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Stroke – pain and shoulder dysfunction

Udar mózgu – ból i dysfunkcja barku

Summary

Strokes are one of the most important problems of modern medicine and are third leading cause of death in many developed countries. Complications of stroke are an important determinant of quality of life and often determine the patient's survival. Complications are to be considered in two groups. The first group of complications is cerebral and the second group involves systemic complications. A common complication concerning musculoskeletal is shoulder pain. The pain, according to many researchers, occurs in 16-80% of patients after a stroke, which proves that this is a major problem in the treatment and rehabilitation of these patients.

Key words: stroke, hemorrhagic stroke, ischemic stroke, shoulder pain, shoulder dysfunction, hemiplegia, hemiparesis.

Streszczenie

Udary mózgu stanowią jeden z najważniejszych problemów współczesnej medycyny i stanowi trzecią przyczynę zgonów w wielu rozwiniętych krajach. Powikłania udaru mózgu stanowią ważny czynnik decydujący o jakości życia, a często decydują o przeżyciu chorego. Powikłania należy rozpatrywać w dwóch grupach. Pierwsza grupa powikłań, to powikłania mózgowe, a druga grupa to powikłania ogólnoustrojowe. Częstym powikłaniem dotyczącym narządu ruchu jest ból barku. Ból, według wielu badaczy występuje u 16-80% chorych po przebytych udarze mózgu, co dowodzi, że jest to istotny problem w leczeniu i rehabilitacji tej grupy pacjentów.

Słowa kluczowe : udar mózgu, udar krwotoczny, udar niedokrwienny, ból barku, dysfunkcje barku, porażenie połowicze, niedowład połowiczny.

Stroke epidemiology

Cardiovascular diseases, which include heart attacks and brain vascular diseases (ch. n. m) are an important social value because they are the most important cause of death in our population. Strokes are the third leading cause of death in most countries and the leading cause of permanent disability of people over 40 years of age. The frequency rate, in some parts of the world, is compared to coronary heart disease and other vascular diseases. According to WHO, stroke is defined as a “sudden occurrence of focal or generalized cerebral dysfunction lasting more than 24 hours or resulting in death in the absence of other apparent reasons of vascular origin”. Therefore, Stroke is a complication of a known or unrecognized cardiovascular disease.

Because of strokes, each year 4.5 million people die in the whole world. The number of strokes per year in the United States is 400,000, in Germany 127,000, in Britain 89,000 and in France 78,000. In Poland, the records are about 70,000 new cases per year and the mortality rate is at a level between 66 - 108 per 100 000 people. In other European countries this number is similar but mortality caused by stroke's complications and the level of disability after stroke are much lower. In developed countries such as Switzerland and Finland a decrease in the number of new cases and in mortality because of a stroke is recorded. It is believed that widely implemented preventive measures, improvement of life style and the reduction of risk factors affect this state of affairs. It is assumed that the increased frequency of strokes and their cultural, biological, and social consequences during the next 25 years will continue to grow. The increase of stroke's modifiable risk factors and aging of the population in the countries of Central - Eastern Europe, including Poland, may contribute to the increased frequency of strokes.

Strokes are a major cause of disability, depression, dementia and huge spending on treatment and secondary prevention incurred by the health service. Epidemiological studies have shown that the total annual cost of treating one patient with stroke in Poland is around 60 000 PLN. In the USA total annual costs associated with strokes are around \$400 billion. In the UK the treatment of all patients consumed 5% of the health budget expenditure. In Australia the total cost of treatment per patient is 33 658 USD and in Sweden 79 000 USD.

Stroke statistical data do not always provide accurate information. Reports on mortality are much easier to obtain than data concerning morbidity. However, stroke is a common and widespread problem and increasing morbidity rate and mortality from strokes in Poland is highly disturbing. (Kuźdzał i wsp. 2011; Kwolek, 2011)

Stroke pathogenesis

Stroke is a disorder caused by a sudden loss of blood supply to the brain. This can be caused by ischemia, when one of the vessels supplying blood to the brain is suddenly blocked or by bleeding from a ruptured blood vessel. The life of brain tissue is dependent on the permanent transfer of blood providing basic and essential nutritional products. If there is a blockage or disruption of the artery, with no other routes of blood flow, the brain region, that was supplied by the damaged vessel, is destroyed. In short it can be said, that the causes of stroke are the changes at the level of the micro- and macro-circulation that form a chain of cellular and molecular changes.

The most common form of stroke is a ischemic stroke, ie. cerebral infarction, making 80% of all stroke incidents. A hemorrhagic stroke, in other words cerebral hemorrhage accounts for 10% of all strokes. Subarachnoid hemorrhage occurs in 6% of stroke incidents and the remaining 4% falls to other less defined forms of stroke.

The underlying cause of ischemic stroke is stopping or reduction of arterial perfusion. The reasons for blood flow reduction include:

- discrepancy between perfusion pressure and the structure of the vessel,
- a blood clot in a intracranial or before cranial vessel against atherosclerosis,
- embolism with material from other major cerebrovascular vessels, carotid and other coming from the heart, lungs and peripheral vessels.

Among hemorrhagic strokes there can be distinguished two types: primary (80%) and secondary (20%). The hypertension is associated with more than half of the primary hemorrhages and amyloid angiopathy affects about 30% of primary hemorrhagic strokes. Secondary hemorrhagic stroke can be caused by: a cerebral vessel defect (aneurysm, angioma), ischemic stroke, iatrogenic causes associated with thrombolytic treatment, cancer, trauma, venous thrombosis or brain endometriosis. Depending on the location of the effusion in the area of central nervous system, hemorrhagic strokes are divided into: lobar, brain, capsular and bridges.

Sometimes it happens that the symptoms of a stroke occur even a few years before becoming ill. To such conditions, according to WHO, we can include: reversible ischemic neurological deficit (RIND) and transitional ischemic attack (TIA). RIND defines symptoms lasting more than 24 hours but completely retiring within seven days. TIA occurs with some or all of stroke symptoms that resolve within 24 hours. Both TIA and RIND suggest significant heart and cerebrovascular diseases and are generally a herald of a full stroke.

Blood supply to the brain is done by four main vessels: two internal carotid arteries and two vertebral arteries. These two pairs of major blood vessels, integrated by connecting vessels, arrange on the lower surface of the brain and form a cerebral arterial circle – called A Willis Circle. From this place, through smaller blood vessels, the blood is being distributed throughout the brain. Cerebral arteries roll about 15% of total blood capacity, leading 20% of oxygen used by the body the central nervous system. Cerebrovascular diseases, which almost always are caused by hypertension and atherosclerosis are the basis for thrombotic and embolic strokes. Patients diagnosed with symptoms of cerebral hypoxia already have far-reaching damage to the vascular endothelium. In addition, in such cases, on the background of atherosclerotic, wall clots may occur in vessels. This type of pathological process significantly affects the vessel patency and function and increases the frequency of strokes. (Kuźdzał i wsp. 2011; Kwolek, 2011; Mazur i wsp. 2010).

Stroke's risk factors

Stroke's risk factors are divided into three groups: non-modifiable, modifiable – certain and modifiable - probable (Table 1).

Tab. 1. Stroke's risk factors

Non-modifiable	Modifiable – certain	Modifiable - probable
Age	Hipertention	Overweight and obesity
Male	Smoking	Low physical activity
Race	Diabetes	Alkohol abuse
An aggravating family history	Carotid artery stenosis	Hyperhomocysteinemia
Socioeconomic status	Atrial fibrillation	Coagulation disorders
	Hyperlipidemia	HRT and oral contraceptives

- Hypertension is the main modifiable factor among stroke's risk factors. Many studies have shown that in people with high blood pressure the occurrence of a stroke is 3-4 times more frequently. In addition, if patient with hypertension also has myocardial pathology, the risk of a stroke increases to 8.8. In case of borderline hypertension occurrence (140-159 mm Hg/90-94 mm Hg) the risk of a stroke increases by 40%. In turn, with consistent high blood pressure (\Rightarrow 160mmHg / \Rightarrow 95mmHg), a chance for stroke's occurrence increases 3-6 times. Also, a high normal blood pressure (120-139mmHg/80-89mmHg) is a risk factor for stroke's occurrence. It should be noted that hypertension has the greatest impact on the ability of stroke occurrence up to 45 years old. Then, with the age this risk is reduced because the age is becoming an non-modifiable and primary risk factor. Benefits from pressure reduction, in stroke prevention, are achieved by lowering the pressure by 10/5mm Hg, wherein the optimum value of the pressure is below 120/80 mm Hg. According to Mac-Mahon's analysis, properly treated hypertension reduces the stroke's incidence and mortality by 40% (pressure drop by 11/6 mm Hg lasting for two years). A large percentage of untreated (approximately 30%) and undetected (about 20%) hypertension is detected among people with strokes. Patients diagnosed with hypertension a systematic and effective therapy, that includes both pharmacological and non-pharmacological action, is obligatory. The treatment should lead to lowering the blood pressure below 140 mm Hg / 90 mm Hg.

- Heart diseases are another major risk factor for stroke occurrence. During atrial fibrillation in the area of left atrium there appear blood stasis and the formation of thrombus, which can become an embolic material. According to the Framingham's analysis, atrial fibrillation increases the risk of strokes 5 times. Having myocardial infarction, in 1-5% of patients, is the cause of ischemic stroke, which usually occurs within five days after the attack. In patients with dilated cardiomyopathy the risk for a stroke occurrence is 3-11% per year. Foramen patent ovale can become a passage for embolic material produced in the peripheral veins. Permeable forament ovale is present in 40% of patients with undiagnosed cause of ischemic stroke. Also hemodynamic disturbances which result in the weakening of cardiac output lead to ischemic regions of the brain on the border of vascularization in the area called "last meadow". Other heart conditions that increase the risk of stroke occurrence include: valvular heart diseases and endocarditis.

- Narrowing of the internal carotid artery associated with atherosclerotic changes is a factor in about 20% of ischemic strokes. In patients with asymptomatic stenosis, endarterectomy produces positive results as long as the stenosis does not exceed 60%, the risk of surgery is less than 3% and stable heart disease is stated. In symptomatic carotid stenosis, the best benefits from surgery are achieved when the stenosis is about 70-99%, in other cases, the number of strokes and deaths is minimally reduced.

- Antithrombotic prophylaxis based mainly on moderate exercise and pharmaceutical treatment reduces the frequency of cardioembolic congestions. Main indications for anticoagulant therapy include: atrial fibrillation, valvular defects, patent foramen ovale, obesity, coronary heart disease and hypertension.

- Diabetes is a major risk factor for stroke occurrence. It is concluded that mainly when combined with other factors, in particular with hypertension, it increases the risk of stroke twice. As an independent agent, mellitus diabetes increases the risk of stroke in women 2,2 times and in men 1.8 times. Proper treatment of diabetes leads to a reduction of stroke and other medical complications.

- Dyslipidemia is an important risk factor for stroke occurrence. Too high level of total cholesterol and triglyceride with simultaneous decrease of HDL-cholesterol fraction leads to cerebral atherosclerosis and coronary atherosclerosis. According to Kwock, the amount of cholesterol exceeding 280 mg% increases the risk of ischemic stroke 2.5 times. A positive correlation exists only between mortality due to ischemic stroke and high cholesterol level. In turn, the cholesterol level below 160 mg% results in a 3 times increased risk of hemorrhagic stroke. It should be also noted that this applies only to men with diagnosed hypertension and undoubtedly results from the weakening of vessel walls. In case of hyperlipidemia an important issue is to regulate lipid metabolism. LDL should be at a level not exceeding 130 mg/dl, at the same time with higher HDL level of 20% of the total fraction cholesterol, triglyceride level should be below 150 mg / dl. In addition, in order to achieve and maintain normolipidemia, daily physical activity, proper diet and weight control should be applied. In some cases, despite keeping the rules on nutrition and physical activity, it is necessary to include pharmacological treatment in order to normalize cholesterol levels in the body.

- Obesity, particularly the abdominal type is considered to be one of risk factors. In men aged 35-65 years and women over 50 years of age, BMI (body mass index) above 30 kg/m² increases the risk of stroke 1.5 times. Prevention of obesity by a daily 60-minute physical activity and proper low-calorie diet significantly improves the patient's health status. In some extreme cases, the treatment of obesity requires the use of pharmacotherapy and surgical intervention.

- Smoking is the undisputed risk factor for stroke occurrence. Among women aged 25-45 years, smoking triples the risk of a stroke. According to Donnan, quitting smoking decreased the risk of ischemic stroke by 10 years, yet after that the threat was still noticeable. Kawachi and his colleagues found that smoking leads to irreversible damage to the vascular walls and thus contributes to the formation of atherosclerotic lesions.

- Consumption of alcohol in amounts greater than 60 g per day increases the risk of a stroke estimated at 1.6-1.8 times. The use of alcohol irregularly in large quantities is also not recommended. According to some researchers, a small amount of alcohol (<15 g / day for females and <30 g / day for males) can help to reduce the risk of stroke occurrence. This is most likely because of lowering fibrinogen levels and reducing HDL cholesterol.

- Physical activity has a beneficial effect on the functioning of the body and reduces the risk of a stroke. In stroke prevention it is important to maintain a regular exercise at least three times a week for 20-30 minutes at a time. Dynamic exercises are recommended, however static exercises and strength sports are not appropriate. The intensity and type of activity should be individually selected to the needs of the patient. Positive effects of physical activity include: reduction of systoles during exercise and rest periods, reduction of myocardial oxygen demand, which also reduces the risk of acute myocardial ischemia, development of collateral circulation, improved myocardial blood supply, reduction of adrenergic activity, reduction of systolic and diastolic pressure, positive effect on carbohydrate and lipid metabolism, alleviating of anxiety and endorphin release, improvement of your mood.

- The diet has a significant impact on the functioning of the whole body. Among the

dietary recommendations, in the stroke prevention, low-sodium diet, carbohydrate restriction and also lipid lowering diet involving reduction of saturated fatty acids and cholesterol consumption are significant. The consumption of polyunsaturated fatty acids, soy isoflavones, protein, plant sterols and fiber is also recommended. In the case of hyperhomocysteinemia ($> 16 \text{ mmol/l}$), leading to the creation of strokes, it is suggested to consume folic acid and of vitamins B6 and B12.

- Hormone therapy related to use of oral contraceptives increases the risk of stroke occurrence. Large doses of estradiol present in the I generation drugs significantly increase the risk for a stroke. Newer generation drugs, that have lower levels of estradiol, probably are not a specific risk factor for stroke occurrence but they are not recommended for women with diabetes, a history of thromboembolic incidents, migraines and who smoke cigarettes. HRT (hormone replacement therapy) is also associated with an increased risk of stroke occurrence.

- Age has a significant effect on the frequency of stroke occurrence and mortality caused by strokes. The age of over 55 brings with every decade the risk of getting a stroke. In addition, age has a significant effect on mortality. Regardless of the type of a stroke, the risk of death increases by about 3% per year between 20 and 92 years of age.

- Male sex predisposes to a higher frequency of stroke occurrence. Men to women ratio is respectively 1,3-1,0. However, the number of strokes among women is higher when they exceed the age of 65. This situation is probably associated with a longer than in the case of men average life expectancy.

- Black population predispose to a higher frequency of stroke occurrence. The probable reason for this situation is the fact that in this race, unlike other, the occurrence of hypertension and diabetes is more common.

- Genetic factors significantly affect the frequency of stroke occurrence, the clinical course of disease and mortality. Currently, it is stated the there is a possibility of family occurrence of a stroke. Also inheriting of risk factors says about the importance of genetic background in stroke's pathogenesis.

Tested and known stroke's risk factors do not fully explain the occurrence of this disease and do not explain the fact that the presence of risk factors does not necessarily lead to a stroke. In addition, it should be remembered that the simultaneous occurrence of a number of risk factors increases the risk of a stroke. (Błaszczuk, 2008; Kwolek, 2011; Kwolek, 2003; Mazur i wsp. 2010)

CLINICAL SYMPTOMS OF A STROKE

Stroke is a condition that results in generalized or focal changes in brain function lasting for more than 24 hours. The focal symptoms include neurological dysfunction associated with specific brain regions. In generalized disorders consciousness disorders are observed.

Localization evaluation of ischemic stroke. Cerebrovascular disorders refer to a specific area of vascularity: 1. Front - the area vascularized by the internal carotid arteries, 2. Back - the area vascularized by the vertebral arteries basal 3. The whole of the brain - the area of front and back vascularization.

Front cerebral circulation disorders – clinical symptoms:

- hemiplegia or hemiparesis,
- Agnosia, abnormal behavior,
- Aphasia,
- Hemi hypoesthesia,
- Pseudobulbar dysphagia,
- Monocular visual disturbances,
- Amblyopia hemiparesis.

Back cerebral circulation disorders – clinical symptoms:

- Dizziness and spinning sensation,
- Nausea, vomiting,
- Weakening of hearing, tinnitus,
- Seizures of incidence,
- Gait disturbance,
- Bulbar dysphagia,
- Double vision
- Feeling of dark and wavy items,
- Scotoma,
- While having the brainstem - impaired consciousness.

In case of cardiac pathology for the whole brain, there are clinical signs typical of both circulatory disorders front and back.

Localization evaluation of hemorrhagic stroke.

Supratentorial hemorrhagic strokes – clinical symptoms:

- Hemiparesis changing into the paralysis,
- Aphasia,
- Swelling of the brain hemispheres changing into swelling of the brain stem - increasing neurological deficits, increasing intracranial pressure, headaches, vomiting, consciousness disorders on ischemic brain stem.

Infratentorial hemorrhagic strokes – clinical symptoms:

- Motor coordination and balance disorders,
- Headaches, dizziness, nausea - intracranial narrowness syndrome,
- Double vision,
- Brain stem failure- disorders of consciousness or changes in heart rate and blood pressure, disorders of stem respiratory functions.

Failure of the brainstem (ITC) is one of the most important clinical syndromes in medicine. It often occurs in a hemorrhagic stroke and much less in ischemic stroke. The occurrence of ITC in any disease or injury shows the disturbance of the organism's homeostasis and it always is a threat to the patient's life. Irreversible cessation of brain stem function means human's death. Impaired consciousness is ITC's main signal, which lead to the lowering of the activity called consciousness. Ischemic brain stem is always accompanied by disturbances of consciousness. (Kalinowski i wsp. 2009; Kwolek, 2011; Kwolek, 2003; Mazur i wsp. 2010)

Clinical picture of a stroke

WHO defines stroke as the most common neurological clinical syndrome. Depending on the pathogenesis, extension and location of the stroke, general patient's condition before the stroke and the process of treatment and rehabilitation, the clinical picture of a stroke can vary from patient to patient. However, specific features that characterize the different types of strokes can be highlighted.

A characteristic symptom of a stroke is sensory paralysis referring to the superficial and deep sense. Since it runs differently in each patient, it is impossible to provide specific periods of this state. However, it can be said that the most common type of paralysis is the mixed one (sensorimotor) and isolated forms of sensory or motor ones are rare. Motor hemiparesis is characterized by a couple of basic stages. Initially, it has a limp character, then by reversing of the paralysis and the emergence of global movements (synergies, isolated movements) spasticity is maximally increased (Ashworth's scale - 4) and after that the muscle tone is normalized. This cycle can be completed at each stage, so each patient's paralysis image may look differently. This recovery scheme as described by Brunnström (Fig. 1).

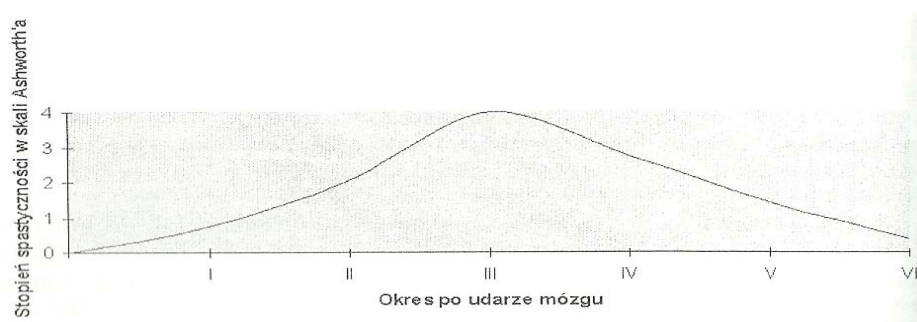


Fig.1. Motor hemiparesis by Brunnström.

The possibility of walking and moving of upper limbs is mainly dependent on the severity of a stroke. Patients with extensive stroke or with a stroke in its first stadium can initial only reflexes, which, however, can not be used operationally. In later stage primitive reactions occur, dependent on the patient's will, which are generated when the patient expresses the intention to move. These are muscle synergies produced by a simple formula, that is why muscle strength, regardless the need, is the same. The movement control involved, in many patients, is so weak that they can start the movement only in specific and beneficial for patient's situations (for instance on lying on their back). Lower limb, due to the small cortical representation, has simple and discreet primitive patterns, so many patients recover the ability to walk. Patients are able to use the flexion formula for walking and rectifier formula for walking and standing. Upper limb movement synergies impede or prevent the execution of precise movements, especially when the wrong treatment establishes them. Double cortical innervation of the trunk muscles prevents these muscles from paralysis and a noticeable body asymmetry is the result of paresis and paralysis of the upper and lower limb.

Hemiparesis shocks are often accompanied by other complications of the musculoskeletal system. They arise mainly from the nature of a stroke, immobility, rehabilitation introduced too late or neglected nursing, and they include: subluxation in the shoulder joint, contractures in shoulder complex, contractures in elbow and arm joints, rotation of the entire lower limb, contracture in the hip joint, hyperextension of the knee joint and varus foot. In addition, there occur, heavy in the treatment, periarticular ossification, local osteoporosis, muscle atrophy of central origin and pain syndromes. Other complications can often be found there, especially in cardiovascular, respiratory, and urinary tract and the digestive systems.

Other consequences and complications of a stroke are cognitive function disorders (gnostic). Aphasia is a common consequence of a damage to the dominant hemisphere of the brain. It may be accompanied by other mental disorders such as alexia (inability to read), akalkulia (inability to count) and agraphia (inability to write). In addition, there may occur impairment of concentration and attention, memory, designing, thinking, planning, weight and shape recognition, identification of one's own body and one's body sides. Apraxia (inability to perform duties of well-known before stroke's occurrence for example: getting dressed) and "hemiparesis neglect syndrome", which manifests itself in not recognizing and forgetting about inflected or paretic side of the body are also common symptoms. It should also be noted that a depression is also a common post stroke disorder. It applies to about 30% of patients, in particular it is observed in patients with a stroke within the dominant hemisphere of the brain.

Cognitive impairment and depression make it extremely difficult and sometimes even prevent the normal process of treatment and rehabilitation. Therefore, it is necessary to conduct various forms of rehabilitation and education in order to restore disturbed patient's activities and to adapt the patient to new circumstances. Only a comprehensively performed treatment gives the greatest chance of success in the course of rehabilitation. (Błaszczuk, 2008; Kalinowski i wsp. 2009; Kwolek, 2011; Mazur i wsp. 2010)

A shoulder of a hemiplegic

A very common complication arising in patients after having a stroke is a shoulder and arm pain. According to many studies, a shoulder pain affects between 16% and 80% of patients after a stroke. Such a large range of data is due to a number of factors that have an influence the occurrence of pain and shoulder dysfunction, and they include: patient's age, the type of a stroke, measurement's time, the state of muscle tension, the type of physical activities used before the stroke, the type of work performed and other. Hemiplegia painful shoulder problem is mainly due to nursing negligence and rehabilitation introduced too late. Disorders in biomechanics and functioning of shoulder complex prolong the rehabilitation process, discourage patients and become a cause of their frustration and fear, which has a negative impact on the overall quality of patient's life.

Shoulder pains are often caused by: changes in the rotator cuff, muscle spasticity, subluxation of the humeral head, reflex sympathetic dystrophy, complex regional pain syndrome, inflammation of the periarticular tissues, joint capsule contracture and degenerative changes. Additional causes may be iatrogenic factors resulting from improper care and of rehabilitation negligence and error.

The initial cause of pain and dysfunction of the shoulder complex is the damage of muscles included in the rotator cuff. The main task of these muscles is to stabilize the humeral head. The muscles of the rotator cuff, as a result of overlapping congestions and microtraumas, weaken and stretch, which can cause damage to the muscle tissue continuity. The mechanism of “pulling” present in the upper limb in hemiplegic patients causes degeneration and ischemia distal cone, strains muscles and destabilizes the joint. The head being deprived of the protection, at the time of raising the side, rises to the top, which as a consequence leads to elevation and humeral head and to subluxation.

Another problem occurs when it comes to spasticity. Spasticity occurs as a consequence of a damage to the central motor neuron, leading to a weakening or exclusion of inhibitory activity of pyramidal tract. At the same time there occurs the advantage of excitatory mechanisms of centers located below, leading to an increased activity of the gamma system, which manifests itself as an increased reactivity muscle on stretching. In the case of spasticity paretic limb mobility is made difficult or even impossible. Increased muscle tension covering the whole upper limb leads to the necessary placement of a limb in two ways. Brunnström and Levitt distinguished, in the area of upper limb, two characteristic, pathological synergisms:

1. Flexion: flexion, dissuasion, external rotation at the shoulder joint, elbow flexion, forearm inversion, wrist and fingers flexion,
2. Erectile: Extension, adduction, internal rotation of the shoulder joint, elbow extension, the conversion of the forearm, hand extension.

Spasticity due to excessive muscle tension can cause pain while resting, it can also cause a pain of trailers (entezopatia). Furthermore, increased tension of muscles rotating the blade downwards (parallelogram, scapula) and muscles rotating the limb internally (subscapular, major pectoralis, biceps muscle of the arm, teres major muscle, shoulder muscle) increase the risk of occurrence of a conflict of carpal impingement region. Subacromial space is the area around the shoulder limited from the above by a shoulder lad, raven-shoulder ligament, raven shoulder appendix and shoulder – collarbone joint and from the bottom by the humeral head with a nodule greater. In this area there is located a subacromial bursa, the muscles of the rotator cuff and the tendon of a long head of the biceps. The average range of this space is from 1 to 1.5 cm. The purpose of the subacromial bursa is to facilitate the movement of sliding for structures located in it's vicinity. The bursa inflammation causes severe pain and impairs blade's work responsible for the proper movement of the scapular-humeral joint.

Another common problem in paralysis and paresis is complex regional pain syndrome “shoulder-hand”, described by Steinbrocker. This syndrome is one of the types of reflex sympathetic dystrophy of the upper limb, which clinical symptoms are triggered within the first year after having a stroke. Reasons for complex regional pain syndrome occurrence are not fully recognized. It is believed that they may be the result of impaired biomechanics of the shoulder joint. This syndrome is characterized by the presence of pain combined with trophic changes in the ligament, muscle and capsular systems. Stimuli causing the disease process are derived from a variety of affected by a disease or damaged tissues. These stimuli stimulate peripheral receptors and cause vasomotor disturbances. Very often the first pathological stimuli is lasts for very short

period, yet long enough to trigger another pathological stimuli, whereby a vicious cycle of vegetative arousal is created. Sympathetic dystrophy stimulus, that began the dystrophy, does not decrease but increases and triggers hyper-sympathetic condition. The arising ischemia increases the pain, this in turn increases the sympathetic reflex and thus forms a pathological sympathetic reflex pain. In hemiplegia, the overlapping micro damages within the richly innervated tissues of the shoulder complex are a stimulus provoking peripheral receptors and these in turn generate vasomotor disorders.

According to many researchers, co-existing degenerative changes of the shoulder joint ,in patients with a history of stroke, make the pain and shoulder dysfunctions worse. Moreover, as the result of prolonged immobilization, inflammation or large degeneration there may occur painful joint capsule's contractures. This condition makes the neurological rehabilitation difficult. It also prolongs the recovery time and affects the quality of patients' lives. A properly conducted shoulder diagnostic, which takes account of existing degenerative and inflammatory changes, facilitates the introduction of the optimal rehabilitation program in order to return the lost of the upper limb function as fast as possible.

An important reason for the emergence and intensification of shoulder pain is also a careless caring for patient, especially in the acute phase, when the patient is immobilized. Laxity and lack of sense favor the occurrence of periarticular tissues injuries. No proper positional positions do not protect the shoulder against damages and contractures of infected limb. Also improperly designed sets of exercises can provoke excessive soft tissues strain leading to their failure. A significant issue is also the proper selection of orthopedic supply. The use of the right equipment reduces the formation of abnormal movement patterns, prevents the occurrence of contractures and injuries and facilitates patient's daily activities. (Cieśla i wsp. 2006; Kwolek, 2011; Mazur i wsp. 2010; Pop i wsp. 2006; Pop i wsp. 2010)

Prevention and shoulder's therapy

The earliest introduction of rehabilitation in the process of treatment of patients with stroke plays a crucial role and influences the obtained results. Often it's early implementation is more important than run after years of rehabilitation. Also the proper taking care of the patient is crucial for the further course of treatment. The scope of nursing activities involves, in the initial phase of a stroke, apart from the usual duties, also the correct positioning of the patient preventing bedsores and contractures. Turning the patient connected with the change of position is made in every 2-3 hours, taking into account placing the patient on his back, on both healthy and sick side and on the stomach. Indirect placement providing an innervative balanced of all muscle groups best fosters relaxation of muscles showing a tendency to contractures, reduces spasticity and builds a convenient starting position for passive movements representing the beginnings of re-education movement activities.

The process of the improvement in patients with paralysis is determined by the severity of stroke and its symptoms. The patient's condition may be very different, ranging from slight movement disorders to severe paresis and paralysis, loss of consciousness, cardiovascular and respirator insufficiency. The patient, in the early period, should be in

correct positions while lying down and sitting. They allow to maintain proper tension, create the best conditions for the prevention of contractures, increase the sense of security and are a source of afferent stimuli. Principles of good patient's position should be carried out for 24 hours and the patient should not stay in one position for longer than 2-4 hours. The position should be comfortable and chosen in a such way that it facilitates the process of recovery of motor function. While the patient is laying on the paralyzed side, the shoulder of paretic upper limb should be placed in pronation. Then, the paretic upper limb is flexed and internally rotated at the shoulder joint, elbow joint in flexion or extension, forearm in supination, hand laid loosely. In case of laying on the non-paralyzed side, paretic upper limb is in flexion or in an intermediate position with shoulder blade in pro traction or retraction. At each position an external rotation at the shoulder joint must be maintained. While laying on the back, the upper limb is in slight retortion and flexion and it is supported on pillows or a wedge in an intermediate setting. Elbow joint is bent or straight. Hand is in functional position. In a seating position, the upper limbs should be placed on a table or countertop mounted to the wheelchair. Supports can also be used and placed under paralyzed upper limb. The support is particularly important in patients with shoulder subluxation or with a threat of occurring of such subluxation to the frail limb.

Recreating the motion of the upper limb is a difficult and long process. The complex anatomy of the shoulder joint in the absence of motor control and reduced muscle tension causes the danger of subluxation in the joint and the emergence of painful shoulder syndrom. Not using the limb, lack of exercise the full extent, the appearance of primitive synergistic movements generate restrictions in mobility in the form of joint contractures. The first main component of rehabilitation is the correct care and the use of compounded positions. Then, the task of rehabilitation is to maintain or recreating the shoulder joint motion and to restore its activity. For this purpose, various forms and methods of improvement are used. Passive movements, step-passive, mobilization of shoulder and upper limb and self-supported movements are the basic forms of the paretic upper limb improvement. The front supine position with support on forearms, supported kneeling and sitting and standing positions with supported back of the arms create the conditions for exercises involving the support on the paretic limb and for motor-controlled study. The use of approximation and the induction of reflex extensor muscle tension eases the task and the stabilization of position. Exercises in the closed kinematic chain, for the paralyzed upper limb, re-educates spastic muscle tension and along with correct postural reactions enable recreation of a selective work of paralyzed limbs. It is necessary to remember that the condition for the restoration of hand's function is an early master of shoulder and elbow joints movement control with a level of muscle tension being close to normal. Another step of restoration of upper limb and hand movement consists of exercises on grip and handling functions. This activity is related to a free movement of the arm in space with muscle tension close to normal and the ability to maintain a stable position in various positions. It is important that, along with the recovery of hand's motor control, exercises also include action tasks resulting from basic self-service actions.

The presented main guidelines and directions of kinesitherapy of patients with upper limb paresis after a stroke aiming the restoration of lost functions must also be supplemented by exercises in intermediate positions, which are a part of normal human physical activity. Recovering of even partial independence in daily life activities is

extremely motivating for the patient and confirms the motor potential and the possibility of full independence. Kinesitherapy in patients who went through a stroke is primarily based on the performance of individual exercises but patients, who can perform active intentional movements and are able to walk independently should participate in the forms of group exercises that improve general physical conditions.

The foundation for rehabilitation in people having a stroke history is kinesitherapy and that it why so much space has been devoted in this work. However, it should be noted, that the essence of physiotherapeutic proceeding, is associated behavior including kinesitherapy (including the neuro educational methods), physical therapy, biofeedback and the use of properly selected orthopedic supply. The effect of all actions taken should aim primarily to undo the pain and to reverse shoulder dysfunction and to restore the functionality of the paretic upper limb. (Cieśla i wsp. 2006; Guzik, 2010; Kwolek, 2011; Pop i wsp. 2005; Pop i wsp. 2006; Pop i wsp. 2010; Żyluk i wsp. 2006)

Conclusions

1. Stroke is the cause of motor deficits, cognitive and emotional-personality disorders that limit the independence of the patient.
2. Shoulder pain is a common complication and it is found in 16-80% of patients undergoing a stroke.
3. Among the factors influencing the occurrence of shoulder pain are: the patient's age, increased muscle tension and the damage to soft tissues in the area of shoulder joint.
4. Proper upper limb position in the early period of illness and effective kinesitherapy have a positive impact on preventing shoulder complex dysfunctions.

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