be avoided. Protective film dressings such as hydrocolloids can be used to prevent friction (140).

3.8.5.3. Nutrition support and hydration

Nutrition support or parenteral fluid therapy for the prevention of pressure ulcers is not recommended for individuals; who can eat adequately and hydrated properly. If a nutritional deficiency occurs, enteral (high-calorie and protein-rich diet) or parenteral nutrition can be started with adequate fluid replacement to prevent dehydration based on the physician's orders. The levels of hemoglobin, blood glucose, and hematocrit should be followed up (148).

3.8.5.4. Training

The individual and his family should be trained by the nurse or a wound care nurse, if available, on the factors that cause pressure ulcers, early signs and symptoms of pressure ulcers, the prevention of pressure ulcers, and the equipment used in the prevention (148).

3.8.6. Wound care and treatment

Simple injuries should be examined at baseline and at least once a week afterward. All

pressure ulcers, their depth, undermining, and tunneling should be recorded (140,148). There is no need to measure the volume of pressure ulcers regularly. The physical location of the wound, its class/category/stage, its size and color, the involved tissue type, the condition of the tissue around the wound, wound edges, invaginations, undermining and tunneling, exudate, and odors should be noted and reported (141).

3.8.6.1. Classification and staging of ulcers

A valid classification system (for example: NPUAP / EPUAP International Classification System) should be used (148).

3.8.6.2. Removal of the necrotic tissue

The need for debridement of the pressure ulcer should be determined by taking the following into account; including the amount of necrotic tissue, stage of the pressure ulcer, its size, the patient's tolerability, and any presence of comorbidities. Autolytic debridement is used and suitable dressing material is used to support its efficacy (148).

3.8.6.3. Dressing materials

The individual and the family are informed about the selected type of dressing; which was determined by taking the pain and tolerability of the patient, the amount of exudate, and the frequency of dressing changes into account. The use of dressing materials that provide a warm and humid environment for wound healing can be considered for the 2nd, 3rd, and 4th stage pressure ulcers. Gauze dressings are not recommended for the treatment of pressure ulcers (148). Wounds should be cleaned with isotonic saline at the baseline and at each dressing session (150). Pressure ulcers should not be cleansed with skin cleansers or antiseptics (e.g. povidone-iodine -Betadine-, hydrogen peroxide, acetic acid) as these agents destroy the granulation tissue in the wound. Dressing materials are diverse. They include transparent film dressings, hydrogels, alginates, foams, hydrocolloids, and saline-impregnated gauze packs. Transparent film dressings retain moisture effectively. They can be used alone for ulcers with partial thickness tissue loss or they can be used in combination with hydrogels or hydrocolloids for pressure ulcers with full thickness tissue loss (140,150). Hydrogels can be used for deep wounds with mild exudate.

Alginate and foams are very absorbent. These are useful for wounds with moderate to very thick exudate. Hydrocolloids retain moisture and they are useful for autolytic debridement (140,150).

3.9. Urinary incontinence, urinary catheters, prevention of urinary infections

3.9.1. Urinary incontinence: Definition and frequency

Lower urinary tract symptoms are categorized under three headings: storage, voiding, and post-voiding. The feeling of "urgency" is characterized by frequent daytime/night urination ("frequency") and urinary incontinence; which are the storage symptoms. Urinary incontinence is defined by the International Continence Society (ICS) (in 2019) as "involuntary loss of urine" in the bladder storage phase (151). It is reported that the frequency of urinary incontinence after a stroke is approximately 40-60% in the acute period and 25% at the hospital discharge. Also, it is reported that 15% of patients are still incontinent at the end of the first year.107 A study conducted in our country reported urinary incontinence at a rate of 58.5% and lower urinary tract symptoms at a rate of 93.5% in the first year after a stroke. The lower urinary tract symptoms included nocturia, urgency, and incontinence (152). However, drawing general conclusions from the literature is difficult because the number of studies about bladder and bowel problems in stroke is few, studies are carried out on small samples, study inclusion criteria (first stroke, recurrent strokes, presence of incontinence before stroke etc.) are not specified clearly, and inadequacies have been identified in the standardization of the time of incontinence (whether the incontinence occurred in the acute period of stroke, one week later, in the rehabilitation clinic, at home) and the methods used for assessing the incontinence (153,154).

3.9.2. The effects of urinary system problems on the stroke patient's lifestyle

Urinary incontinence is one of the important problems affecting the life of stroke patients and their relatives. Urinary incontinence can cause interrupted sleep, impair the physical comfort, lower the self-esteem, induce social isolation and depression, and impair the skin integrity. Moreover, the risk of urinary infections increases, especially with incomplete emptying of the urinary

bladder (154,155).

3.9.3. Urinary incontinence in stroke: Its causes and types

Incontinence can involve highly diverse and complex causal factors; including stroke-related injury in the neurophysiological pathways that control voiding, functional difficulties in reaching and using the toilet due to stroke sequelae, and bladder hyporeflexia due to neuropathy and/or drug use (155).

Urinary incontinence in stroke is categorized according to the function of the detrusor muscle and the external sphincter. Overactivity (overactive bladder) of the detrusor muscle is often reported, while sphincter function is maintained in stroke patients (156,157). The most common lower urinary tract symptoms in stroke patients are frequent urination ("frequency") due to detrusor overactivity and nocturnal urination ("urgency") (152).

Common types of incontinence in stroke patients are given below. However, it should be remembered that urinary incontinence is multifactorial and multiple types of incontinence can be seen together in the same patient (151,152,158).

Urgency or urgency-type urinary incontinence (urge incontinence): It results from overactive bladder. Urgency may be seen without urinary incontinence or involuntary urination may occur due to urgency.

Frequent urination (frequency): Frequency is frequently urinating during the day.

Nocturnal polyuria (nocturia): It is nighttime urination more than once during the night. It results from the impaired circadian rhythm of the antidiuretic hormone secretion in stroke.

Overflow urinary incontinence: It results from chronic retention of urine due to decreased detrusor activity. Overflow urinary incontinence also occurs due to common accompanying factors in stroke such as neuropathy and anticholinergic medication use. The patient with overflow urinary incontinence cannot empty the bladder completely; the post-void residual volume (urine remaining in the bladder after micturition) is high, and overflow urinary incontinence can occur as dripping or the patient passes urine as a constant leak.

Disability-associated urinary incontinence (previously known as functional incontinence):

Despite normal bladder functions, urinary incontinence occurs due to the patient's inability to reach the toilet or the bedpan because of neurological deficits such as aphasia, cognitive impairment or difficulties to move. It may occur due to the disability of the patient to use the toilet, too.

Insensible urinary incontinence: The patient is not able to notice urine excretion due to impaired consciousness/alertness.

Even though the patient notices the wetness, he is not aware of when and how he/she has passed urine.

Stress urinary incontinence: It is the sudden leakage of urine with physical exertion such as urinary incontinence due to coughing or sneezing. It develops due to weakening of the pelvic floor muscles with age. The voiding pattern is normal. Pre-existing stress incontinence may worsen with stroke even if it does not result from stroke.

3.9.4. Diagnosis of incontinence

In order to identify incontinence, infection, and other problems; diagnostic tests should start in the first 24 hours and should be completed in one week in stroke patients after admission. Making a diagnosis includes anamnesis, physical examination, and diagnostic tests (Table VIII) (107,155,159-162).

Medical history: Complaints of the patient, the frequency of urination before and after a stroke, the history of urinary incontinence (duration, frequency, volume, and the ability to control) (considering the high frequency of urinary incontinence in population-based studies, it should be remembered that the urinary incontinence may be a pre-existing one before the stroke); the patient's awareness of the need to urinate, changes in bowel habits (urination and defecation problems often accompany each other); fluid intake of the patient including alcohol, caffeinated beverages, or other diuretic fluids; medication use (diuretics etc.), and environmental and social factors (ability to reach or use the toilet).

Physical examination: Pain, pressure, or distension in the pubic region during the abdominal examination; examination of the sensory functions and reflexes in the pelvic floor, perineum, and rectum. Temporary causes of urinary incontinence can be reviewed with "DIAPPERS". "DIAPPERS" resembles the word "diaper" and it is an acronym created to facilitate recall of temporary causes of incontinence.

D: Delirium

I: Infection (especially urinary tract infections)

A: Atrophic urethritis/vaginitis

P: Pharmaceuticals - Some medications (diuretics, sedatives/narcotics, anticholinergics, sympathomimetics, some antihypertensives, anti-parkinson medications, NSAIs, etc.)

P: Psychiatric - (depression)

E: Excessive urine output - (excessive intake of fluids/caffeine, endocrine disorders, etc.)

R: Restricted mobility

S: Stool impaction - (it can cause urinary and also fecal incontinence)

Tests: Initial diagnostic tests should include the non-invasive ones. A routine use of invasive tests is not advised. Urinalysis (leukocytes, bacteria, glucose, proteins, or erythrocytes are investigated in the urine) (an urinalysis should be performed in the first 24 hours to identify the treatable causes), monitoring of the fluid intake and output and the use of a voiding diary (A voiding diary is strongly advised for all stroke patients with urinary incontinence; including patients with catheters. The voiding diary is advised to be kept for at least 3 days, preferably 5-7 days, starting at the day of admission or starting with the onset of incontinence. Also, a fluid input/output chart should be kept. These records should include the volume/type of fluids taken, frequency of urination, time of urination, and volumes of urination, and any associated problems.)

Post-voidal (after the urination) urine volume measurement (with portable scanners or catheters) (the aim is to diagnose urinary retention) (usually, a volume of more than 100 mL is accepted positive).

Invasive tests: Urodynamic tests, etc.

Uro-neurophysiological tests: In some cases, other types of tests can be performed to evaluate the pelvic floor muscles, the urethra, the anal sphincter, pudendal nerve functions, and the motor and sensory functions of the bladder and the urethra.

Urodynamic studies: Since upper urinary tract complications (hydronephrosis and reflux) are not common in stroke patients, a routine use of invasive urodynamic studies is not recommended.

It is recommended that patients should be re-evaluated for the cause of incontinence and they should be referred to a specialist for further examination if they do not gain bladder control within two weeks from the diagnosis of stroke.

Table VIII. Diagnosing urinary system problems.

HISTORY	PHYSICAL EXAMINATION	TESTS
Symptoms (before the stroke and after the stroke)	Examination of the general condition	Urinalysis
Symptom start	Abdominal examination	Monitoring fluid input-output
Severity	Pelvic floor examination, sensorial examination of the rectum, and examination of rectal reflexes	Bladder diary
Frequency	Examination of temporary causes (DIAPPERS)	Measurement of the post-void residual volume
Need to urinate at night	Neurological/functional examination	Invasive tests
Fluid intake	Cognitive functions	Uro-neurophysiology
Medications	Hand skills	Urodynamic tests
Environmental/social factors	Walking & coordination	
	Speech	

3.9.5. Management of incontinence in stroke

Incontinence is an important predictor of the clinical course in acute stroke and further nursing home stay (163). As with other deficits, early rehabilitation is very important in incontinence. Interventions in the acute period can be useful in the prevention of persistent incontinence. For this reason, it is recommended that all patients are evaluated according to a protocol and the necessary interventions are initiated accordingly. Patients and relatives should also be involved in this rehabilitation plan. If the problem cannot be resolved, the patient should be referred to specialists. When the problem becomes permanent despite all interventions, consultancy should be provided to the patient and the family about the supply of necessary materials (164).

A stepwise approach is recommended in the management of incontinence in stroke. It is recommended to review and correct the problems that may cause incontinence after evaluating the problem with detailed evaluations. Behavioral methods are recommended at the first step. It is reported that these methods can be effective in urgency and stress incontinence in stroke (165). Pharmacological treatments can be tried when behavioral methods are not effective. If urinary retention is severe, intermittent catheterization should be performed to empty the bladder during the hospital stay. When urinary retention persists, permanent catheterization is preferred over an intermittent one. Catheter use is not recommended for other causes (162,164). Treatment approaches by the type of incontinence is summarized in Figure III.

3.9.5.1. General approaches

3.9.5.1.1. Review of potential problems that may cause incontinence

First of all, the patient should be examined for potential problems that may cause incontinence (urinary infection, constipation, fecal impaction, diuretic-associated polyuria, glycosuria in diabetic patients, etc.). Then, temporary/correctable causes should be managed (154).

3.9.5.1.2. Lifestyle recommendations

The patient is advised to avoid diuretics/bladder irritants (such as tea, coffee, carbonated drinks/cola, chocolate, artificial sweeteners, alcohol, smoking, spices, and citrus fruits). The patient should be informed about the ways of avoiding putting on extra weight. Information should be provided on the prevention of constipation (increasing fluid intake and activity, eating fiber-rich foods, regular defecation, and laxatives if necessary). It should be remembered that the pressure of a full intestinal loop on the bladder neck and urethra can cause urinary retention. When the patient suffers from incontinence, either the patient or the relatives sometimes restrict the fluid intake of the patient. They should be informed that fluid intake should not be restricted. However, they are advised to reduce their fluid intake in the evening. The patient is advised to go to the toilet in the morning after waking up and at night before sleeping even though there is no urgency. Valsalva and Crede maneuvers should be avoided as they increase the intra-bladder pressure uncontrollably; which may cause kidney injury (154,156).

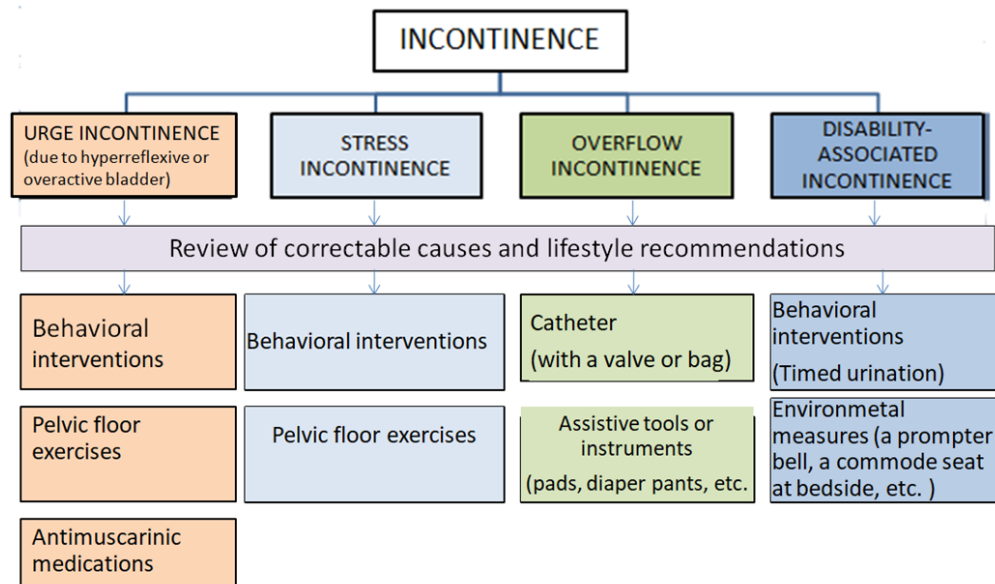


Figure III. Approach to frequent forms of urinary incontinence in stroke.

3.9.5.2. Behavioral interventions

For problems that cannot be controlled with a general approach, a behavioral intervention plan is developed based on detailed evaluations to be started as early as possible (in the acute phase) (107,165). It should be remembered that time, effort, and patience are needed to benefit from these methods (154).

Timed urination: The patient should be taken to the toilet or offered a commode seat/bedpan/urinal at certain time intervals (every 2-4 hours during the day, every 4 hours at night). Another method is to adjust the voiding frequency according to the patient's daily routine instead of following regular intervals for urinating. In this method, the frequency of assisting the patient to reach the toilet is determined based on the fluid input/output chart and the voiding diary. For example, a patient passing urine every three hours should be taken to the toilet every two hours.

Prompted voiding: In this method, the patient is asked every two hours whether it is wet or dry. Then, the patient is given feedback whether the answer was correct. This method aims to increase the awareness of the patient. The patient is motivated to stay dry. He/she is asked whether he/she needs to go to the toilet. This method is especially used for patients with cognitive problems, causing inability to realize the need to urinate.

Bladder training: The voiding diary of the patient is examined to identify the times of voiding. Then, the times to go to the toilet is scheduled for the patient accordingly. The aim is to increase the length of time between two voiding timepoints systematically. Furthermore, the patient is trained to relax and suppress the feeling of urgency using the pelvic floor muscles at times when he/she feels the urge to urinate. This method is useful in stress and urgency incontinence (154).

3.9.5.3. Pelvic floor exercises (Kegel exercises)

Kegel exercises aim to strengthen the pelvic floor muscles systematically and improve the functioning of the urethral sphincter. This method is useful in stress and urgency incontinence. To be able to perform the pelvic floor exercises, the sensory and motor functions in the perineum must be intact. In individuals with sensory deficits, biofeedback or electrical stimulation can be tried (160).

The patient is instructed to relax and contract the pelvic floor muscles with the knees slightly flexed and the head slightly raised in the supine position. The patient is asked to contract the anal sphincter and the perivaginal muscles as if trying to stop the need for urination and defecation. Three repetitions of the exercises are performed at baseline, aiming to achieve ten sets of ten slow and consequent ten rapid contractions further (160).

3.9.5.4. Pharmacologic therapy

Antimuscarinics (anticholinergics) can be used for the treatment of overactive bladder in stroke. However, it is stated that these drugs should be used only if there is a storage problem determined by urodynamic tests. These drugs can increase the urine residue in the bladder, resulting in urinary infections. Therefore, the measurement of the urine residue is important after starting treatment in patients without catheters. These drugs can also cause side effects such as dry mouth, constipation, blurred vision, etc. (160).

3.9.5.5. Use of auxiliary equipment and products in persistent incontinence

If incontinence continues despite medical therapy or surgical interventions, ambulatory products such as condom catheters, other external incontinence devices (penile clamp etc.), pads, disposable diaper pants, and mattress protectors can promote social continence (154,155,162).

3.9.6. Urinary catheters

Urinary retention can occur in stroke patients due to urinary bladder hyporeflexia. Urinary retention is a problem that requires early intervention as it can cause kidney problems. When urinary retention occurs, it must be emptied with a catheter. The patient, suffering from this condition, is monitored for the emergence of symptoms and post-void residual volume (PVR) and the bladder is emptied intermittently with a catheter. If retention is chronic; it is recommended to continue intermittent catheterization and, if possible, not to switch to permanent catheterization. After the patient is discharged from the hospital, the patient can continue intermittent catheterization at home by using a clean technique instead of a sterile one. However, the patient should have adequate cognitive functions and hand skills in order to achieve these procedures. Intermittent catheterization requires the patient to empty the bladder before the bladder capacity reaches 500 ml. This requires catheterization 3-4 times a day. Catheterization of the patient once a day or every other day may be sufficient in patients with partial urinary retention (patients; who can empty the bladder partially or completely). Intermittent catheterization should be performed when the patient can urinate but the amount of PVR is more than 100 ml and urinary symptoms are present (urgency, frequency, or

urinary infection). When PVR is less than 100 ml and constantly measures at these volumes, catheterization is terminated. Permanent urinary catheterization is performed in patients; who are not suitable for intermittent catheterization (patients with urethral trauma or obstruction, anatomical anomalies, or patient preferences) (154,155,162).

Routine use of urinary catheters should be avoided in acute stroke patients as this can lead to urinary tract infections (52). The use of urinary catheters is recommended only in patients with urinary retention and when the monitorization of the fluid input/output is critical for the patient. Since urinary catheters cause serious complications such as infections, septicemia, and even death; it should be reserved as a last resort until all methods are tried. If a catheter has been placed, the aim should be to remove it within 24 hours (107).

Besides the significant risks posed by catheters for urinary infections, early catheterization is an important obstacle for the evaluation and treatment of the patient's urinary problems. A catheter should be placed when other methods cannot be applied or fail to provide benefits. A urinary or suprapubic catheter can be placed depending on the patient's condition (155).

A variety of different catheters made of different materials are available in the market. The selection of the catheter type should be based on the estimated time of catheterization. Catheters made of latex, teflon-coated latex, silicone-latex, or polyvinyl chloride materials need to be replaced in a short time (up to 3 weeks). Catheters made of silicone elastomers, hydrogel coated latex, silver alloy coated latex, 100% silicone, or hydrogel coated 100% silicone catheters can be used for a long time (up to 12 weeks) (154).

If short-term use is estimated for a patient, it may be recommended to use a catheter with a valve at the tip instead of a drainage bag. The patient or relatives open the valve at the end of the catheter and empty the bladder if a catheter with a valve is placed instead of a catheter with a bag. This method is close to physiological conditions, allowing the bladder to maintain its tone and capacity (155).

If the stroke patient is to be discharged from the hospital with intermittent or permanent catheterization, training and counseling should be provided to patients and their relatives about the

catheter care, procurement of materials, and who to contact in case of problems (worsening of the incontinence, urinary tract infections, and catheter-related issues) (157,164).

3.9.7. Prevention of urinary infections

Urinary catheterization is the leading cause of urinary infections in acute care settings (54). Stroke patients are twice more likely to develop urinary infections compared to patients with general medical and surgical pathologies due to immunosuppression, bladder dysfunction, (incontinence, retention, etc.) and the use of foley catheters (166). Urinary infections are seen in 15-60% of stroke patients and constitute an indicator for a poor clinical course. These infections may lead to complications such as bacteremia and sepsis (52).

Although it may be necessary to place a urinary catheter in the acute phase of stroke, their use should be avoided as much as possible. When they are necessarily placed, they should be removed as soon as the patient becomes medically and neurologically stable (52).

Other options posing a low risk for infection (condom catheters or intermittent catheterization) should be considered before inserting an indwelling catheter. For example, condom catheters can be used in men with no urinary retention (52,166).

The patient with catheters should be evaluated for urinary tract infections when their body temperature is high. Similarly, patients with altered consciousness with no neurological causes should also be evaluated for urinary tract infections. A complete urinalysis and urine microscopy is performed at baseline to investigate a potential urinary tract infection (52).

The patient should be evaluated for signs and symptoms of infection (fever, dysuria, discomfort, a cloudy appearance of the urine, foul-smelling urine, and pyuria) (167).

When signs and symptoms of urinary infection emerge, antibiotic therapy should be started but routine prophylactic use of antibiotics should be avoided (53). It is stated that prophylactic antibiotic therapy can be considered if infection develops after catheter replacement or if catheterization caused an injury (hematuria or more than two attempts to place a catheter) (160). Antibiotic therapy is not required in asymptomatic bacteriuria. Samples for culture tests should be

collected before starting the antibiotic therapy. These samples should never be taken from the urine bag (157).

Care should be taken not to raise the urine collection bag above the bladder level in the catheterized patient and not to contact it with the floor. The bag should be emptied before it is full. Before emptying the bag, hands should be washed and disposable gloves should be put on. The bag should be emptied without disrupting the closed system (167).

The issue of bladder gymnastics (clipping the catheter for certain periods) before removing the catheter remains controversial. The number of studies investigating this subject is few and their results are not consistent (168,169).

4. RESTORATIVE NURSING CARE FOR STROKE PATIENTS IN THE LONG-TERM

4.1. Communication with the stroke patient: speech disorders

Stroke can cause communication problems, too, besides other problems. Communication problems may occur in varying ways and severity depending on the size of the cerebral area involved in stroke. Communication disorders are common in stroke. One-third of stroke patients are reported to experience aphasia, dysarthria, and speech apraxia (170).

The language and speech disorders of the stroke patient constitute a major problem when combined with various other hospital-related factors including anxiety, insomnia, pain, and difficulties to maintain the patient's privacy. Communication plays an important role in all processes involved in the care provided for the stroke patient; however, they are commonly overlooked by team members, resulting in unfavorable outcomes. It is important to understand the extent of the problems experienced by individuals and to benefit from their remaining communication skills in the best way. If healthcare professionals successfully identify the problem, they can establish an effective way of interaction with the patient by using appropriate communication strategies. An effective communication between the staff and the patient brings many advantages including the precision in the diagnosis, the efficiency of the treatment, favorable patient compliance, and high patient satisfaction. Personnel providing care for a stroke patient should ensure not to have extra

barriers related to communication problems in addition to the already existing ones (171,172).

The three most common problems experienced after a stroke are aphasia, dysarthria, and speech apraxia (173,174).

4.1.1. Aphasia

Aphasia, sometimes called dysphasia, is the most common language disorder after a stroke (173). Because the left brain plays a major role in language processes, aphasia is often seen in people with left hemisphere injury. Aphasia affects the ability to speak, read, and write. Language disorders may range from disorders in formulating language to a complete loss of ability to speak. Repetition of phrases is common. Difficulties in comprehension vary from difficulties of understanding complex expressions to inability to understand even a single word. Comprehension difficulties are usually more evident in Wernicke's aphasia although there may be exceptions. Comprehension impediments are difficult to detect (173,175).

The ability to read and write is impaired in aphasia. Being unable to read in an acute care setting is a factor that disrupts patients' orientation. For example, the patient may be unable to read some basic signs ("Toilet", "Dining Room", "Call Bell"). Some individuals may read words one by one but they may not be able to understand the text. The ability to write shows individual variability. Some can write some words or a sentence, while others cannot. Sometimes, the ability to write and read may show significant differences in severity. For example, some can write several meaningful words but they cannot speak with a meaningful content (or vice versa). As it occurs with language impediments, aphasic individuals often make mistakes when writing and they may be confused while spelling similar words. Due to right hemiplegia, many people with aphasia may have to write with their non-dominant hands, which they have not used before stroke. These changes cause patients to spend considerable efforts and they reduce their speed of writing (176).

4.1.1.1. Types of aphasia

Expressive aphasia (non-fluent aphasia): This type of aphasia is also called Broca's aphasia, manifested by telegraphic, hesitant, and interrupted speech. The damage is in the frontal

region of the left lobe in Broca's aphasia. Patients with this type of aphasia cannot formulate grammatically correct language. For example, they could say "Saturday ... shops" instead of "I went shopping on Saturday." They often experience problems in finding words and have apraxia. People know what they would like to mean but have difficulties in expressing their opinions or communicating with others. The phrase "right on the tip of my tongue but I can't say it" describes this type of aphasia. Non-fluency can manifest in both written and verbal communication.

Fluent aphasia: It is also called "jargon aphasia" or Wernicke's aphasia. Fluent aphasia is characterized by normal speech quantity and rate. However, speech is difficult to understand due to multiple errors. Fluent aphasia patients are often not able to produce words precisely and correctly (neologism). Their speech consists of repetitions and similar sounds. Some individuals with fluent aphasia may not be aware that their speech is erratic. For this reason; they may feel surprised and angry and they may readily reject interventions when caregivers cannot understand them.

Global aphasia: It is the most severe type of aphasia. Global aphasia occurs when stroke affects a large area of the left hemisphere anteriorly or posteriorly. Global aphasia becomes manifest just after a stroke. The individual's inability to understand what has been told is receptive aphasia, while inability to express is called expressive aphasia. In global aphasia, both types of aphasia coexist. Besides difficulties in speaking and understanding, these people lose their reading and writing skills, too (170,173).

4.1.1.2. Diagnosis of aphasia

Nurses play a significantly important role in the early diagnosis of aphasia. While communication problems are clearly related to aphasia in some patients, this relationship may not be so clear in some patients. It may be difficult to detect aphasia in patients, who speak little or no Turkish. Aphasia can be identified with screening tests. The guideline about stroke rehabilitation in adult patients published by the UK National Institute for Health and Care Excellence - (NICE) recommends that all stroke patients should be screened for communication difficulties within the initial 72 hours (177).

4.1.1.3. Nursing care of aphasic patients

Although aphasia-related communication problems make nursing care difficult, a number of interventions are still available to apply. Most aphasic patients find it difficult to understand long or complex sentences and they can understand concrete words better than abstract ones. A slow rate of speech is recommended as a beneficial method while speaking to people with aphasia. For example; instead of saying to the patient "after measuring your blood pressure, I need to give you your heart medicine;" it may be better to say, "I will measure your blood pressure (the nurse first shows the instruments to the patient and then perform the measurement). Now I need to give you your medication (the nurse shows the patient the medicine). These medicines are for your heart (the nurse points to his/her heart)". Another example can be as follows: Instead of saying, "when you are discharged tomorrow, you will receive an appointment paper from us for your follow-up visit," it may be more useful to say "you will go home tomorrow. The doctor will ask you to come back to the hospital. So he/she will be able to evaluate how well you are. He/she will write the time of your appointment for you" (178).

It is recommended that clues and signs about the speech content should accompany the conversation. For example, the nurse can show the patient the injector when he/she is going to give the patient an injection. Many patients with aphasia benefit from written words and pictures. Therefore; if diagnostic tests are to be performed, the procedure can be explained to the patient in writing or by showing the picture of the equipment. It can be difficult to know if the aphasia patient understands. Sometimes, the patient can repeat what is told to him/her without understanding at all. Therefore; important information should be provided to the patient several times with accompanying pictures, written words, and symbols. One should make sure that the patient understands. Adequate time should be allowed for the individual to communicate. Other ways of communication alternative to speaking should be reminded to the individual. For example, a patient suffering from pain can be asked to show the location of the pain. Some aphasic individuals use gestures, facial expressions, or drawings very effectively. Giving them a pen and paper when they attempt to express something may help test whether their writing is better than their speech.

Signs are beneficial for some individuals with aphasia when they experience a sudden difficulty to articulate a specific word. In some cases, providing the first sound of a word or information about its meaning makes it easier for the patient to say the word. However, this method is not always effective. This method works only if the nurse knows the target word. Equipment such as symbols, maps, family photographs, and pictures to express daily basic needs can be utilized to communicate with aphasic individuals. Communication strategies is important to use when essential information such as information about medicines and medical tests should be provided to the patient. Nurses working with aphasic individuals need to be trained on communication disorders and on the methods to facilitate communication. There is available evidence that training is effective in facilitating communication (172,174,178).

4.1.2. Dysarthria and apraxia

Dysarthria and apraxia describe the impediments in articulation rather than language formation. Approximately 42% of patients with stroke have dysarthria and 11% have apraxia (sometimes called "dyspraxia"). Neurological control of the muscles involved in speech is impaired in dysarthria. These are the muscles of the thorax used for respiration, the muscles of the larynx used for sound production, the muscles in the neck, face, tongue, and lips to produce different speech sounds. Different types of dysarthria indicate the region of the neurological damage and the affected cerebral hemispheres. Except for cases with other accompanying speech problems, no disorders are found; which prevent the person from finding words, choosing appropriate words or establishing a meaningful sentence. People can understand, read, and write well the expressions told by other people. However, the speech of the individual can be far from being comprehensible or even impossible to understand (173).

The occurrence of dysarthria and apraxia at the same time can make the situation more complicated. Similarly; dysphagia (difficulty swallowing) may also accompany dysarthria. The management of dysphagia should be highly prioritized in stroke patients.

An evaluation of the patient's ability to communicate should aim to determine the level of understandability of the patient and to identify the

factors leading to impairment. Frenchay Dysarthria Assessment (FDA-2) is a commonly used test. This test allows to make a thorough evaluation of speech including its pitch and speed, as well as respiration. FDA-2 also examines the movements of the tongue and lips, scoring the patient's understandability by evaluating the produced words, sentences, and speech. Such a systematic assessment helps identify which aspects of speech are disrupted or remain intact, contributing to set objectives to achieve (179).

Treatment involves speech exercises and training on how to slow the speech and on the ways to use gestures, mimics, and writing. In some cases, auxiliary equipment is used for the facilitation of communication. These can be technological devices giving electronic sound output, especially to be used in patients with no accompanying aphasia.

Post-stroke dysarthria is usually associated with a favorable prognosis. Half of the patients can fully recover within six months after a stroke. However, mild neurological deficits may persist in some patients (180).

Speech apraxia or dyspraxia is a deficit of motor planning/programming needed for the coordination of movements to orderly produce speech sounds. Unlike dysarthria, the neuromuscular system is intact in speech apraxia or dyspraxia. The impairment in this disorder results from erroneous programming and speech planning. Difficulties emerge when the patient wants to say anything or wants to speak. However, automatic speech is possible. For example, the individual can easily say the days of the week or count. Speech apraxia is manifested by errors in the sounds of words and hesitant and imprecise speech. Effortful speech is often observed as the person tries to control the tongue and lip movements during speech. The patient is unable to speak completely in severe cases. Although some patients suffer from only speech apraxia, this disorder is usually accompanied by aphasia (179,181).

4.1.2.1. Nursing care of individuals with dysarthria and apraxia

Dysarthria makes it difficult for the patient to express his needs and concerns. Therefore, appropriate strategies should be used for allowing the individual to express himself and maintain communication.

The communication strategies advised for stroke patients are listed below (174,178,182,183):

- Communication with the individual should take place in a silent environment that is not distracting.
- A normal tone of voice should be used when speaking to an individual with stroke. Sentences should be clear and simple.
- The individual should be carefully listened to while talking. The speech process of the patient should be followed.
- The understood parts of the message should be repeated so that the patient does not have to repeat everything. - If you cannot understand the message after repeated attempts, "yes/no" questions should be asked or patient should be encouraged to write.
- One should not act as if everything is understood. It is best to be honest and inform the patient by apologizing that the content of the speech is not understood. The person is asked to repeat the sentence. Another approach could be to postpone the conversation to a more convenient time. However, it is absolutely necessary to remember and talk about the postponed subject again.
- The person should not be interrupted when he/she is trying to speak. No interventions are performed but the speech should be actively observed until one is sure that the patient finishes the sentence. The patient should be asked whether he/she needs anything.
- Sufficient time should be allowed for the individual to respond or to express what he/she wants to say.
- Often, problems become more manifest with fatigue; therefore, it is recommended to conduct important interviews in the morning or after the patient takes a rest.
- Another factor that affects the speech of the patient is his/her body position. Therefore, it is important that the patient sits in an upright position.
- It is no longer possible for the patient to perform two activities simultaneously; especially it becomes impossible to talk while eating. Therefore, any distracting factor must be eliminated.
- The existence of other communication-related barriers should be investigated. For example, it should be ensured that the patient can hear correctly and is wearing the hearing aid appropriately.

- Depending on the characteristics of the lesion, most patients do not develop disorders in language and consciousness. Therefore, these patients can benefit from strategies like writing down keywords. Furthermore, patients can understand and follow verbal or written instructions.
- If the person repeats some statements, attempts must be made to draw his/her attention to another subject. This can be achieved by changing the topic or activity.
- It is also necessary to give advice to the patient. The following advice can be provided:
 - The patients should not try to form long and complex sentences; instead, they should try to use single words or simple sentences as much as possible to explain what they want to say.
 - They should often pause and try to speak slowly and loudly.
 - They should frequently check whether the listener understands the content of the speech.
 - Since the speech will be difficult to understand, they should not have a conversation and try to limit the conversations when they feel tired.
 - They should use strategies to facilitate the conversation. They can use some signs or write keywords.
 - If patients do not achieve their goals, they may be advised to rest and try again later.

4.1.3. Communication difficulties due to right hemisphere damage

It is difficult to identify deficits at the beginning when they have developed due to right or non-dominant hemisphere damage. These difficulties may include disturbances in attention and decreased perception. Patients with right hemisphere injury have impediments in the interpretation of visual or verbal information along with cognitive impairment. Problems due to right hemisphere damage may include neglect to the left side of the body, visual agnosia (inability to recognize objects), constructional apraxia (inability to accurately combine parts to form a meaningful whole, for example, a two-dimensional or three-dimensional object cannot be copied), and disturbances of spatial perception. Anosognosia (lack of awareness of the disorder or the deficit) can be observed along with impairment of attention, memory, organization, and problem solving skills. Sometimes prosopagnosia (face blindness-difficulty to recognize faces) occurs in

stroke patients. Some patients may start to experience difficulties in recognizing music due to loss of music perception. Many of these problems affect communication, sadly both for the person and the family. For example, face blindness can impair the patient's ability to recognize his/her spouse or children. People with right or non-dominant hemisphere damage may have difficulty interpreting the content of a speech or understanding the speaker's intentions. These are called pragmatic difficulties. Pragmatic difficulties frequently manifest in nonverbal behavior such as decreased eye contact, decreased facial expressions, and decreased movements. Also, there may be difficulties with intonation and emphasis in speech. Because the patient's speech is monotonous, people in the conversation may not be able to interpret intonations; or, the patient may not be able to interpret intonations in others' speech (for example, the patient may be unable to discern anger or joy). People may have difficulties in using and understanding words; which are used beyond their literal meanings. These problems include difficulties in understanding jokes, metaphors, and deductions. There may be crowding of the speech, rambling, and wandering off the subject. Reading and writing can be impaired. Individuals with right or non-dominant hemisphere damage find it difficult to follow a topic and to understand the whole, and they may misinterpret humor, irony, and metaphors (182-185).

4.1.3.1. Nursing care of individuals with right hemisphere damage

Communication difficulties due to right hemisphere damage affect the communication adversely in the clinical setting. Moreover, difficulties in storing new information in the memory affect the patient's ability to cope with stroke-related impairment. The patient may display compulsive and anxious behavior; for example, they may ask the same questions over and over again. Also, cognitive problems and memory impairment can cause them to appear indifferent to their problems and to the efforts of the stroke team. Awareness about these challenges is necessary to achieve favorable clinical outcomes. In individuals with right or non-dominant hemisphere damage; strategies to manage cognitive and communication problems include promoting the use of precise words for

their literal meanings, maintaining a regular routine, and using memory aids. It is important to ensure the safety of the individual. All risk factors that jeopardize the safety of the patient; such as toxic substances, cleaning agents, and cutting tools, should be removed from the environment. The patient should be encouraged to turn the head from one side to the other. This maneuver helps the individual to perceive the whole. This is particularly useful for individuals; who have trouble seeing to one side or have neglect to one side. The individual should be encouraged to take care of the affected body area. If the person has problems seeing to one side or neglect toward a side, the tools and equipment that the patient may need should be placed on the unaffected side of the body. Unnecessary visual or auditory stimuli that may distract the attention of the patient should be removed from the environment. These stimuli can be dangerous by creating confusion and clouding the consciousness of the patient. A calm and quiet environment will help the patient to focus. The person should be protected from injuries due to the impaired perception of depth and distance. It is necessary to make sure that sharp edges and protruding corners of the objects in the environment are safeguarded (175,176,183,186,187).

4.1.4. Evaluation

Observations of nurses help identify patients; who need more detailed examinations. A detailed assessment aims to find the cause, severity, and the effects of the communication disorder along with the role played by environmental factors. Assessment can also reveal issues about social participation and the quality of life. The obtained data can be used for making comparisons with the former findings to see the development of the individual along the course of recovery. Furthermore, the assessment involves receiving the opinions of the patient and the family.

Hospitalized patients have strong needs for communication. For example, they need to understand the diagnosis and prognosis of their diseases. They want to ask questions about the care and procedures provided for them. It is difficult to meet their needs when patients suffer from post-stroke communication disorders. The likelihood of developing negative mood and depression, unfavorable functional outcomes, and mortality is high in patients; who have difficulties

in reporting their needs. Communication needs of each patient can be identified through observation and discussion so that the patient can be assisted to meet these needs during the hospital stay. This assistance may involve providing auxiliary aids to patients such as pictures or symbols so that the patient can use them to communicate about important topics instead of using words (174,177,182).

A nurse plays a key role in the provision of support to patients with post-stroke communication disorders. All members of the multidisciplinary team should be aware that patients can potentially develop post-stroke communication problems. Therefore, the examination of post-stroke communication problems should be included in the assessment of patients. Nurses have the most significant contact with acute stroke patients, creating a distinct difference in the quality of care. Nurses can contribute to achieving successful outcomes in stroke rehabilitation by implementing attentive and thoughtful communication strategies (174,178).

4.1.4.1. Psychological effects of communication disorders

Stroke alone is a crisis point for the individual. An accompanying communication disorder to other stroke symptoms increase the magnitude of the crisis experienced. In this crisis period; aphasic individuals can experience shock, anger, disappointment, anxiety, aggression, shame, guilt, grief, or loss. Family members may feel surprised because of the negative emotions displayed by the patient. Therefore, they need support and information about acute stroke. Families look for answers to the following questions; including "what is stroke?", "what is aphasia?", "what will be the accompanying problems?", and "how can we obtain further information?". Families need honest but hope-instilling information about the prognosis of the patient's disease. It is necessary to provide accessible information for the individual with aphasia and for the family (181,188).

Impediments to communication unfavorably affect recovery after a stroke. Also; other variables, such as the emotional state of the patient and the provision of social support, act significantly on the quality of life. Long-term job loss due to stroke and aphasia with an impending decrease in income

may bring along limitations in social life and may create a distance from friends. The incidence of depression is high in patients with prolonged aphasia. These negative results are further aggravated by inadequate social support especially after a stroke, partial recovery, risk for a recurrence, and the patient's concerns about the future. Depression is associated with poor rehabilitation outcomes, lower quality of life, and higher mortality. These findings indicate that the interventions for improving the quality of life of the patient should not only aim to facilitate communication but also aim to improve the emotional state of the patient and his/her social interactions (171,181,188).

4.1.4.2. Communication with aphasic patients speaking a foreign language

It is very important not to overlook aphasia and other communication disorders in stroke patients; who speak a minority language in the community. Ideally; the patient should be evaluated by a person, who speaks the native language of the patient. If this is not possible, the patient should be evaluated by interpreters or bilingual team members. It is important not to use family members and friends as interpreters because this can disrupt family relationships and provide unreliable data. If the patient is bilingual or multilingual, it is important to evaluate the communication skills in all languages spoken by the patient because both languages are usually affected and rarely one language remains unaffected in aphasia. However, the manifestations of the language disorder may vary. Typically, the language learned earlier in life or the language used most of the time by the individual is more resistant to impairment. The second most commonly used language by the patient is rarely less impaired after a stroke. These differences in the manifestations of the impairment warrant attentive examinations (189).

4.2. Management of severely affected and minimally responsive stroke patients in the subacute period

Although the number of stroke survivors increases owing to advances in medicine, stroke remains to be a disease causing severe and permanent disability (190-193). Minimally responsive stroke patients constitute a group of stroke patients with long-term disorders in

consciousness; including coma, vegetative state (VS), and minimal consciousness state (MCS). Patients in this group can switch from one state to another or their conditions can persist for a long time. Although rarely, only a minority of patients may live in a state called "locked-in" syndrome, where the patient is conscious but he/she is dysfunctional and unable to move and communicate. Locked-in syndrome is not an impaired consciousness state but it is included in the category of minimally responsive stroke patients as these individuals suffer from significantly severe physical limitations (194).

Patients with long-term disorders in consciousness and lock-in syndrome are totally dependent, requiring total assistance for all activities of daily living. A multidisciplinary team, the family, the spouse, friends, and informal caregivers should be included in the post-stroke patient management processes so that they would understand related situations well to determine the type of the required care. Patients in this group and their caregivers are very sensitive and they face various problems (194-196).

This section addresses the definitions of consciousness levels, the problems experienced by severely affected and minimally responsive stroke patients after hospital discharge, nursing interventions applied for the prevention or elimination of these problems, training needs of stroke patients and of family members/informal caregivers, hospital discharge plans, and palliative care and end-of-life care to be provided for these patients.

4.2.1. Definitions

Coma, vegetative state, minimal consciousness state, and lock-in syndrome are described in the literature as follows:

Coma: It is a deep unconsciousness state. The individual cannot be wakened up. He/she is unresponsive to stimuli, including the painful ones. The sleep-wake cycle is not normal. Coma does not describe the brain death. Some brain functions remain intact in comatose patients (194,197).

Vegetative state: It is characterized by the state of unawareness; in which the patient is awake and the eyes of the patient are open. Nonpurposive spontaneous movements can occur. Persistence of this situation for a month is called persistent vegetative state. Patients in VS open their eyes spontaneously; however, there is no evidence of

smooth pursuit eye movements or eye fixation. These patients do not obey orders or they do not act intentionally or for a meaningful purpose. Cardiovascular regulatory functions, respiration patterns, and cranial nerve functions are usually intact. Although some of the patients in VS regain partial or complete consciousness in time, others remain in the same state for a long time with no significant improvements in their neurological status (194,197).

Minimal consciousness state (MCS): It is a subcategory of patients; who do not meet the criteria for a comatose or vegetative state. Patients in MCS display significant alterations in consciousness. These patients go through sleep-wake cycles and intermittently switch to awareness states, being aware of himself/herself or the environment. They can follow the given orders, display purposeful movements, and sometimes give yes/no answers to some questions (194,197).

Lock-in syndrome: Consciousness is preserved but there is a total paralysis of the somatic musculature. These patients are unable to move and speak. However, they sometimes open their eyes and they stay awake for some time, displaying an upward gaze (194,197).

Brain Death: Brain death is characterized by the complete and permanent loss of the following; including the response to painful stimuli, brain stem reflexes, respiration, and consciousness. Although brain death resembles coma clinically, it is a separate entity; which is characterized by irreversible loss of brainstem reflexes and breathing.

It is not easy to determine whether a patient is in coma, VS, MCS or locked-in syndrome. Misdiagnosing a disorder of consciousness may be a problem. For example, 43% of patients in VS can later be diagnosed to be in minimal consciousness state. Incorrect interpretations result in misdiagnosis or the patient's condition may change unexpectedly over time (194).

Consciousness/being conscious means that the person is aware of himself/herself and the environment and he/she can respond to stimuli. No diagnostic tests are available to determine the state of unconsciousness precisely. Unconsciousness can only be determined by the patient's failure to display behaviors that he/she is conscious. Patients can remain in VS and MCS for months or years. VS is determined to be

permanent when it lasts longer than one year after traumatic brain injury and more than 6 months after a stroke. If MCS lasts longer than 4 weeks, it is called a continuing MCS (194).

4.2.2. Examination and diagnosis

The first step in making the diagnosis is to identify the factors that lead to impaired consciousness and to determine that it is not associated with anesthesia, medications, or metabolic disorders. The criteria listed below indicate decreased or impaired consciousness (194):

- The patient is not aware of himself/herself and of the environment.
- The patient does not consciously respond to visual and auditory stimuli.
- The patient cannot produce meaningful language.
- Sleep-wake cycles can be observed.
- Hypothalamic and brainstem functions are intact along with spontaneous respiration and circulation.

The main objective to evaluate an individual with severe and complex neurodisability is to identify the patient's problems, to determine what the patient can/cannot do, and to determine to what extent the patient can perform a job successfully and independently or to what extent he/she needs physical and verbal assistance. Priorities should be determined, planned, implemented, and the outcomes should be evaluated concerning how and from whom the information is obtained about the patient with MCS (the findings may be observed; information can be obtained by taking anamnesis, or information may be provided by other healthcare professionals and relatives). Information sharing should include psychological conditions and stress levels of caregivers as they may need professional support (193,198-200).

A nurse should assess the patient with long-term disorders of consciousness before the patient is discharged from the hospital to return home or transferred from acute care to a rehabilitation unit, palliative care unit, or permanent-care institutions. The nurse should primarily evaluate the following in the patient; including the breathing function (mechanical ventilator, tracheostomy care), nutritional status (dysphagia, aspiration risk), personal hygiene (oral care), continence function, impediments to mobility, communication ability, skin integrity, medications

used, psychological problems (depression, anxiety), pain, and the risk of deep venous thrombosis. The nurse should also plan appropriate nursing interventions, implement them, evaluate the outcomes, and provide training to family members/informal caregivers on identified issues (146,196,201,202).

4.2.3. Nursing care for problems emerging in patients with severe and minimally responding.

Most of the severely affected and minimally responding stroke patients remain bedridden for the rest of their lives. Depending on the consequences of stroke and immobility; patients may experience respiratory distress (mechanical ventilator support may be needed), difficulty swallowing, malnutrition, poor hygiene, urinary and fecal incontinence, problems related to immobility (shoulder pain, central pain, spasticity), skin problems, communication disorders, psychological problems (depression, anxiety), pain, and deep vein thrombosis (146,194,201-203). This section addresses nursing interventions for the prevention and elimination of these problems.

4.2.3.1. Maintenance of respiration function

Severely affected and minimally responding stroke patients may need to be connected to a mechanical ventilator due to respiratory distress. A tracheostomy is performed in patients, who need mechanical ventilator support for a long period.

4.2.3.1.1. Tracheostomy care

Although a tracheostomy is a temporary intervention, it can be used during the rehabilitation process or may remain permanently in severe and minimally responding patients. Tracheostomy care plays an important role in the prevention of respiratory system infections in patients with a tracheostomy. The following should be followed up in the patient with a tracheostomy (196);

- The patient's swallowing and breathing functions are evaluated.
- The inner cannula of the tracheostomy is cleaned and replaced in aseptic conditions.
- Clinical protocols are followed to clean the tracheostomy area; wiping the area from the inside out by using appropriate antiseptic

solutions and the aseptic technique.

- When necessary, endotracheal/tracheal aspiration is performed.
- After the aspiration, oral care is performed with appropriate oral care products in compliance with the institution's protocols.
- Family members/informal caregivers are trained on tracheostomy care.

4.2.3.2. Swallowing disorders and malnutrition

Difficulty swallowing occurs in a significant percentage of patients after a stroke. The likelihood of developing dehydration, malnutrition, and aspiration pneumonia is high in stroke patients with difficulty swallowing, which is an important contributor to mortality (102,146,200,204).

- In a stroke patient with swallowing disorders, the following should be performed:
- The swallowing function is evaluated before the patient is transferred to another unit of care (a rehabilitation unit, a palliative care unit, care institutions, or home).
- Difficulty swallowing is evaluated by a speech therapist in patients, who are identified to have insufficient or disordered swallowing.
- Behavioral approaches such as swallowing exercises, environmental changes, and safe swallowing methods are tried in patients with difficulty swallowing. Also, necessary dietary interventions are made.
- Superficial neuromuscular electrical stimulation for stroke patients with dysphagia is performed only by specialists, who are expert clinicians in their field.
- Stroke patients with persistent weight loss and recurrent infections are closely monitored.
- The signs or symptoms of the aspiration of secretions, foods or fluids are evaluated (abnormal lung sounds, cough, dyspnea, etc.).
- In patients with difficulty swallowing, nasogastric tube feeding is started primarily in the early phase of stroke (within the first 7 days). Percutaneous gastrostomy is performed in patients; for whom a long-term difficulty swallowing (>2-3 weeks) is estimated (102,146,200).
- For patients fed with a nasogastric tube;
- The correct placement of the tube is checked before each feeding session.
- Intestinal sounds are auscultated to make sure that GI tract motility is proper.
- During the feeding session, the patient's head is

raised at least > 45 degrees and the patient is brought to the right lateral decubitus position from the supine position.

- Residue is checked before feeding when necessary.
- After the feeding session, the patient's head is kept elevated at a degree of 30-45 degrees for 45 minutes.

NG tube is flushed with 50-100 ml water to avoid clogging (102,193).

When the patient develops aspiration symptoms;

- Feeding is stopped.
- The patient is aspirated in compliance with aseptic conditions.
- The nutritional risk of the patient is evaluated and the food he/she consumes is recorded.
- The nutritional status of the patient is evaluated regularly.
- Biochemical tests are performed (albumin levels are tested and glucose levels are tested to detect whether glucose metabolism is impaired).
- Swallowing function is evaluated.
- Unintended body weight loss is checked.
- Food intake is monitored.

4.2.3.3. Oral care

Severely affected and minimally responding stroke patients experience difficulties to maintain good oral hygiene due to physical weakness, poor coordination, and cognitive problems. Moreover, the mechanical ventilator support and nasogastric tube feeding contribute to unfavorable effects on the oral hygiene (146,205)

To provide adequate oral care;

- The patient's oral health, dental diseases, the conditions of gums and oral hygiene, and denture use are examined.
- Oral hygiene of the patient is evaluated daily using appropriate instruments.
- Using special cleaning tools and agents such as toothbrush and chlorhexidine gluconate, the oral cavity of the patient is cleaned by brushing the buccal mucosa, dental surfaces, gums, and the lower and upper palate.
- Oral care is ideally performed in each stroke patient with prostheses before meals and at bedtime in line with appropriate oral care protocols and by using appropriate instruments (toothbrush, mouthwash, dental floss, or oral care kit).
- When it is difficult to administer the

requirements of a oral care protocol to a patient, a dentist and a speech and language specialist should be consulted.

- Patients with poor oral health should be referred to a dentist as soon as possible.

4.2.3.4. Maintenance excretory functions

Bladder and bowel problems occur in about half of patients after a stroke. Permanent bladder and intestinal problems significantly impede the home care and rehabilitation processes (146,191,200).

4.2.3.4.1. Urinary retention / incontinence

- All stroke patients should be evaluated for urinary incontinence and retention.
- The volume of the residual urine is measured using a portable ultrasound device after the patient urinates.
- The intervals for intermittent catheterization is determined according to the residual volume of the urine.
- Routine urinary catheterization is not recommended for stroke patients. However, intermittent catheterization is used to empty the bladder during the hospital stay when urinary retention is severe. When retention persists, urinary catheterization is performed.
- Due to the risk of urinary system infection, urinary catheterization is performed carefully in compliance with aseptic techniques.
- In order to reduce the risk of infection, the site of insertion is evaluated daily and perineal care and catheter care are provided in compliance with clinical protocols and current guidelines.
- The urinary catheter is aimed to be removed as soon as possible. When it is necessary to continue with the catheter, the catheter is changed regularly.
- When patients are discharged from the hospital to continue with either intermittent catheterization or permanent catheters, their relatives are trained on urinary catheter care and signs and symptoms of catheter-related infections. They are instructed that they should contact the nearest healthcare institution in case of infections (60,146,200).

4.2.3.4.2. Fecal incontinence / constipation

- All stroke patients should be evaluated for fecal incontinence and constipation.
- Bowel habits of the patient are evaluated.

- Fecal impactions require the administration of laxatives based on the physician's order.
- The amount of fluid output (vomiting, watery stool, and urine output) and fluid intake (via a NG tube and IV rote) is monitored.
- When there are no contraindications, it is ensured that the patient consumes 1500-2000 ml of fluid per day.
- In order to increase bowel movements, passive movements are performed on the patient in the bed.
- Cleansing of the perineum is properly provided after defecation.

Family members/informal caregivers are informed that they need to follow up the defecation of the patient and that the nutrition and the fluid intake of the patient are important factors. They are trained on how to maintain the hygiene of the perineum. Also, they should be informed that they should contact the nearest healthcare facility or inform the healthcare team members when the patient fails to defecate (60,146,200).

4.2.3.5. Positioning, mobilization, the risk of falling

Various physical problems may develop after a stroke and patients may experience pressure ulcers, joint edema, contractures, and joint pain. These problems delay the recovery significantly and negatively. Also, they affect the psychology and well-being of the patients unfavorably. When the patient is not brought to a proper position during feeding sessions, aspiration pneumonia may develop especially in patients with dysphagia. Aspiration pneumonia increases the likelihood of developing respiratory infections. Hemiplegic shoulder pain may also develop in these patients. Therefore, the following should be performed for these patients:

- The most suitable position is given to the patient in the bed to minimize the above-mentioned problems.
- To ensure optimal lung expansion, the patient is placed in an upright position and supported with pillows.
- Patients with dysphagia are brought to an upright position to reduce the risk of aspiration during both oral and enteral feeding.
- Patients should be mobilized as soon as possible.
- Mobilization of the patient is defined as a process; which includes movements in the bed, standing up, sitting in an armchair, and walking.

- The degree of achieved mobilization should be assessed for all patients by physical therapists before they are discharged from the hospital.
- The safest and most convenient methods are used for transferring the patient from the bed to the chair or the toilet by a trained healthcare professional.
- The physiotherapist and the nurse should collaborate during the transfer of the patient.
- Safe maneuvers such as pulling the patient upwards or sliding in the bed are used during the mobilization and the transfer of the patient.
- Moving the patient properly reduces the risk of pain and subluxation.
- Unless contraindicated, ROM exercises are performed and the patient is moved and seated inside the bed.
- Family members/informal caregivers are informed and practical training is provided about the passive exercises and how they are performed on the patient in bed.
- Assistive tools (such as a splint to prevent contractures) are used when necessary to move the patient. Family members and caregivers are trained on the use of the respective assistive tool.
- The patient's risk of falling is evaluated with appropriate measurement tools.
- It is ensured that the patient bed is elevated at the proper level.
- Bedside rails are raised.
- The use of correct techniques is ensured for the transfer and ambulation of the patient.
- If the patient is to be seated on the chair, a seatbelt should be fastened.
- To improve the patient's unsteadiness, the patient's affected arm is placed on the arm sling when he/she is outside the bed (146,192,196,200).

4.2.3.6. Communication problems

4.2.3.6.1. Aphasia

Approximately one-third of stroke patients develop aphasia and aphasia is observed to persist in the 6 month after a stroke in 32% to 50% of these patients. Aphasia occurs due to the damage in the certain areas of the brain. The severity and the clinical features of aphasia and the recovery from it vary from patient to patient. Common problem in aphasic patients is their inability to adequately communicate with people neither by writing nor orally. Aphasia is chronic for most of the patients. This problem affects not only the

patients but also their families and the healthcare team. To communicate with a patient with aphasia;

- Patients should be examined by a speech and language therapist.
- Characteristics of aphasia is explained to the family members.
- It is explained to the family that they should be kind and understanding to the patient and that they should talk to the patient in normal tone.
- All interventions are explained to the patient.
- Short yes/no questions are asked to the patient during communication.
- One should speak to the patient slowly in order not to overwhelm the patient with very intense stimuli. Adequate time should be allowed for the patient to respond.
- The patient is allowed to find the word he/she is trying to remember.
- The person, who speaks to the patient, should be directly looking at the patient while standing or sitting on the unaffected side (on the left) of the patient.
- An alternative communication method, namely, an illustrated aphasia board, is used.
- Relatives of the patient are informed about the patient's condition and patience is advised.
- Environmental stimuli impeding communication efforts or distracting the patient's attention are reduced.
- Patient relatives can sometimes correct the patient's mistakes; however, they should generally avoid to do so.
- The patient and family are supported to start speech therapy early (60,191,196,204).

4.2.3.7. Skin integrity

In order to prevent pressure injuries during the hospital stay and after the discharge from the hospital, the patient is regularly examined with the Braden objective risk assessment scale.

- The friction and pressure on the body areas of the stroke patient is reduced to prevent any disruption in the skin integrity.
- Proper skin care is provided.
- Excess humidification of the skin should be avoided.
- An adequate diet and hydration should be provided (52,54,60,206).

4.2.3.8. Adherence to medical therapy

Attempts to improve compliance with drug treatments are often complex. Family

members/informal caregivers should be informed about the following methods to increase medication compliance in stroke patients.

- Family members of the stroke patient are informed about the use of reminders (setting an alarm clock or writing the name and time of the medicine on a piece of paper and sticking it to some place where it is most likely to be seen by the patient frequently during the day, etc.) in order not to miss the time to give the patient the medicine.
- Family members/informal caregivers are provided with counseling and training on the purpose of medication use, the effects side effects of the patient's medications, when to apply to the hospital, and the drug-drug and drug-food interactions. The adherence of the patient and respective family members is followed up by telephone calls.
- The information is provided before the patient is discharged from the hospital. Then, the provision of information is continued via regular follow-up visits in the outpatient clinics (60,191,196,204).

4.2.3.8. Psychological problems

4.2.3.8.1. Depression

Poststroke depression can occur in one-third of stroke patients. Poststroke depression should be recognized early because it unfavorably affects the rehabilitation process, impairs the patient's quality of life, and increases the risk of mortality. Therefore;

- Patients are evaluated for signs and symptoms of post-stroke depression.
- Patients diagnosed with post-stroke depression receive their prescribed medications appropriately. Family members/informal caregivers should be informed of the treatment regimen.
- The effects and side effects of medications are closely monitored (54,206,207).

4.2.3.8.2. Anxiety

Anxiety is common after a stroke and is disturbing. Anxiety can occur in the acute and non-acute period of the stroke and patients may be afraid of having a recurrence. If anxiety is severe, it may be incapacitating for the person. Therefore;

- The anxiety level of the patient is evaluated.
- Patients with anxiety receive appropriate medical treatment and information is provided to family members/informal caregivers.

- The effects and side effects of medications are closely monitored (54,206).

4.2.3.9. Other problems

4.2.3.9.1. Deep Vein Thrombosis (DVT)

DVT and pulmonary embolism may develop on either side of the body of the patient due to immobility resulting from the physical weakness. In order to avoid DVT, the following should be considered and practiced:

- It was found out that the use of compression stockings was ineffective in preventing DVT in stroke patients. However, intermittent pneumatic compression was shown to be effective in reducing the risk of DVT.
- Intermittent pneumatic compression is used in immobile patients to prevent DVT.
- Prescribed anticoagulant therapy is administered to ischemic stroke patients based on the physician's orders.
- Stroke patients need to be mobilized early to prevent muscle damage and shortening and to reduce the risks of aspiration, shoulder pain, and respiratory complications.
- The patient is seated in the bed at least for a short time rather than lying in the bed for long periods.
- Passive joint exercises are performed on the patient (146,196,200,202).

4.2.3.9.2. Pain

Chronic post-stroke pain is seen in stroke patients, affecting the rehabilitation process unfavorably and impairing the quality of life. The most common types of post-stroke pain are central pain, hemiplegic shoulder pain, and pain due to spasticity. Central post-stroke pain (CPSP) can be spontaneous. Spontaneous pain can transform into continuous and intermittent pain. Dysesthesia, allodynia (feeling pain only with touch in the absence of painful stimuli) or hyperalgesia (pain aggravates further with painful stimuli) are common. Shoulder pain due to hemiplegia can develop within weeks or months after a stroke. Shoulder pain occurs after a stroke due to limitations resulting from sensory and motor deficits, subluxations, and limited range of motion in the joints of the patient (193,196,202,204). Therefore;

- The patient's severity of pain is evaluated with appropriate measurement tools.

- The factors aggravating and alleviating the pain are identified.

- The shoulder is suspended to prevent shoulder pain.

- When shoulder pain results from inflammatory conditions (inflammatory arthritis, adhesive capsulitis), intra-articular steroid treatment is applied.

- There is insufficient evidence for the use of the following methods for the treatment of shoulder pain.; including physical therapy, EMG – biofeedback, transcutaneous electrical stimulation, intramuscular electrical stimulation, NSAID therapy, cryotherapy, massaging, and acupuncture/acupressure.

- Excessive motion beyond the normal range is avoided as it can lead to subluxation and pain.

- In stroke patients, electrical stimulation is applied to the supraspinatus and deltoid muscles to reduce the risk of shoulder subluxation.

- A routine use of splints to reduce spasticity in the wrist and fingers should be avoided.

- When pain results from spasticity and it limits physical activities, Botulinum toxin type A is applied.

- As the effects of routine functional stimulation, robot-mediated passive therapy, oral anti-spasticity drugs, and intrathecal anti-spasticity drugs have not been determined yet; they are not recommended for the routine use to reduce spasticity.

- Patients with central pain that do not respond to standard treatment after a stroke receive medications according to the physician's orders. The effects and side effects of the drugs are monitored (193,196,200,204).

4.2.4. Training of patients, family members / informal care providers, and the discharge plan

4.2.4.1. Assessment of family members / informal caregivers after a stroke

Family members/informal caregivers should be assessed and the following should be performed:

- Their readiness for the transition from the clinical care to rehabilitation is assessed.
- Interventions should be patient-centered and appropriate for the patient's values and needs.
- Coping levels, depression, and other psychological and physical conditions of family members/informal caregivers are evaluated.
- Their needs are identified at each clinical visit.

- Their readiness to receive information, their knowledge levels and skills, and their needs to receive psychological support are evaluated.
- Of the respective family member/informal caregiver; the state of the well-being, the employment status, the social life, ways of contributing to the stroke care, skills and experiences, the economic status, living conditions at home, the health insurance status should be evaluated. Also, the availability of support from other family members for the provision of care to the stroke patient should be assessed.
- The depth of assessment is based on the unit or facility, where the patient will be transferred to (home, rehabilitation unit, palliative care unit, long-term care home) (204).

4.2.4.2. Training of family members/informal caregivers after a stroke

Training of family members/informal caregivers is promoted after a stroke in order to maintain the continuity of the care.

- In every process of the long-term stroke care, the requirements and the objectives for the provision of information to the patient and the family members/informal caregivers are evaluated and noted by the healthcare team members.
- Training process is implemented based on training needs.
- Training is provided to patients and family members/informal caregivers on an individual basis (Table IX).
- The training process should be interactive and continuous with repeat sessions. The training program should be developed according to the educational status of the patient and the family.
- Printed letters or writing boards are used in training sessions for aphasic patients.
- Training is carried out by taking the acute, subacute, and chronic periods of stroke into account.
- All stroke patients and their family members/informal caregivers are informed about the F.A.S.T. acronym, which will enable to know about a stroke better.
- Stroke patients and their family members/informal caregivers are informed that they should immediately apply to the closest healthcare center because the F.A.S.T. warning signs can indicate the development of a new stroke.
- Written or other readily accessible training materials containing the provided information should be provided to all stroke patients and their

family members/informal caregivers (53,54,206).

4.2.4.3. Hospital discharge plan

- Patients and family members/informal caregivers should be thoroughly informed at each stage of the discharge process.
- Holistic hospital discharge plans are developed in collaboration with the stroke patient and the family members to meet the special needs of the patient.
- The training plan for the hospital discharge begins to be developed after the admission of the patient.
- The discharge plan should be well-organized and should be developed in collaboration with healthcare professionals, the patient, the family, and caregivers.
- Hospital services should provide the following before the discharge of the patient to ensure a safe process.
- Stroke patients and their family members should be offered opportunities to identify and discuss potential needs (physical, emotional, social, economic, and social support) that may occur in the period after the hospital discharge. This should be performed with the collaboration of the multidisciplinary team members.
- Primary care teams (family physicians and nurses) are informed about the time when the patient will be discharged.

All medications of the patient, the assistive tools, the transport of the patient, and necessary support services should be organized for a safe hospital discharge.

A copy of the post-hospital-discharge care plan; which was developed together with the stroke patient and the relatives, should be provided to the patient and the family (53,54,206).

- The aim of the hospital discharge plan and the estimated date of the hospital discharge are determined with the patient and the family members/informal caregivers.

The hospital discharge plan should address the following:

- Home adjustment based on the patient's needs and condition to create a safer environment,
- Physical requirements for patient care before the hospital discharge, caregiver capacity, psychosocial needs of the patient and caregivers, and the need for decision-making,
- The caregivers' awareness of the needs of the stroke patient after the hospital discharge and in

Table IX: Subject matter of training programs for patients and family members/informal caregivers.

Patient	Family Members/informal caregivers
Exercise	Individualized care techniques (tube feeding)
Symptom management	Communication strategies
Management of risk factors (drug use)	Physical transport methods (transport from bed to chair etc.)
Preventing a secondary stroke	Feeding the patient with dysphagia
Nutrition	Self-management skills to enable patient independency as much as possible
Manage fatigue and sleep regulation	Accessing community services and resources
Medication management	Problem-solving techniques
Coping with physical changes	End-of-life care and palliative care
Coping with emotions including fear, anger, and depression.	
Coping with changes in cognition and memory	
Coping with changes in perception	
Problem-solving and decision-making about health	
Sexual life	

the future,

- Schedules of daily, weekly, and monthly follow-up visits; aiming to assess the readiness of the patient for the hospital discharge and to identify potential impediments on the way to the hospital discharge in line with planned and pre-meditated objectives.

Printed materials should be delivered; containing patient care plans, risky situations, action plans for recovery, medications used by the patient, schedules of follow-up visits, and the time to contact the health care team.

- Family members/informal caregivers are provided consultancy on the phone when necessary (53,54,206).

4.2.5. Palliative care and end-of-life care

Advances in acute stroke treatment require stroke patients and especially their family members to make lifestyle-changing decisions in both acute and chronic stages of stroke. It is critical for the severely affected and minimally responsive patient and the family members to take responsibility and to decide about the treatment and care processes during the transition from active treatment to palliative care (208,209).

American Heart/Stroke Association state that palliative care should be considered for all stroke patients, especially when they are estimated to have a short life expectancy and impaired quality of life (190,210).

During the palliative care period;

- The interdisciplinary stroke team should discuss the current condition of the patient, potential effects of the stroke, general care principles, and the objective of the care; whether it will be performed for providing comfort or prolonging the life of the patient or for improving the patient's

functional capacity.

- To facilitate the decision-making processes about the provision of care; the interdisciplinary stroke team should be in contact with the family members/informal caregivers on a regular basis, providing information about the diagnosis, prognosis, and the estimated effects of the stroke.

- The following topics should be explained to patients and family members/informal caregivers:

- Mechanical ventilation, enteral/intravenous nutrition, and intravenous fluid therapy are necessary for the survival of the patient,
- It should be reviewed whether the long-term use of all of the prescribed medications are necessary if it is decided that the goal of care is the provision of comfort.

- Vital signs will be monitored and blood sample analyses and diagnostic tests will be performed routinely.

- Oral care,

- Assessment and management of pain,

- Assessment and management of delirium,

- Assessment and management of the respiratory distress and secretions,

- Assessment and management of incontinence, nausea, vomiting, constipation, and skin and wound care,

- Assessment and management of seizures,

- Assessment and management of anxiety and depression,

- Palliative care units,

- Death.

The interdisciplinary stroke team should have developed adequate communication skills to determine the physical, spiritual, cultural, psychological, and social needs of the patient. They should regularly contact with the patient and the family members/informal caregivers to determine

whether these needs are met.

The patient and his / her family members/informal caregivers should be able to reach the members of the palliative care team when necessary (uncontrollable or complex problems and when the patient's life ends).

- End-of-life care should be provided for the stroke patient during the palliative care process.

- It should be discussed with family members whether organ donation can be possible.

Supportive consultancy should be provided to family members after the patient's death.

4.3. Improvement and rehabilitation of physical deficits and disability in the stroke patient

Regardless of the type of the ischemic stroke, different levels of disability develop in individuals due to reduced cerebral blood flow and brain damage (211). The resulting deficits cause clinical consequences and disability of variable severity; including paralysis and loss of motor control; sensory, visual, cognitive, and sexual dysfunctions, and balance and muscle coordination disorders (212).

The clinical consequences resulting in physical disability in stroke patients are motor dysfunction and complications.

4.3.1. Musculoskeletal system and motor deficits

Balance problems: After a stroke, patients may have trouble performing some or sometimes all of the following three activities associated with the balance control:

- 1) Inability to keep a particular posture; inability to sit or stand up.

- 2) Inability to perform voluntary movements: Impairment in walking and going up the stairs.

- 3) Diminished responsiveness to external stimuli: Stumbling, slipping, or difficulty pushing.

Paralysis: Hemiplegia and hemiparesis result from impaired voluntary motor control (212). Patients have difficulties in performing daily self-care tasks and activities of daily living.

Ataxia: It is the deficit in the muscle strength required to perform synchronized movements. Patients display coordination and rhythm loss.

Apraxia: It is the inability of the patient to perform previously learned activities. For example: inability to use forks, spoons, inability to comb the hair or button a shirt (212).

Spasticity: The increase in the muscle tone due to upper motor neuron damage impairs the patient's ability to perform activities of daily living and impedes the mobilization of the patient, causing intense levels of stress, fatigue, and weakness. Furthermore, the upper limb spasticity forces the hand and wrist to flexion toward the elbow and forces the arm to flexion toward the chest.

4.3.2. Potential Complications

Complications increase the stroke-related mortality, prolong the course to rehabilitation, and cause more disability and patient dependence.

Falls and fractures: Stroke patients are four times likely to have fractures after falls compared to the general population. Falls and injuries constitute an important problem. It is estimated that 24% of acute rehabilitation patients, 39% of geriatric rehabilitation patients, and 73% of patients at home experience a fall. Patients limit their mobility due to the fear of falling, impairing the success of the rehabilitation.

Pain: Pain is an important physical symptom that affects patients' recovery and rehabilitation after a stroke. Hemiplegic shoulder pain and neuropathic pain are major problems requiring rehabilitation.

Fatigue: It is a major symptom; which negatively affects the participation of the patient in rehabilitation processes, impairs his/her functionality, and hinders the improvement of physical symptoms.

Dysphagia: It results from the affected parts in the upper parts of the mouth, tongue, palate, larynx, or esophagus.

Loss of bowel and bladder control: It is reported that approximately 25-50% of patients experience bowel and bladder incontinence.

Dysphasia or aphasia: It results from the loss of function of the muscles involved in speech.

Contractures: It is a state of high resistance to passive extension and steadiness resulting from fibrosis and contraction of the tissue; which supports muscles and joints.

4.3.3. Stroke rehabilitation

The primary goal in stroke rehabilitation is to prevent complications, to minimize deficits, to strengthen the postural control, and to maximize the functionality so that the individual can achieve the highest possible level physically, mentally, socially, and professionally. The secondary goal is to prevent recurrences (213).

It requires individualized medical and nursing care and management due to stroke findings that differ from one person to the other.

Tools used in the evaluation of a stroke patient:

- National Institute of Health Stroke Scale (NIHSS),
- Glasgow Coma Scale (GCS),
- Barthel Index,
- Modified Rankin Scale,
- Modified Ashworth Scale,
- Braden Risk Assessment Scale.

4.3.4. Nursing management and rehabilitation for improvement of physical deficits and disability

- It is recommended that early rehabilitation for hospitalized stroke patients should be performed in professional settings providing stroke care, namely neurological intensive care units or stroke units.

- An effective stroke rehabilitation program should address the individual's physical, psychological, behavioral, cultural, spiritual, and social problems.

- Planning a rehabilitation schedule should start as soon as possible and plans should focus on minimizing potential rehabilitation complications in the acute phase. Care should be exercised for performing early and intensive rehabilitation.

- It is not recommended to start intensive and early mobilization within 24 hours of the stroke onset as it can unfavorably act on potentially positive clinical outcomes.

- Early mobilization of stroke patients is recommended to be performed by nurses or physiotherapists, who are experts in their field.

- Nurses need to acquire the necessary skills to position the stroke patient correctly (Figure IV).

- It is recommended that all stroke patients should be assessed before the hospital discharge, where the acute care has been provided. The assessment should include the patient's fulfilment of activities of daily living and communication skills and functional mobility of the patient.

- it is recommended that the readiness of the patient should be evaluated in order to ensure his/her active participation in exercise programs (107).

- It is suggested that passive joint range of motion exercises can be performed by nurses in order to maintain the joint mobility and prevent immobility-related complications.

- It is recommended that the swallowing function of the stroke patient should be evaluated within 24 hours.

- It is recommended that the nurse should evaluate the patients for their fluid, protein, and calorie intake in the early period and should cooperate with the dietician.

- Nurses should monitor the patient's nutritional status and body weight to prevent malnutrition, maintain the oral hygiene of the patient, assist patients who are not able to eat by themselves, and ensure that the feeding is performed by using the appropriate route and technique.

- Nurses should cooperate for the start of bowel and bladder exercises early so that potential constipation, fecal-urinary incontinence, retention, and infection problems can be prevented.

- Patients' participation in the fulfilment of activities of daily living should be promoted and unilateral neglect should be prevented.

- The patient's personal belongings, the television or reading materials should be placed in the visual field of the patient on the unaffected side. Massaging should be applied to the affected side and the patient should be supported to use the affected side.

- The patient should be encouraged and assisted to perform self-care activities like bathing, putting on clothes, and eating.- In order to prevent shoulder adduction, a pillow should be placed under the armpit on the affected side.

- The pain severity of the patient should be evaluated with pain scales. Massaging and stretching exercises should be performed on the patient and foam supports should be used.

- To minimize the fatigue; the nutrition and energy management of the patient should be followed up and any pain should be managed adequately.

- The emotional state of the patient should be evaluated. The development of any potential feelings of hopelessness, depression, or anxiety should be prevented.

- The patient should be assisted to return to work and family life as soon as possible.

4.4. 4.4. Psychiatric and cognitive problems after a stroke

Stroke is a sudden, life threatening, disabling, and traumatic life experience. In the post-stroke process, the focus is mostly on motor and sensory impairment, speech disorders, and changes in the

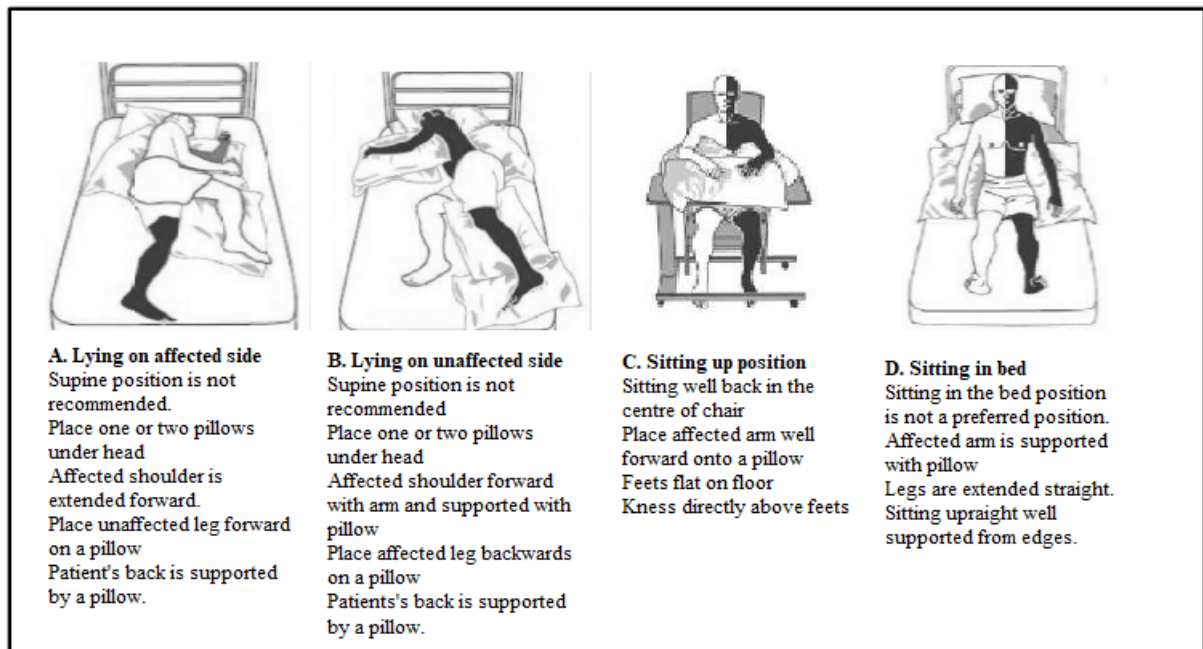


Figure IV. Guide of positioning the patient with hemiplegia in the bed (With permission of Wiley-Blackwell, Charles P. Warlow et al. Stroke: Practical Management 3e)

ability of the patient to perform activities of daily living. Long-term follow-up studies of stroke patients by multidisciplinary teams demonstrate that the incidences of psychological and psychiatric problems in these patients are too high to overlook (214). Unfavorable effects of a stroke can vary and manifest differently in the patient's mood, cognitive functions, and behaviors; emerging not only in days but also in months or even years. Many of these changes are difficulties for both the patient and their relatives and they impair the quality of life. Mood changes act on the physical recovery, the return to social life, and other outcomes in the period after a stroke (174,215).

Stroke is an emergency that occurs suddenly and results in hospitalization. This sudden incident can be sad and worrying for the person. If stroke caused loss of function, the individual is likely to react emotionally. Patients can often experience anxiety, confusion, and an urge to cry in the first few days after a stroke. They may also be concerned about their roles and responsibilities (for example, they may be concerned about how their spouse will manage at home, how their business will be managed, or who will take care of children). The patient may be concerned about how long any damage or injury will last and

whether he/she can continue his/her life as before. This is sometimes called "role crisis" or "role anxiety". People may be concerned about their current or future abilities to perform their normal roles (for example; whether they can continue to fulfil their responsibilities as a spouse, parent, employee, or a social club or committee member). Also; frustration, irritability, and anger are early emotional reactions after a stroke. Such reactions occur in situations that can potentially change the lifestyle or cause impediments (214,216,217).

4.4.1. Depression

Poststroke depression is a common and well-studied reaction. Poststroke depression often occurs in the first year after a stroke; however, it can occur anytime. Studies show that 20-40% of patients are likely to develop depression. Poststroke depression is a critical issue to emphasize as it delays the healing process and increases mortality rates (218). The high incidence of poststroke depression allowed to demonstrate that it is a different entity from other depression types. This point of view argues that poststroke depression results from the neurological injury occurring after a stroke. Some lesions (lesions of the left hemisphere, especially frontal lesions) are

more likely to cause depression compared to lesions in other parts of the brain. However, asystematic review of the lesion location and of the mental states of individuals after a stroke yielded no solid evidence to indicate that a specific area or side of the brain caused the poststroke depression. This suggests that the etiology of poststroke depression is multifactorial. Clinical depression is a syndrome; that is, it comprises a set of symptoms and signs. Symptoms include at least one-month of disturbed sleep and/or appetite, inability to enjoy activities, negative thinking (including the person's self-esteem), and lack of energy. Feelings of sadness and the urge to cry are significant. Depressed mood is more common in stroke patients compared to individuals of similar age, who have not had a stroke. Some individuals may develop depression early after a stroke; in others it may develop later. Some argue that depression usually occurs in the period of returning home. The problem may arise when the patient faces difficulties of living with a disability at home. Depressed mood can be short-term in many patients, recovering spontaneously when the individual adjusts to the disability (214,215,218-220).

The high incidence of post-stroke depression indicates the importance of the early diagnosis and the management of disease processes. Studies have found out that depression is associated with previous depressive episodes, the extent of stroke-related neurological deficits, and the disability in the acute and subsequent periods. Depression has not been found to be significantly related to age, gender, lesion location, and stroke subtypes. Another study has reported that patients with communication problems are more likely to develop depression compared to those without communication problems. Depression occurs more frequently in patients with a low level of perceived social support. This observation reveals the importance of close and especially reassuring relationships. Also, it is reported that having too many positive or negative expectations may cause depression (220,221).

4.4.1.1. Depression diagnosis and screening

Since depression occurs in about 30% of stroke patients in the first year; all patients admitted to the hospital after a stroke should be evaluated at various stages, especially at periods of

transition from one stage of the post-stroke processes to the other. Having a long clinical interview with patients is unrealistic and unnecessary. Concise methods for depression screening are available to identify patients at risk of depression. Making a diagnosing of poststroke depression can be challenging due to a partial overlap between the stroke and depression symptoms and neurological deficits such as memory and communication problems. However; several approved scaling tools are available for use in stroke patients, including those patients with communication problems. However, none of these tools is sufficient to make a diagnosis. Therefore; a more detailed clinical evaluation compared to assessments with scales should be performed in individuals; who were identified to be at risk of developing depression with the administration of scales (218).

Asking the patient about her mood and emotional difficulties can make some nurses uncomfortable. The situation should be explained to the patient and relatives and the following questions should be asked:

- "We know that many stroke patients feel sad or emotional. Do you mind if I ask you a few questions about how you feel?"
- "People sometimes think that the situation will never improve after a stroke. Do you have similar thoughts?"
- "Do you often feel sad or depressed?"

Language-based assessments are problematic in patients with severe cognitive deficits or communication difficulties. Even if a low score is obtained by the administration of a scale, indicating that the patient is unlikely to have a mood disorder/mood change; this information should be noted. The mood of a stroke patient should be evaluated every few weeks to assess any changes that may occur over time. High scale scores of stroke patients should be noted and detailed information should be provided to the doctor or nurse in charge of the care. The diagnosis and treatment of poststroke depression is important as it can affect the length of hospital stay, rehabilitation processes, and recovery. Patients with depression have a low likelihood to comply with medical treatments or to quit smoking. Minimal participation in social activities, low quality of life, high suicide rates, and poor survival is observed in these patients (215,219).

4.4.1.2. Depression treatment

Antidepressant therapy is the most common treatment for post-stroke depression. Antidepressants reduce the severity of depression; however, these medications are recommended for use in serious cases due to their potential side effects. Patients with mild depression may benefit from counseling, engaging in hobbies and exercising (if possible), or participating in social activities. These methods should be considered as a priority option before starting antidepressant therapy. Another alternative to drug therapy is structured psychological therapy. This method is also known as "talking therapy". Structured psychological therapy can be applied by appropriately trained stroke nurses. A brief therapy involving several sessions can be effective. Cognitive behavioral therapy is reported to act positively on the symptoms of poststroke depression. Preventive psychotherapy (problem solving therapy and motivational interviews) and case management were found to be effective in reducing the likelihood of depression although slightly. A study on patients with aphasia found out that behavioral therapy was effective in improving the depressed mood (222,223).

Mindfulness therapy is another method suggested to be effective in improving depression. Interventions based on the mindfulness theory have been shown to improve the quality of life and several psychological symptoms such as anxiety and fatigue; which emerged after a transient ischemic attack and after a stroke (224). Other recommended treatments in this field include physical exercise, music, acupuncture, deep breathing, meditation, imagination, recurrent transcranial magnetic stimulation, and ecosystem-focused therapy (222).

4.4.2. Sensuality

Sensuality or emotional lability refers to uncontrolled crying or laughing. Crying or laughing may be appropriate for the stimulus; however, they are not proportional to the emotional load of the event. Moreover, these responses can occur for no apparent reason. While 20-25% of the patients are affected in the first 6 months, 10-5% of them continue to have the symptoms even for one year after a stroke. The lability of emotions is the distinctive feature, allowing for an easy identification. The etiology of these manifestations is not entirely clear but it can

be caused due to damage to certain brain areas such as thalamus. Heightened emotionality may result from the psychological distress of patients. Furthermore, it is more likely to occur in patients with depressive mood. The heightened emotionality, responsive to antidepressant therapy, suggests that the cause is neurological. The nurse assumes an important role in assisting the patient and the family in their coping with the emotional lability. Sensuality can cause social isolation if it persists. Patients may avoid socializing, especially with close family and friends; contributing further to the social isolation. Therefore, it is important to closely follow up patients with heightened emotionality (216,218,221).

4.4.3. Anxiety

Another common disorder that occurs after a stroke is generalized anxiety disorder (GAD). It can accompany depression but it can occur alone, too. It is less easily identifiable and less commonly diagnosed compared to depression. GAD occurs in approximately 30% of these patients. Anxiety that is ignored and not treated after a stroke may result in impairment in the fulfilment of activities of daily living and cause inadequacies in social functions. Anxiety can occur immediately or in weeks or months after a stroke. It can become chronic, too. It is reported that both anxiety and depression developing early after a stroke can become chronic. Anxiety is a syndrome or a symptom cluster, comprising restlessness and often fear and anxiety. Furthermore; physical symptoms occur such as shortness of breath, palpitations, and tremors. Similar to depression, the severity of anxiety is variable to a considerable extent. The most unfavorable consequence of anxiety is the series of limitations, incapacitating the person. Symptoms can occur without a specific triggering event or they can be triggered by various conditions. Patients with anxiety experience extreme feelings of unrealistic fear and anxiety. (225).

The sudden development of stroke can evoke anxiety symptoms to such an extent that the individual becomes unable to engage in activities. People can start avoiding the places and the events associated with the time when the stroke has occurred. Moreover, patients may be afraid of having a stroke recurrence. The fear of recurrence can be manifested in the patient's questions,

asking healthcare professionals repeatedly whether he/she will be ok. This type of behaviors can be a reassurance seeking behavior. Hearing a "yes" answer does not help the patient or does not reduce the fear of the patient that he/she will not recover. The "yes" answer can even reinforce the reassurance-seeking behavior, causing patients to ask the same question repeatedly (226).

Psychological approaches are the most commonly recommended type of anxiety treatment. Medical therapy is recommended for serious cases. Antidepressants display an alleviating effect on the anxiety. Cognitive behavioral therapy is planned for long-term benefits. Although the efficacy of cognitive behavioral therapy in stroke patients has not been proven yet, its efficacy on depression in the general population has been proven. Cognitive behavioral therapy is the general name given to the technique of solving problems through verbal interaction, that is, through interviews. During the interviews, it is ensured that the person identified his/her thoughts, feelings, and behaviors through a mirror effect. This way; people can notice and change their ineffective thoughts and behaviors, resulting in the alleviation of anxiety and depression. These therapies should be administered by appropriately trained practitioners, such as a clinical psychologist or a psychiatric nurse (221,222,225-227).

4.4.4. Post-traumatic stress disorder

Post-traumatic stress disorder (PTSD) is considered a reaction to the disease. Stroke is potentially experienced as a traumatic event, resulting in PTSD. Although PTSD develops in 5-30% of stroke patients, it has not been recognized as a stroke sequela. The severity of PTSD is not related to age, neurological deficits, or the disability. It is more common in women, patients with a low education level, and in those, who evaluate their stroke experience more negatively. The severity of the patient's fear at the time of the stroke and the extent of his/her concerns about potential disabilities are the major factors associated with PTSD. However, these observations have been reported only by cross-sectional studies. Therefore, these pieces of information are limited to fully establish the involved factors (216,217).

PTSD can occur in stroke patients similar to the development of depression in this patient

population. Favorable outcomes can be achieved with differential diagnosis and specific treatment. Therefore; clinicians and investigators should be aware of the possibility of an accompanying PTSD in the individual while evaluating patients for post-stroke depression. If a thorough evaluation is not performed, depression may be treated primarily. However, this will not be an adequate approach. According to the NICE guidelines, focusing on depression instead of PTSD will impede favorable outcomes (177). When both depression and PTSD occur, focus should be on PTSD first. Depression can be relieved accordingly. No specific guidelines are available for the diagnosis and treatment of PTSD. However, NICE guidelines highlight the need for a specific assessment of PTSD in high-risk groups. These risk groups include individuals with a history of depression and those with a disabling disease. Antidepressants and behavioral therapy are effective in the treatment. A comprehensive neuropsychological evaluation after a stroke is critical. Every healthcare personnel working with stroke patients should be knowledgeable about the clinical manifestations of PTSD (221,228,229).

4.4.5. Cognitive disorders

Deteriorations in cognitive functions commonly develop in the post-stroke period; creating burden placed on the patient, family, and the healthcare system. However, improvement of the physical functions has received most of the attention so far. Rehabilitation of cognitive functions has not been a matter of sufficient clinical importance. The damage caused by stroke in the brain can significantly impair sensory or cognitive functions. Cognitive impairment often includes deficits in memory or decision-making skills. Sensory impairment unfavorably acts on processing of information input, such as visual and auditory information. Moreover, problems may occur in three-dimensional vision, perceiving movements of objects, or in the perception of smell and taste; impeding the brain's perception of the environment (230,231).

It was reported that more than half of the individuals developed deficits at least in one domain of cognitive functions in the six-month period after a stroke, resulting in high disability rates and a poor quality of life (232). Post-stroke cognitive dysfunction has been reported to be associated with depression and dementia in the

long term. The incidence of depression has been found out to be high in individuals with cognitive impairment. It has been found that stroke patients with cognitive impairment have six times higher incidence of dementia, developing in the post-stroke period. It has been found out that 10% of people developed dementia after the first stroke and that one-third of patients developed dementia after the second stroke. A close relationship has been reported between cognitive deficits and the transfer of patients to nursery care. This rate is especially high in individuals seriously affected by a severe stroke. A quarter of patients with cognitive impairment are diagnosed with dementia in the next three years. Failure in the implementation of routine screening procedures can end in overlooked diagnoses of cognitive deficits. Cognitive deficits may not be identified during the hospital stay because the individual is assisted by healthcare professionals in that period. However, the patient will face the deficits after the hospital discharge. When the patient returns home, those deficits may remain unnoticed through the homelife. However, they become apparent when the patient starts performing complex tasks such as returning to work or driving. Therefore; it is recommended that cognitive functions should be examined in the post-stroke period (231-233).

4.4.6. Attention deficits

Attention is a cognitive function that is commonly affected especially in the early periods after a stroke. Because attention is necessary for appropriate functioning in almost every cognitive domain, attention deficits can significantly impair patients' ability to live independently. Attention skills allow the brain to ignore most of the stimuli and selectively focus on what is necessary to process effectively during a constant input of various sensory stimuli. Attention disorders significantly impair the performance of complex and difficult activities. For example, driving can be quite challenging for a patient with disordered attention. Other clinical problems such as pain and fatigue or emotional problems like depression may aggravate attention deficits. Individuals with disordered attention may benefit from brain retraining by reinforcing the identification of specified stimuli and by selectively focusing on them (233,234).

4.4.7. Memory disorders

Memory disorders commonly occur in the post-stroke period. They become manifest especially in the first week and first month after a stroke. Unlike other cognitive disorders, patients recognize this problem. Memory disorders can respond to treatment. Patients can be trained to gradually adopt simple techniques to compensate at least for the memory loss. Memory can be evaluated with standard scales. It is important to examine the patient and refer the patient to a specialist to find out if there is an underlying physiological mechanism causing the problem (231).

4.4.8. Visual-spatial disorders

Such disorders include neglect lateralized to one side, perceptual disorders, motor apraxia, and dyspraxia. These problems may occur in approximately in 1 out of 10 patients and in almost half of patients with a stroke affecting the left hemisphere and the right hemisphere, respectively. Recovery can be rapid with problems usually disappearing after 2-3 weeks; however, symptoms may persist in other patients. This can hamper living and working independently. Visual-spatial disorders can cause significant problems during rehabilitation. The persistence of these problems increases the likelihood of a longer hospital stay, discharge from the hospital with a need for home care, and social isolation (233).

Tests are available to perform to support the diagnosis but the diagnosis of visual problems can be made with a clinical assessment alone. Today, only a few interventions are available for the treatment of visual-spatial or perceptual disorders. Therefore, ensuring patient safety and the use of supportive techniques are recommended. Interventions for motor apraxia have provided benefits in the fulfillment of activities of daily living in the short term but there is no evidence that the benefits are permanent (233,235).

5. AFTER STROKE

5.1. Planning the hospital discharge for an acute stroke patient, supportive care at home, palliative care

5.1.1. Planning the hospital discharge for an acute stroke patient

A comprehensive planning for the hospital discharge is recommended to be developed

addressing the patient and the family in overcoming the stroke-related problems so that the return to daily life can be facilitated. The purpose of the hospital discharge plan is to shorten the hospital stay, improve the coordination of services after the hospital discharge, and avoid long-term unmet needs (236). Patients; who were hospitalized and treated in a stroke unit due to acute ischemic or hemorrhagic stroke should receive training with their relatives before they were discharged from the hospital. The training should include information about the risk factors and symptoms of stroke, what to do when the symptoms of stroke emerge, action points to proceed at home or rehabilitation institutions after the hospital discharge, the follow-up visit schedule at the stroke outpatient clinic, and adherence to medical advice and therapy. A written plan for the follow-up of the patient at home should be handed to the patient and the family (47).

While assessing the hospital discharge readiness, the patient and the family members should be provided guidance under the following headings (162):

- Stroke patient and their family members/caregivers should be provided with information tailored to meet individual needs by using the relevant language and communication modalities.
- Information should be given at different stages in the course to recovery.
- Active participation of the stroke patient and their family members/caregivers should be ensured to receive information and reinforcement of training about the follow-up of needs and procurement of necessary materials.
- The stroke patient and their family members/caregivers should be delivered critical pieces of relevant information about stroke and they should be trained on FAST stroke warning signs so that their immediate presentation to the hospital can be ensured when signs or symptoms of a recurrent stroke emerge.
- The need for training, information exchange, and adoption of behavioral changes should be addressed for the long-term management of issues secondary to a stroke.

5.1.1.1. Hospital discharge care plans

Comprehensive hospital discharge care plans, which are tailored to the needs of stroke patients,

should be developed with caregivers to be implemented as soon as possible (162)

5.1.1.1.1. Goals

Stroke patients and their families/caregivers are offered the opportunity to identify and discuss their needs (physical, emotional, social, recreational, financial, and social support) with relevant members of the multidisciplinary team after the hospital discharge.

Primary healthcare teams and community services are informed before or during the hospital discharge of the patient.

All medications of the patient, equipment, and necessary support services should be organized for the conduct of the hospital discharge.

All necessary treatments to be provided by specialists should be organized readily.

A post-hospital-discharge care plan; which was developed together with the stroke patient and the family, should be developed. The planning process for the hospital discharge should address relevant community services to be obtained, self-management strategies (information about medications and recommendations for treatment adherence, goals for homelife, and home care), stroke support services, rehabilitation, and the schedule of outpatient follow-up visits.

A properly developed protocol or a standard tool can help implement a safe and comprehensive hospital discharge procedure (162).

5.1.1.1.2. Patient and caregiver needs

Hospital services should be able to offer stroke patients and their families/caregivers the opportunity to identify and discuss their needs (physical, emotional, social, recreational, financial, and social support) with relevant members of the multidisciplinary team after the hospital discharge (162). Please see Table X and Table XI.

5.1.1.1.3. Assessment of the homelife

Before the hospital discharge, a home visit will enable to develop a long-term care plan to meet social support needs (162).

5.1.1.2. Caregiver training

Relevant members of the interdisciplinary team should train the family before the hospital discharge of the stroke patient. This training program should include self-care techniques, communication strategies, physical activity

techniques, ongoing prevention strategies, and other specific stroke-related problems, adoption of maneuvers for safe swallowing and proper diet regimens, and the management of behavioral and psychosocial issues (162).

A study conducted at Queensland hospitals participating the Australian Stroke Clinical Registry evaluated hospital discharge care plans, antihypertensive drug prescriptions, and antiplatelet drug prescriptions during hospital discharge processes (236). A "checklist" is used during the hospital discharge process after a stroke to help prepare the patient for every other next step in the route to recovery and to provide guidance to the patient and answer questions (237). This checklist includes information about the following items: the cause of the stroke, whether the patient is prone to other risks for a recurrent stroke, strategies for risk reduction, the patient's expectations for recovery and rehabilitation, potential physical, emotional, behavioral, and communication challenges, methods to address these difficulties, recommendations for diet and exercise, the schedule for follow-up appointments if necessary, any further tests or rehabilitation if needed, an appointment follow-up chart if relevant (the date/time of the appointment, the name of the physician/professional, phone number), recommendations for lifestyle arrangements, modes of transfer from the hospital at the time of hospital discharge, environmental arrangements for safety at home, description of potential situations requiring assistance, how to obtain caregiver assistance when special skills are required to perform specific tasks, a checklist to take medicines (the name of the medicine, how often it should be taken, the time to take the medicine, special recommendations, and the telephone number of the pharmacy), procurement of medications, financial assistance to manage costs, and insurance coverage. Accessible resources (stroke support groups, associations, and other information resources) are provided for how to obtain further information by asking the needs and the level of knowledge of patients. Also; the names, specialties, and contact details of the physician, nurse, and the social service professional are provided to the patient and the family members/caregivers (237).

5.1.1.3. Follow-up visits at the outpatient clinic after the hospital discharge

All patients should be called for the first follow-up visit within 4-6 weeks after the hospital discharge. The second visit should be scheduled at a date at the end of the 3rd month, the third at the end of the 6th month, the fourth at the 9th month, and the fifth at the end of the year. Then, follow-up visits are scheduled at dates every 6 months or annually. The treatment adherence and the compliance with recommendations are evaluated separately at each follow-up visit. Adverse effects and the functional state of the patient are reviewed. For this purpose, Modified Rankin Scores and NIH stroke scale scores are documented. Turkish Cerebrovascular Diseases Society recommends the long-term use of the checklist for post-stroke follow-up outpatient visits developed by the World Stroke Organization (WSO). Needs of patients and of their families/caregivers should also be evaluated in those follow-up visits (47) (Table X).

5.1.2. Support at home

A multidisciplinary follow-up and treatment process, which will take a long time after hospital discharge, awaits the stroke patient. Home care services play an important role in ensuring the continuity of care at home required after the hospital discharge. The purpose of home care is the provision of necessary equipment and services at home or in the living environment of the patient so that the well-being, functions, and the comfort of the individual is restored, maintained, and optimized. The assessment of stroke patients in their living environments enables professionals to identify their needs for care so that these needs can be met. The provision of care to the patient and the patient's participation in activities of daily living can be best assessed in the living environment of the patient. The effects of the disease on the family, the caregiver burnout, and the suitability of the environment for patient care can only be evaluated through home visits. Also, home visits enable professionals to observe risks for falls and implement appropriate preventive measures. Studies on stroke patients conducted in our country report that the most challenging issues experienced by the caregivers of stroke patients are positioning the patient and providing assistance to the patient to move, reach the toilet

and the bathroom, to communicate, and to eat. However, it is observed that the most commonly demanded services by the patients and their relatives are the expectations regarding the follow-up and treatment of the disease. It is determined that these needs mostly aim to prevent stroke complications. It is found out that patients and patient relatives expect the facilitation of INR follow-ups, the wound care, prescriptions for regularly used medications, the delivery of health reports for the need for diaper use, the care and replacement of urinary catheters, injections, and the management of sleep problems. On the other hand, there are additional items in the physician's agenda; which include the prevention of stroke complications, recurrences, and atrial fibrillation; screening for potential factors, the resolution of problems about medication use and nutrition, the prevention of falls, enhancing of the functionality of the patient, and the provision of appropriate modes of transfer services to the hospital (238). The high frequency of falls (70.8%) and the high risk of falling (20%) among partially dependent patients in the study indicate that the identification of the risks for falls and the implementation of preventive strategies should be prioritized by the home care team.238 The study by Akdemir et al. on stroke patients in their second year after the hospital discharge identified the following factors involved in the etiology of the development of contractures/deformities/atrophy: "the patient and the family members were not informed about the physiotherapy program adequately, the physiotherapy requirements of the patient could not be met, the exercise program could not be effectively applied by the patient's relatives, and the lack of adequate assistance to the patient for physical weakness" (239).

Other studies identified a list of requirements for effective home care both from the patient's and the caregiver's aspect. The patients needed information, emotional support, training, evaluation, physical care, assistance for medication use, the adoption of an appropriate diet, the resolution of insurance problems, therapy after the hospital discharge, and support for cognitive impairment and depression. The requirements of caregivers for home care included the following: emotional support, assistance in positioning the patient, assistance for the self-care

of the patient, resolution of communication problems, support for adaptation to care, support for engagement in social activities, social support, stress, support in the fulfillment of activities of daily living, resolution of negative impacts on the family economy and family activities, and meeting clinical and social needs during the provision of care (195,240-250).

Conducted by İnci and Temel, The main requirements of family members; who provide care for a stroke patient, were listed in a systematic review study from our country in 2016 (251):

- Training Requirements (the patient and the family members)
- Emotional needs (the patient and the family members)
- Financial needs
- Social needs
- Instrumental needs (a case manager, safety at home, home care services)
- Needs associated with the provision of care (support for the fulfillment of activities of daily living)

At this point, it is critical to identify the needs of the patient and family members associated with the home care so that they are trained and directed accordingly. The patient and the family members should receive information and training about the cognitive, visual, self-expression, and decision-making skills of the patient to perform activities of daily living; including self-care, skin care, bathing, dressing, eating, transport, and exercising. Dysphagia, incontinence, safety at home, and preventive measures against falling should be addressed along with adaptive changes at home environment. Also, necessary information and guidance should be provided about driving, returning to work, other symptoms of stroke, risk factors, medication use, prevention of complications, and access to financial resources, information, physicians, or healthcare professionals (Table XI).

5.1.2.1. Unmet needs in the long term

Several studies examined unmet needs of stroke victims over one year. In the "UK Stroke Survivor Needs Survey", most of the stroke survivors reported that they faced several unmet or partially met needs; including especially emotional problems (39% reported

Table X. Assessment tools to assess the needs of stroke survivors and caregivers (1).

Name of the Assessment Tool	Description	Author
Stroke Caregiver Unmet Needs Resource Scale	The unmet needs (physical, emotional, and behavioral consequences) in stroke is evaluated through 12 scale items (can be administered in person or on the phone).	Green and King*
Greater Manchester Stroke Assessment Tool (GM-SAT)	Assesses the health-related, social, and emotional needs of stroke victims along with accompanying caregiver needs through 34 topics. Specially designed for those with communication difficulties.	Rothwell et.al.*
Post Stroke Checklist (PSC)	It is a scale consisting of 11 yes/no questions about physical and emotional problems and life and family relationships after stroke. Designed to be used by clinicians in the 3rd month, 6th month, and yearly.	Ward et.al.*

*See Williams, J., Perry, L., Watkins, C. (2019). Stroke Nursing. Print ISBN:9781119111450 |. Chapter 12. Online ISBN:9781119581161 |DOI:10.1002/9781119581161

Table XI. Initiatives to support stroke survivors and caregivers in the long-term (1).

Initiative	Explanations and Examples	References for Further Information
Written Information	Passive written information without active instructions includes individualized information or leaflets; health-related information about the individual, generic and adapted information updated at multiple time points, and complex interventions targeting multiple stakeholders (patients, caregivers, and primary care specialists).	Redfern et al.*; Forster et al.* ; Legg et al.*
Education and Practical Training	Hands-on lessons, case studies conducted personally on the phone or via the web; holds an active training component.	Redfern et al.; Bakas et al.* ; Forster et al.*; Legg et al.* ; Brereton et al.*
Psychoeducation, Self-Management, and Psychological Therapy	Initiatives aim to reinforce personal strengths and enhance the individual's coping skills to manage their health in the long term. It can be distinguished from general education by its psychological components. In the form of psychoeducation; self-management interventions are delivered by people with specific training and supervision; as well as by psychiatrists and psychologists, based on the theory of self-sufficiency. Psychological treatments include cognitive behavioral therapy (CBT), motivational interviewing, problem-solving, and goal setting.	Redfern et al.*; Legg et al.* ; Hackett et al.*; Lui et al.*; Hackett et al.*; Foster et al. * ; Jones and Riazzi*.
Liaison Work	Besides using the needed components, it also focuses on linking with social services, benefit organizations, and the voluntary sector.	Ellis et.al.*
Respite Care	Services include day centers, hospitals, and home-based services in line with the needs of caregivers.	Hanson et.al*.; Shaw et.al.*
Peer Support	Peer support entails sharing knowledge and experience along with emotional, appraisal, informational assistance. It can be delivered during home visits, in acute care settings, through web-based support, and follow-up calls.	Stroke Foundation*;* Dennis*; Kessler et al*.; Morris and Morris*; Stewart et al*.; Smith et al*.; Tamplin et al.*
Financial Support	Financial support may include extra payment for caregivers or cover expenses, including those made for homelife adaptations and equipment.	Addo et al.*; Department of Health and Social Care.*

*See Williams, J., Perry, L., Watkins, C. (2019). Stroke Nursing. Print ISBN:9781119111450 |. Chapter 12. Online ISBN:9781119581161 |DOI:10.1002/9781119581161

reported unmet needs), cognitive impairment (59% with memory deficits and 43% with cognitive deficits), and fatigue (43% reported unmet needs). Of the survivors, 84% reported that they had completely unmet needs. Furthermore, the needs to be met increase with disability (physical disability, cognitive problems, fatigue) and sociocultural factors (ethnicity, young age). In particular, for every 1-year decline in age, the number of fully unmet needs increased by 1%. More than half of the survivors reported that they had unmet information needs. A systematic review of the training needs of survivors and caregivers

reported the need for training on the psychological and social consequences of a stroke. Also, it has been determined that information about recovery, caregiving, social activities, and other support services is required.¹⁷⁴ (Table X and XI)

5.1.3. Palliative care

Palliative care is an essential process for the support of individuals and of their families when the individual suffers from life-threatening and complex conditions, including stroke. Palliative care aims to improve the quality of life of patients and their families when they face life-threatening

illnesses. It is also involved in the identification of physical, psychosocial, and mental problems; symptom control, and in the diagnosis, assessment, and the treatment of pain. Palliative care refers to the provision of care to patients with life-limiting conditions for indefinite periods. End-of-life care aims to provide support to patients in the last 12 months of their lives in order to extend their lifespan as much as possible (174).

Palliative care in stroke is limited to short period of care for dying patients due to life-limiting complications. Today, no integrated concepts have been established to determine the correct time for the start of palliative care in stroke patients. Also, there is an ongoing debate to determine the ways of screening relevant symptoms. Palliative care supports the holistic approach in stroke patients, improves the quality of life, and offers treatment options according to the patient's wishes and values (210).

5.1.3.1. Supportive tools for palliative care

Today; various tools, approaches, and pathways are available for use in palliative care. Some of these tools have been adapted for use in a stroke care setting. Three models of palliative care that have been widely used in the UK in the past two decades remain to be a subject of debate. These are the "Liverpool Care Pathway" (LCP), the "Gold Standards Framework" (GSF), and the "Assessment, Management, Best practice, Engagement, and Recovery (AMBER) Care Bundle" (174).

The GSF approach is the provision of care for the last 12 months of life in any type of care setting by using a series of protocols and guidelines. The Proactive Identification Guidance is used, which provides a flowchart to identify the risk of death, palliative care needs, and decision-making. Validated scales such as the National Institutes of Health Stroke Scale (NIHSS) are used. The GSF process in the UK hospitals increased the rate of the identification of patients at the end of life. It has been reported that the early identification of patients in the last year of life is promoted and the coordination of their care was improved in the London stroke unit. This shows that GSF is suitable for use in stroke care and supports the identification of patients whose life may end immediately or within one year

after a stroke (174).

The National Clinical Guideline for Stroke and the National Stroke Strategy of the UK recommends that all stroke patients should have access to specialized palliative care specialists and that all personnel providing such care should be trained appropriately. Since the course of stroke is variable, it is difficult to describe models for the timely integration of palliative care. Many patients report that their symptoms are not effectively controlled, they cannot receive adequate assistance to overcome psychological morbidity, and caregivers face difficulties in accessing information (208). Also, it is reported that the number of studies about determining palliative care needs in stroke patients are limited and that further studies are required (252).

The 2017 revision the Stroke Guideline of the Stroke Foundation strongly recommends that stroke patients and their families/caregivers should have Access to specialist palliative care teams when necessary and that they should receive care in compliance with the palliative care philosophy and principles. It has been stated that prognosis should be estimated or end-of-life assessment should be performed so that a palliative care plan for stroke can be developed to support patients and their families/caregivers and to improve the provision of care to dying stroke patients (162).

Primary palliative care should be available for serious stroke patients or for stroke patients with life-threatening conditions, as well as for their families, throughout the entire course of the disease. The goals of stroke care units and healthcare professionals to fulfil the requirements of primary palliative care (253):

- Promotion and implementation of patient- and family-centered care
- Regular follow-up of the prognosis
- Description of appropriate targets for care
- Discussion of team decisions along with their impact on the end-of-life care
- Evaluation and effective management of stroke outcomes
- Building up of experience in end-of-life palliative care
- Assisting the coordination of care; which may include referring the patient to a palliative care specialist or to a nursing home if necessary.

5.1.3.2. Palliative care: Recommendations

The recommendations about the palliative care are listed below with levels of evidence (253).

5.1.3.2.1. General recommendations

1. All patients; whose lives were negatively affected or whose life expectancy or quality of lives were reduced, should have access to and be provided with primary palliative care services along with their families in line with their needs.

2. Stroke care systems should provide a well-coordinated and integrated healthcare environment to support healthcare workers; who can focus on both the disease process and on the patient and family.

5.1.3.2.2. Target setting process: Recommendations

1. Knowing and using effective communication techniques is a critical core competency to improve the quality of decision making in stroke; as well as improving the outcomes and satisfaction of patients and families.

2. Knowledge, skills, and competence are important factors in the effective management of meetings with stroke patients and families.

3. While healthcare professionals make recommendations about the best course of ongoing care, they should also integrate best scientific evidence available with patient values and preferences.

4. Since patient preferences change over time, it is important to review goals and treatment options periodically so that they can be reaffirmed or revised when necessary.

5. A structural approach should necessarily be implemented for setting patient goals in order to improve the quality of healthcare provided to stroke patients.

5.1.3.2.3. Painless physical symptoms: Recommendations

1. Post-stroke sexual dysfunction should be identified, periodically screened, and referred to relevant resources when diagnosed.

2. Stroke patients with excessive daytime sleepiness should be directed to an accredited sleep center for evaluation.

5.1.3.2.4. Social victimization: Recommendations

1. Training on potential stroke outcomes,

prognosis, and on the role of the caregiver in these processes is beneficial in preventing the caregiver burnout. Caregivers should be informed about available resources for obtaining support. Training of caregivers should be reviewed.

2. The identification of stress in stroke patients and their families is critical.

3. Healthcare providers should develop self-care strategies to monitor symptoms and manage caregiver burnout within the context of the provision of care to stroke patients with severe and life-threatening conditions.

5.1.3.2.5. Spiritual needs

It may be advisable for healthcare professionals to ask stroke patients and their families about their spiritual or religious beliefs and to refer them to a cleric or a spiritual care provider.

5.1.3.2.6. The role of palliative care providers

Although not an exhaustive list, formal palliative care counseling for stroke patients may be necessary for the following conditions:

- Management of refractory pain, dyspnea, agitation, or other symptoms emerging especially by the end of life;
- Management of complex forms of depression, anxiety, sorrow, and existential distress;
- Management of the fear of death;
- Long-term support for nutrition and for ventilation support;
- Management of the extubation process during palliative care;
- Transfer to a nursing home.

5.2. Nurse's role in the management of vascular risk factors in the stroke patient after the hospital discharge

Reducing the risk of recurrent strokes is possible only by a successful control of vascular risk factors after the hospital discharge. (Table XII). Major vascular risk factors are hypertension, diabetes mellitus, hyperlipidemia, smoking, unhealthy diet, obesity, and inactivity. Treatment of these risk factors begins in the inpatient clinic. Also, an appropriate diet is prescribed considering the accompanying risk factors of the patient. The diet recommended for stroke patients today is the Mediterranean diet; which is rich in vegetables, fruits and whole grains. Red meat is consumed at low proportions, while eating white meat, fish, and

legumes is promoted. Low-fat milk and dairy products are other components of the Mediterranean diet. Mainly olive oil is consumed and little or no salt intake is advised. A diabetic diet is prescribed to patients with diabetes in order to provide appropriate amount of calories for the body weight of the patient. For obese patients, a diet for gradual weight loss is started. Before the hospital discharge, appointments with a dietitian should be scheduled for the patient or the relatives to develop a nutrition plan to be implemented for the homelife of the patient. Besides adopting an appropriate diet, medical therapy is started for the treatment of diabetes mellitus and hyperlipidemia. Doses of medications are adjusted by taking targeted parameter values into account.

If the patient and the relatives are not properly informed about vascular risk factors and their treatments during the hospital stay, non-adherence to the diet and treatment will be likely in a short time after the hospital discharge. This type of non-adherence is commonly observed at outpatient follow-up visits or when patients present with a new vascular event to the hospital. Because most patients and family members feel distressed, helpless, and confused in the first weeks; a one-day or one-session provision of information will not be sufficient for a patient or a relative, who is not familiar with stroke. Information about vascular risk factors is an important issue that requiring the ownership of both physicians and nurses. Moreover, the role of nurses as treatment providers cannot be denied as they spend more time with patients at frequent intervals. Awareness of vascular risk factors is currently low in the society. Furthermore, most patients are not aware of their risk factors.

Regarding hypertension; information can be provided to the patient and relatives at times of blood pressure measurements during the day. Also; the importance of checking blood pressure regularly after the hospital discharge, keeping records of the measured values, and their review with the physician at follow-up visits can be emphasized. Other than in exceptional cases, the target systolic blood pressure is <140 mmHg and diastolic blood pressure is 90 mmHg in stroke patients. It is advisable to measure the blood pressure when the patient is in the sitting/supine position and after a minimum of 5-10 minutes of rest after meals. It should be noted that the

reduction of salt consumption, healthy eating, weight control, increasing physical activity, and smoking cessation are critical for an effective blood pressure management. Ideally, daily salt consumption should be <2.4 g and should be maintained at 1.5 g if possible. A quantity of 1.5 g salt corresponds to a teaspoon of salt filled to brim (254).

Regarding diabetes mellitus; information can be provided to the patient and relatives at times of blood glucose measurements from the finger tip during the day. Also; the patient and relatives should be informed that unhealthy eating and inadequate physical activity can impair blood glucose regulation and prepare the grounds for vascular diseases. If the physical condition of the patient allows before the hospital discharge, it will be advisable to weigh the patient and inform him/her about the ideal body weight targets according to their height. It should be ensured that newly diagnosed diabetic patients see a dietitian to discuss healthy eating and that they attend training seminars about the disease.

Depending on the general condition of the patient during the hospital stay; patients or their relatives should be informed about medications, the diseases they are prescribed for, the purpose of treatment adherence, and the goal of the prevention of all vascular diseases, especially of a stroke and heart attack. At the time of hospital discharge, most patients do not know why the medications are prescribed, what benefits or potential harms these medications are associated with, and how long they should be used. They can stop taking medications suddenly, using an ordinary complaint not associated with the treatment at all. While giving medications to the patient; the nurse should inform that this is a blood pressure /blood glucose/cholesterol-lowering medication, emphasizing the importance of using these medications regularly until the physician stops the treatment. Regular follow-up visits with the physician will enhance compliance with medical therapy. Therefore, the first follow-up visit should be scheduled before the hospital discharge.

Inactivity can occur due to severe neurological findings that limit the mobility of some stroke patients. Performing in-bed exercises is critical for these patients for reducing the risks of chronic pain and spasticity-associated contractures; as well as for accelerating a

functional recovery. These exercises are initiated during the hospital stay; creating opportunities for the patient's relatives to be trained as much as possible on how to perform them on the patient. The patient's relatives should be recommended to continue performing these exercises on the patient regularly after the hospital discharge. In patients with no limitations in their movements and with no contraindications for such physical activities, aerobic exercises are advisable. For example, brisk walking or cycling 3-4 times a week is recommended for these patients to reduce vascular risks. Each session is advised to last approximately 40 minutes, causing sweating. Smoking is a major risk factor for a stroke. Not only regular smoking but even smoking only a few cigarettes is hazardous for health. It should be

noted that smoking cessation will be challenging for the patient. Therefore, they should be informed that they can apply to "smoking cessation centers" established in many public hospitals. Cutting down smoking is not enough to reduce the risks. It is recommended that the patient should quit smoking completely and smoking in the same environment with the patient should be prevented (254). During the discussion about vascular risk factors, the role of the nurse is to listen, support, encourage, and guide the patient. Any oppressive, persisting, and judgmental attitude should be avoided. Each time period devoted to a stroke patient during the provision of nursing services is also a training and counseling session for the patient to be prepared for the period after the hospital discharge.

Table XII. WSO Post-Stroke Checklist.

Secondary prevention of a stroke

Activities of daily living
Mobility
Spasticity
Pain
Incontinence
Mood
Communication
Cognition/thinking
Life After Stroke
Relationship with family
Fatigue*
Other problems*

*Extra items added by the Canadian Stroke Network. See: World Stroke Organization. <https://www.worldstrokecampaign.org/learn/the-post-stroke-checklist-psc-improving-life-after-stroke.html> (Access Date: 08.September.2019).

6. TRAINING TO BE A STROKE NURSE

As per the health services conditions, the minimum requirement for a stroke unit is to assign 1 nurse for the care of preferably 4 and at a maximum of 5 beds at any time of the day. Stroke unit nurses ensure the continuation of care and follow-up in the stroke unit. Therefore, a stroke unit nurse should meet the criteria of having completed appropriate and adequate training on the diagnosis and treatment of acute stroke. In-house refreshment training on vocational skills should be held in stroke units annually. It is recommended that physicians and nurses on the stroke unit should receive annual training accredited for at least 8 points. Moreover, the primary stroke center should organize training programs at least twice in a year for the public on the diagnosis, treatment, risk factors, and prevention of a stroke. Besides discussing risk

factors and protection, these training sessions should inform about the action points to take at the emergence of a stroke and should emphasize the need to call emergency health services urgently to arrive at the hospital as early as possible. A professional point of view should be developed to accomplish these goals (47).

Adequate and continuous training on the protocols of treatment, prophylaxis, and care should be provided for the non-neurologist professionals (nurses, etc.) on the stroke unit. In this context, the tasks of nurses on the stroke unit can be listed as the following; including the mobilization and positioning of the patient; the provision of prophylaxis and treatment for pressure ulcers; monitoring and follow-up of neurological parameters, vital signs, and fever; the evaluation of dysphagia, and early detection of aspiration pneumonia and dehydration.

Training of patients and their relatives is also another major component of the training protocol.

Normally, the neurologist and the physiotherapist on the stroke unit evaluate the patient for developing a rehabilitation plan for the acute period. Within the framework of written protocols, acute physiotherapy can be initiated by physiotherapists and nurses; who have completed training on the subject (documented). It is recommended that at least the upper extremity and hand functions should be evaluated and followed up using a standard method. If there is not an inpatient rehabilitation unit in the hospital of the primary stroke center, a contract agreement should be made with an external center to refer the patient to undergo a long-term rehabilitation program. The same applies to patients; who will undergo an outpatient rehabilitation program (47). The efficacy of training on the rehabilitation of stroke patients was demonstrated on nurse-patient interactions.²⁵⁵ Another study on nurses and physiotherapists working in stroke units demonstrated that nurses and physiotherapists were eager to actively participate in trainings and interdisciplinary teamwork on this subject (256).

Development of patient-specific programs is critical for effective rehabilitation. An active rehabilitation program requires performing 45-minute sessions 5 days a week at a minimum but preferably 7 days a week. The patient should start treatment in the acute period as soon as possible after the clinical stabilization. The rehabilitation program should continue at a level tolerable by the patient until the goals set by the rehabilitation team are achieved. The patient should be regularly evaluated for his/her capacity on the cognitive, psychological, and functional domains. It is reported that assigning one physiotherapist for five patients is adequate. In case of inadequacies to meet this requirement or when necessary, nurses can contribute to the program at the intervals between the sessions. Development of pressure ulcers should be prevented in modern stroke units. Prevention of pressure ulcers is essential. Therefore, it is critical to regularly position the patient, perform activities for the maintenance of appropriate posture, and examine the patient's skin for integrity. The patient should not be left in the same position for more than two hours and the skin should always be kept dry and clean (47).

All stroke patients should be evaluated for bowel and bladder functions and for incontinence

within the first 4 hours of their admission to the stroke unit. Indwelling urinary catheters should not be inserted in stroke patients unless urinary retention or any absolute indication is detected. Condom catheters or the use of diapers can be optionally used in immobile patients. When a Foley catheter is placed; its rationale should be documented, the condition of the catheter should be evaluated daily, and the urinary catheterization should be stopped as soon as possible. If bladder control is not achieved at the end of the 2nd week after a stroke, the patient may need to be re-evaluated for incontinence. If necessary, other methods such as urodynamic studies can be used. It is recommended that the stroke unit team should undergo specialized training on the management of incontinence. The patient should be evaluated for the cognitive, visual, attentive, and emotional functions. Preferably, validated methods should be used for these assessments. This assessment should be performed immediately after the hyperacute period and prior to the implementation of the rehabilitation program. Findings can sometimes be considered major criteria whether to support an "early hospital discharge" program (47).

At this point, the quality metrics of stroke units are critical parameters to monitor improvement in the follow-up, treatment, and the care processes provided for the patient. Major quality metrics recommended for the management of ischemic stroke in inpatients are summarized in Table XIII.

Nurses should have the necessary knowledge and skills to provide treatment and care at targeted quality levels for stroke patients (174). The National Stroke Strategy of the US (257) provides a strategy and implementation plan that outlines the features of a better service and aims to improve the quality of care to be provided for stroke patients. The quality indicators QM18 and QM19 are used in the plan, directly referring to the need for training (258).

The UK Stroke Training Forum was established to implement accepted quality assurance and transferable skill training programs in stroke management processes. The UK Stroke Forum is responsible for the integration of education and training, workforce competencies, professional development, and career paths. The UK Stroke Forum Steering Group comprises representatives from several organizations;

Table XIII. metrics for the management of ischemic stroke in inpatients

Deep vein thrombosis prophylaxis	Evaluation of dysphagia before starting oral intake
Starting antiaggregant therapy within 48 hrs	Training of the patient and family members
Receiving antiaggregants at the time of hospital discharge	Smoking cessation
Anticoagulant therapy for patients with atrial fibrillation	Rehabilitation plan
IV tPA administration	Early rehabilitation*
Lipid profiling studies	Rate of hospital-acquired pneumonia*
	In-hospital mortality on day 7*

*Extra criteria added by the "German Stroke Registers Study Group".

including stroke-specific and stroke-related professional organizations, health and social care organizations, voluntary organizations, and service users. The "Stroke- Specific Education Framework (SSEF)" comprises 16 elements of care, covering all stroke care algorithms. The UK Stroke Forum promotes a better infrastructure to improve SSEF further and to enhance sustainability, accreditation, and participation so that a better quality care can be provided for the stroke patient. The overall aim of SSEF is to build up stroke-specific knowledge and skills over the general skills owned by healthcare professionals, social workers, volunteers, and independent healthcare staff. In order to achieve success in the training program, the following criteria should be met (174);

- Plans should be developed considering the existing level of skills, knowledge, and experiences-general competencies.
- Plans should include hands-on training on the aimed acquisition of knowledge and skills to improve practice.

The principles of care in the Stroke Care Algorithm are as follows (257):

- 1- Creating awareness: Stroke as a Medical Emergency
- 2- Risk Management: Primary and Secondary Prevention
- 3- Provision of Information, Advice, and Assistance for Individuals Affected by a Stroke
- 4- Support for Care Plans
- 5- Assessments for Transient Ischemic Attack (TIA): Evaluation and Management During the Event
- 6- Treatment for TIA: Assessment and Management for Follow-up
- 7- Emergency Interventions: Assessment and Management Before the Hospital Admission
- 8- Evaluation (Stroke): Emergency Evaluation and Management
- 9- Treatment (Stroke): Urgent Assessment and Management

10- Specialist Rehabilitation

11-Long Term Care and Support

12-Participation in Community

13- Return To Work

Each of the 16 components of care in the Stroke Algorithm of the Stroke-Specific Education Draft (SSED) comprises three sections. These sections are basic requirements; knowledge and understanding, and the assessment of skills and ability. Skills are listed as follows (257):

Basic requirements (Section 1)

The basic requirements for the level of care for each item on the stroke algorithm are listed below:

- 1-Assessment;
- 2-Pre-diagnosis/decision;
- 3-Examination
- 4-Final diagnosis/decision;
- 5-Treatment/Management;
- 6-Referral to other institutions and services
- 7-Communication

Knowledge and understanding (Section 2)

This section is a list of stroke-specific information and criteria for insight to be owned by healthcare professionals on a stroke unit. The level of knowledge or understanding depends on the target group. In the column titled "knowledge and understanding" in SSEF, the required level can be specified by one of the following (Health Skills definitions):

Basic: Criteria require a very limited and generalized understanding for the existence of an entity. No details are included.

Factual: Criteria require factual knowledge that is detailed on a real level but does not contain a superficial understanding of any principle or theory.

Working: The criteria require the application of the real knowledge of the technical principles and results widely understood within the field of application.

In-Depth: Criteria require a broad and detailed understanding, forming the theoretical basis of an application area, including conflicting theories and constructs.

Critical: The ability to evaluate and design criteria and approaches. It includes situations related to the critical application of theories and conceptual constructs in the field of practice.

This section addresses the following:

- Stroke symptoms
- Atypical features of stroke
- Treatment of stroke as a medical emergency
- Emergency response and investigations, interventions, and treatments for stroke and its treatment
- Timeframe for emergency investigations, interventions, and treatments for stroke and its treatment
- Anatomy and physiology of the central nervous system
- Timeframe of physiological and neurological changes during a stroke

Additionally, knowledge and understanding of emergency response is assessed. Requirements for emergency response:

- Evaluation
- Diagnosis of stroke
- Pre-diagnosis / decision
- Making a preliminary diagnosis
- Clinical evaluation
- Confirmation of the preliminary diagnosis
- Treatment / management
- Initiating the follow-up
- Preventing complications
- Appropriate referral
- Communication

Skills and ability (Section 3)

This section addresses the transfer of knowledge and understanding to practice within the framework. Focus of skills required for any research interventions or directing are summarized in the list below:

- What needs to be done?
- When should it be done?
- Where is it done?
- How should it be performed?
- On whom is it performed?

Additional skills include "communication" and "participation in research and audits". The participation of the staff in research and auditing is of major importance. These activities help them to

build extra skills and experience about how to inform the patient and caregivers based on the findings (evidence-based). Stroke patients suffer from highly specific and severe communication difficulties. When communicating with stroke patients, pre-existing communication difficulties should also be taken into account. All information to be provided for the patient and family members should be transferred conveniently and should be readily accessible. The program should be compatible with the cultural level, language competencies, education levels, and the degree of aphasia. All information should also be delivered in writing.

This chapter addresses the following:

- Starting the emergency protocol (Stroke Program)
- Reporting the current event and the need for urgent treatment
- To know when to apply stroke FAST screening tests and to have an understanding of the implications of the results
- To know when to apply vascular risk assessment tools ABCD2 (Age, Blood pressure, Clinical features, Duration, Diabetes) for the treatment and to have an understanding of the implications of the results.
- Defining local emergency response and treatments for a current stroke and knowing how to manage them effectively.
- Taking a detailed history, interpreting it, and evaluating the cognitive capacity
- Detection of features for a differential diagnosis; for example, being able to detect hypoglycemia or epileptic seizures.

Additionally, skills and ability about emergency response are addressed. Skills and ability to perform an emergency response include the following:

- Evaluation
- Treatment / management
- Initiating the follow-up
- Preventing complications
- Appropriate referral
- Communication

Knowledge and Understanding

Risk factors for stroke treatment (lifestyle; socioeconomic, cultural, vascular, familial, and genetic risk factors; drugs, and concomitant diseases)

- Stroke types and etiology
- Stroke risk based on the type and etiology

-Primary and secondary prevention in stroke
Pharmacological and non-pharmacological interventions and the place of treatment for the primary and secondary prevention of stroke.

- Methods for behavioural change

Skills and ability

- Taking a detailed history, interpreting it, and evaluating the cognitive capacity

-Selecting appropriate assessments / research and interventions / treatments; planning training based on individual needs and requests (personalized information)

-To determine the needs and wishes of individuals at risk of stroke and of individuals affected by a stroke.

-Identifying risk factors and applying vascular risk assessment tools

-Communication and Analysis: Providing timely information, advice, and support for current risks, assessments / research interventions / treatments, time periods for treatments, and the rationale and possible side effects of treatment.

- Assessing existing support services (health services, social services, and voluntary and independent services) for individuals affected by a stroke; having a discussion about these services.

- Evaluation of the motivation

- Monitoring the process, adopting or adapting a plan for care or management

-Evaluating and facilitating concordance.

A nurse should complete at least 20 hours under the category-2 and 30 hours under the category-3 of the Candidate Handbook of Stroke Certified Registered Nurse ("Continuing Education") of the "American Board of Neuroscience Nursing" (259).

Category-1: Training to Become a Stroke Nurse A nurse should complete at least 20 hours under the category-2 or 30 hours under the category 3; complete 30 continuing education hours in an accredited institution, and attend accredited courses on stroke nursing.

Category-2: Program or project activities

Category-3: Research Although some categories have annual maximums, this category does not specify a minimum or maximum for the recertification cycle. All acceptable items; including the continuing education programs or postgraduate activities are required to be stroke-related. Any activities unrelated to stroke is not acceptable. Example:

PhD dissertation (subject matter must be applicable to care of stroke patients) = 25 CE

Master's thesis (subject matter must be applicable to care of stroke patients) = 15 CE

Category-4: Teaching Although some activities have yearly maximums, this category does not specify a minimum or maximum for the recertification cycle.

Some samples for acceptable activities and acceptable CE points for this category are listed below: All activities must be stroke-related. Any activities unrelated to stroke is not acceptable.

a. Presentation of stroke content at a conference or class for 60 minutes = 2 CE (maximum of 10 per year)

b. Poster presentation of stroke content at a conference = 2 CE

c. Participation in an academic course related to care of stroke patients for 1 semester credit hour = 15 CE

d. Development and teaching of an academic course for care of stroke patients for 1 quarter credit hour = 10 CE

e. Precepting a new stroke nurse for 80 hours = 10 CE

Category-5: Publication Some activities in this category have maximums for the recertification cycle. Some samples for acceptable activities and acceptable CE points for this category are listed below: All activities must be stroke-related. Any activities unrelated to stroke is not acceptable.

a. Writing or editing a chapter in a text = 10 CE (maximum of 40 per recertification cycle)

- The chapter submitted for CE credit must be stroke-related, although the text it is included in may not be exclusively made up of stroke content.

b. Publication of a stroke article in a peer reviewed journal = 5 CE (maximum of 20 per recertification cycle)

c. Publication of an article on neurology nursing or a special field related to the care of stroke patients. The article should be written for a local journal or bulletin.

Category-6: Involvement in Professional Organizations.

Scope of Training:

1. Anatomy, physiology, and etiology of stroke (31 items)

A. Correlate expected complications to site of injury.

- B. Identify physiologic changes at the cellular level (e.g., penumbra).
- C. Basic vascular anatomy
- D. Basic brain structures.
- E. Recognize stroke syndromes (e.g., Middle Cerebral Artery Syndrome, Homer's Syndrome, Wallenberg Syndrome)
- F. Identify associated stroke disorders (e.g., etiology).
- G. Understand stroke mimics.
- H. Define stroke types (e.g., ischemic, hemorrhagic).
- I. Understand the role of neuroplasticity in stroke recovery.

2. Hyperacute care (35 items)

- A. Initial triage
 - 1. 1. Communicate with pre-hospital personnel.
 - 2. Assess ABCs.
 - 3. Identify stroke signs and symptoms.
 - 4. Activate the stroke response team (e.g., chain of survival).
- B. Treatment protocol
- C. Assessment
 - 1. Facilitate urgent diagnostics.
 - 2. Evaluate medical history.
 - 3. Perform baseline neuro assessment.
 - 4. Apply various stroke scales (e.g., NIHSS, Hunt-Hess, GCS, ABCD2, ICH, etc.).
- D. Treatment considerations
 - 1. Maintain oxygenation.
 - 2. Maintain hydration.
 - 3. Assess swallow ability.
 - 4. Manage blood pressure.
 - 5. Manage blood glucose.
 - 6. Manage medications.
- E. Thrombolytic therapy
 - 1. Calculate dosing.
 - 2. Identify inclusion and exclusion criteria.
 - 3. Manage thrombolytic therapy per protocol.
 - 4. Maintain the provision of care
 - 5. Identify complications.
- F. Patient disposition
 - 1. Stabilize patients for admission or transfer.
 - 2. Identify an appropriate level of care (e.g. stroke unit, stroke center)
- G. Describe and facilitate advanced interventions for ischemic strokes (e.g., mechanical embolectomy, intraarterial thrombolysis, or hemicraniectomy.
- H. Describe and facilitate interventions for hemorrhagic stroke
 - 1. Appropriate anticoagulation

- 2. Anticoagulation
- 3. Identify the need for ventriculostomy
- 4. Manage increased intracranial pressure syndrome (IICPS)
- 5. Understand surgical decompression
- 3. Acute care (46 items)**
- A. Generalized stroke care
 - 1. Evaluation
 - a. Comprehensive assessment, including a neurological examination (e.g., NIHSS, GCS)
 - b. Correlate patient history with signs and symptoms.
 - c. Prioritize patient's needs based on assessments (e.g., seizure prophylaxis, communication abilities, mobility).
 - d. Facilitate diagnostic test such as ECHO, MRI, carotid artery imaging tests based on stroke guidelines.
 - e. Monitor patient safety before, during, and after the intervention.
 - 2. Plan of Care
 - a. Collaborate with the multidisciplinary team
 - b. Monitor, report, treat, and document.
 - 1. Neuroassessment and vital signs
 - 2. Cardiac rate and rhythm
 - 3. Oxygenation and ventilation
 - 4. Pain
 - 5. Blood glucose
 - 6. Body temperature
 - 7. Increased intracranial pressure
 - c. Implement safety measures
 - 1. Aspiration precautions
 - 2. Fall precautions
 - 3. Seizure precautions
 - 4. Skin precautions
 - 5. Infection prevention protocols
 - 6. Venous Thromboembolism prophylaxis
 - 7. Stress ulcer prophylaxis
 - d. Measures
 - 1. Patient positioning (e.g., affected extremities, splinting, turning)
 - 2. Early mobilisation
 - 3. Range of motion (ROM)
 - 4. Elimination (i.e., bowel and bladder management)
 - 5. Activities of daily living
 - e. Therapeutic environment.
 - 1. Establish appropriate levels of stimulation.
 - 2. Provide orientation measures.
 - 3. Establish alternative means of communication if necessary.
 - 4. Adapt environment according to patient needs.

5. Promote sleep hygiene (e.g., light, noise)
- f. Spiritual and psychosocial care:
 1. Encourage verbalization of feelings.
 2. Identify positive coping mechanisms.
 3. Respect patient's culture.
 4. Assess patient's healthcare beliefs.
 5. Facilitate patient's spiritual needs.
 6. Assess and manage depression, anxiety, and fatigue.
 - g. Facilitate care goals and decision making regarding:
 1. Hospital discharge planning
 2. Palliative care
 3. End-of-Life care
 - h. Provide individualized education to patients and caregivers
 - i. Manage nutrition (i.e., specialty diets, consistency of diet, alternate forms of feeding)
3. Quality stroke metrics
 - a. Participate in quality improvement projects
 - b. Facilitate compliance with quality metrics (e.g., VTE prophylaxis, patient perception of care)
- B. Ischemic stroke
 1. Facilitate diagnostic studies
 2. Manage blood pressure (e.g., permissive hypertension or orthostatic hypotension, etc.)
 3. Recognize the signs of reperfusion syndrome
 4. Manage hydration (e.g., iv solutions, oral fluid intake)
 5. Manage and assess patient post-thrombolytic administration
 - a. Frequency of monitoring
 - b. Angioedema
 - C. Other bleeding
 6. Manage patients following interventional procedures
 - a. Distal extremity assessment
 - b. Complications (e.g., hematomas, arterial dissection, arterial thrombosis, pseudoaneurysms, inguinal bleeding)
 7. Understand treatment options:
 - a. Endovascular management (e.g., arterial stenting)
 - b. Patent foramen ovale management
 - c. Atrial fibrillation management
 - d. Surgical intervention (e.g., carotid endarterectomy, craniectomy)
 - e. Medical Management
 - C. Hemorrhagic stroke
 1. Facilitate diagnostic studies
 2. Monitor and mitigate vasospasm (e.g., transcranial Doppler).

3. Manage fluid and electrolyte balance (e.g., sodium, magnesium, osmolarity).
4. Manage blood pressure
 - a. Aneurysmal subarachnoid
 - b. Intracerebral hemorrhage
5. Understand treatment options:
 - a. Endovascular management (e.g., coiling, embolization)
 - b. Surgical intervention (e.g., clipping, craniotomy and craniectomy)
 - c. Cerebrospinal fluid (CSF)
 1. Ventriculostomy
 2. Shunt
- 4. Post-acute care (19 items)**
 - A. Define roles of the multidisciplinary team.
 - B. Understand levels of rehabilitative care (e.g., acute rehabilitation, subacute rehabilitation, home health, outpatient rehabilitation)
 - C. Facilitate referrals to resources (e.g., support group).
 - D. Identify and manage rehabilitation issues (e.g., spasticity, cognition, psychosocial, dysphagia)
 - E. Multidisciplinary plan of care
 1. 1. Criteria for involving patient and caregivers in decision-making and care plan.
 2. Identify goals for rehabilitation.
 3. Assist patient in performing activities of daily living.
 4. Collaborate regarding medication management.
 5. Facilitate the discharge planning process.
 6. Demonstrate transfer techniques and assistive devices.
 7. Assist patient toward maximum functional capacity.
 8. Involve patient in activities that will enhance self-esteem.
 9. Use assessment scales (e.g., modified Rankin, Barthel, Functional Independence Measure [FIM]).
 10. Assess caregiver dynamics.
 11. Assess psychosocial impact of stroke.
 - F. Provide and reinforce stroke education:
 1. Risk factor management
 2. Home care
 3. Environmental Safety
 4. Exercise and Activity
 5. Medication management
 6. Signs and symptoms requiring activation of emergency medical services
 7. Signs and symptoms requiring medical follow-up
 8. Nutrition

5. Primary and secondary preventative care (19 items)

A. Assessment

1. Identify modifiable and non-modifiable risk factors.
2. Review diagnostic study results (e.g., imaging, laboratory).

B. Plan of care

1. Individualize the plan of care.
2. Provide education about stroke and lifestyle changes.
3. Identify patients' limitations to care treatments (e.g., financial, social).
4. Collaborate with multidisciplinary teams.
5. Provide information about medication management.

C. Community health education

1. Provide education on stroke risk factors, symptoms, and emergency states.
2. Identify relevant measures for stroke prevention.
3. Provide patients with resources for stroke prevention.
4. Recommend patients identified as high risk for a stroke to see a medical provider.

Training programs and publications for multidisciplinary stroke care in our country were initiated to promote improvements in neurology nursing. The first "Stroke Nursing Course" was held in Istanbul in the year 2005. In 2008, this activity was included in the Neurological Intensive Care Symposium with the support of the Turkish Neurology Association. Since 2008, neuro-intensive care nursing courses and training courses on stroke have been regularly held for nurses working in neurology units.

Neurology Nurses Association has been continuing its activities with the support of the Turkish Neurology Association since 2012 in order to ensure that education programs are effective, broadly attended, and continuous.

Additionally, the Neurology Nursing Coordination Board of Turkish Neurology Association has been established, aiming to facilitate organization in the treatment and care of neurological diseases at the national level.

Planned Actions:

1. Promotion and dissemination of the main principles and practices of neurology nursing
2. Establishing standards of the Neurology Nursing Course and the Stroke Nursing Course to enable the transfer of theoretical and practical knowledge

and skills so that these courses can be transformed to "certification programs" accredited by the Ministry of Health.

3. Investigating of organizational practices related to stroke nursing in western countries
4. Preparing a guide for nursing care in neurology patients.

The studies carried out for this purpose should continue and the recommendations of the developed training program guideline should be followed to support the work conducted in compliance with the "Directive on Health Services to Be Provided to Patients with Acute Stroke".

Bottom Line:

Acute stroke nursing is the most important component of achieving the survival of the patient in the best-functional state, which means the clinical success in acute stroke management. This expert opinion article schematizes the basic quality metrics (Table XIV) and education criteria in acute stroke nursing; which is a subspecialty of nursing.

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Table XIV: Basic metrics for acute stroke.

IV tPA administration	
Door-to-needle time	The door-to-needle time is the time from the patient entry to the emergency room to the start of tPA infusion. This time interval should be as short as possible. The initial aim is to reduce this period to less than 1 hour for half of the patients.
NIHSS scores before the intervention	Before IV tPA is given, NIHSS should be applied and the scores should be noted in order to systematically demonstrate the clinical severity. The form must be filled in and sub-scores should be marked. This will document that a neurological examination was performed before therapy.
Contraindications for IV tPA administration	If IV tPA was not applied in the patient arriving within the appropriate time frame, the rationale should be noted. Validity of the rationale should be evaluated by regular meetings.
Door-to-imaging time	The time from the entry of the patient to the emergency unit until the production of a preliminary CT scan report should not be longer than 45 minutes.
Pre-treatment blood pressure	For administering IV tPA safely; the systolic/diastolic blood pressure should be less than 185/110 mmHg.
IV tPA administration	Drug administration time [hour and minute], the dose, and the administering personnel are noted.
Neuroendovascular therapy	
Confirming the indication for endovascular therapy	The endovascular therapy decision must be made within the first hour following the patient's entry into the emergency unit. If thrombectomy/aspiration will not be performed in the first 6 hours, the rationale should be documented. If treatment is to be applied, the patient should be referred.
NIHSS scores before the intervention	Before the neurointerventional therapy, NIHSS should be applied and the scores should be noted in order to systematically demonstrate the clinical severity. The form must be filled in and sub-scores should be marked.
Symptom onset-to-groin puncture time	The groin puncture for the interventional therapy should be performed at the end of the 6th hour latest after the symptom onset.
Imaging prior to endovascular treatment	Available CT or MR imaging [obtained in the emergency room, in the hospital, or brought in by referred patients, obtained via remote access, or delivered in a CD] should be assessed within 45 minutes.
Vascular imaging prior to endovascular treatment	Any large vessel occlusion should be demonstrated with appropriate techniques prior to endovascular therapy.
Door-to-groin puncture time	The interval from the patient's entry to the emergency unit or from the time of the arrival of referred patients at the hospital until the time of groin puncture should be less than 90 minutes.
Outcome of endovascular therapy	The time to complete the procedure, the final reperfusion score [TICI], the number of total passes, and the time to achieve the final TICI score should be recorded.
Stroke treatment	
Antiaggregant therapy	Antiaggregant therapy should have been started at the end of the second day at the latest in acute stroke. If it did not start, the rationale should be noted.
Antiaggregant or anticoagulant therapy at the time of hospital discharge	The patient should be receiving antiaggregant therapy for a major vascular disease-related stroke or anticoagulant therapy for a cardioembolic stroke (in patients with atrial fibrillation) in compliance with the respective guidelines at the time of hospital discharge.
Smoking	Smoking cessation should start before discharge. At least patients and family members; who smoked in the past year, should be included in a smoking cessation program.
Dyslipidemia	Lipid profiling tests should be performed and statin therapy should be initiated when indicated.
Patient care in stroke - Before hospital discharge	
Screening for dysphagia	A structured swallowing assessment should be performed within the first 48 hours before the patient starts eating, drinking, and taking oral medication.
Nutrition	Patients with no dysphagia should start eating and patients with dysphagia should start receiving enteral nutrition in the first 48 hours. Patients should achieve calorie targets within the second 48 hours.
Venous Thromboembolism	DVT and PTE prophylaxis with intermittent pneumatic compression and/or low molecular weight heparin should be started in immobile stroke patients. If it is not started, the rationale should be noted. The number of patients; who developed DVT/PTE should be recorded. This initiative should be implemented within the first two days of hospitalization.
Aspiration Pneumonia	Early mobilization, physical therapy, oral care, secretion management, and the follow-up of examination findings should necessarily be performed using a structured approach. If it is not started, the rationale should be noted. The number of patients; who developed aspiration pneumonia should be recorded.
Falling	Preventive measures should be implemented against not only fall-related injuries but all type of falls. Risk for falls should be estimated on an individualized basis. If no preventive measures are implemented, the rationale should be noted. Any incident of fall should be reported.
Urinary tract infections	Urinary catheterization should be avoided as much as possible. The indications for the placement of the urinary catheter should be checked regularly.
Stage 2 or advanced pressure ulcers	Structured risk assessment [for example, with Braden scores] and physical examination should be performed; the patient should be properly positioned in the bed, and mobilization and physical activity [such as ROM] should be planned.
Cognitive state	The cognitive state and limitations in the activities of daily living should be assessed during the hospital stay of each stroke patient.
Rehabilitation	The need for vocational, physical, and speech rehabilitation should be determined and strategies should be developed during the hospital stay. After the assessment, the next rehabilitation level [outpatient, inpatient, at home, etc.] should be determined. If there is no need for rehabilitation, this should be noted.
Stroke training	Training on stroke should be provided for the patient or caregiver (group) before discharge. Training topics should address at the least the following; including identifying and controlling personal risk factors, stroke warning signs, activation of emergency health services, the need for follow-up after discharge, and the use of medicines.
Control visit in the third month	
Optimization of risk factors	Patients should be examined for hypertension, diabetes, smoking, adequate use of anti-platelet/anti-coagulant therapy, obesity, engagement in physical activity, and depression.
Stroke-related disability	Modified Rankin scores should be documented in patient charts.

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Authorship Contributions

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1. Stroke: a short review. 1.1. The epidemiology, importance, and the global burden of stroke, and future strategies (Serefnur Oztürk); 1.2. Current standards for the treatment of acute ischemic stroke: Intravenous thrombolysis and thrombectomy (Recep Baydemir); 1.3. Current treatments for acute intracerebral hemorrhage (Turkan Acar); 1.4. Acute stroke management systems: Stroke units and stroke centers (Ayse Guler, Hadiye Sirin)

2. Treatment and care for acute stroke. 2.1. Intravenous thrombolytic therapy for hyperacute ischemic stroke: Final checks before tPA administration, Preparation and administration of the medicine (Sakine Boyraz); 2.2. The first

24 hours after IV tPA: Monitoring of the patient, blood pressure monitoring, neurological examination follow-up, NIH stroke scale, and potentially common complications, bleeding, and orolingual edema (Sakine Boyraz); 2.3. Nursing management for neurointerventional procedures for the treatment of the acute stroke patient: Basic principles of patient follow-up after angiography and the treatment of major complications (Sakine Boyraz); 2.4. Perioperative and intraoperative neurology nursing in neurointerventional vascular procedures (Ozcan Ozdemir, Ozlem Aykac); 2.5. Posture, mobilization, and early-stage physical therapy and rehabilitation in the acute ischemic stroke patient (Ayfer Karadakovan); 2.6. Nursing practice in the hyperacute period of intracerebral hemorrhages and subarachnoid hemorrhages: Follow-up of the posture, blood pressure, neurological examination, and consciousness (Ayfer Karadakovan); 2.7. Major problems and nursing practices in patient follow-up after subarachnoid hemorrhage (Ipek Midi); 2.8. Neurological deterioration in an acute stroke patient: Follow-up, frequently encountered conditions, and treatments (Mukadder Mollaoglu); 2.9. Medical treatment and nursing approaches in brain edema and increased intracranial pressure in ischemic and hemorrhagic stroke (Ethem Murat Arsava); 2.10. Postoperative patient follow-up in the neurology intensive care unit (care after decompressive craniectomy, aneurysm surgery, and hematoma surgery) (Bijen Nazliel); 2.11. Intra-hospital transfer of acute neurological patients (Mukadder Mollaoglu)

3. General provision of care and management of systemic problems. 3.1. Management of fever and the body temperature in the stroke patient (Mukadder Mollaoglu); 3.2. Oxygen therapy in the acute stroke patient (Erdem Yaka); 3.3. Evaluation of the swallowing function in the stroke patient (Murat Mert Atmaca); 3.4. Hydration and nutrition in the stroke patient: Evaluation, starting oral / non-oral feeding, monitoring, and calorie and protein supplements (Nedim Ongun); Nursing practices (Zeliha Tulek); 3.5. Follow up of blood glucose levels in the stroke patient (ZelihaTulek); 3.6. Oral care, airway management, oxygen therapy, and pneumonia prevention and treatment in the stroke patient (Gulsen Caglar); 3.7. DVT/PTE prophylaxis in the stroke patient (Gulsen Caglar); 3.8. Pressure ulcer in the stroke patient: Risk, prevention, and treatment (Aylin Ozakgul); 3.9. Urinary incontinence, urinary catheters, prevention of urinary infections (Zeliha Tulek and Aylin Ozakgul)

4. Restorative nursing care for stroke patients in the long-term. 4.1. Communication with the stroke patient: Speech disorders (Ozlem Kuçukguclu); 4.2. Management of severely affected and minimally responsive stroke patients in the subacute period (Oznur Usta Yesilbalkan); 4.3. Physical disability, disability improvement, and rehabilitation in the stroke patient (Naile Alankaya); 4.4. Psychiatric and cognitive problems after a stroke (Ozlem Kuçukguclu)

5. After a stroke. 5.1. Planning the hospital discharge for an acute stroke patient, supportive care at home, palliative care (Zehra Durna, Nurdan Yildirim); 5.2. Nurse's role in the management of vascular risk factors in the stroke patient after the hospital discharge (Canan Togay Isikay)

6. Training to be a stroke nurse. 6.1. Education and training to become a stroke nurse: Needs, procedure, certification (Zehra Durna).

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