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Abstract

Strokes occur rarely in individuals under the age of 45 and are even more uncommon under the age of 30, the etiology of this pathology in young adults being generally related to unknown or unusual causes. We present the cases of three young adults that suffered strokes with three different unusual etiologies. The three men were 30, 36 and 43 years old, with no pathological antecedents, with neurological symptoms characteristic for stroke. Because the differential diagnostics are sometimes tricky, in all three cases imagery was very helpful. It is necessary to emphasize that in these cases one of the most important things to know is the etiology. It is very important to treat the effect too; this is the reason why we never miss an opportunity to use alteplase when all conditions are met. Common rehabilitation regimes for young adults, who have suffered a stroke, include a combination of physiotherapy, occupational therapy, speech-language therapy, and pharmacological therapy. Strategies to improve motor recovery in young patients include constraint-induced movement therapy, robot-aided rehabilitation, virtual reality training, functional electrical stimulation, increased exercise intensity, and acupuncture.

Keywords: *stroke, young patients, etiology, thrombophilia, drugs abuse, artery dissection, rehabilitation,*

Introduction

Stroke is generally a condition that occurs in older patients. In the past years, the incidence of stroke among young adults has risen (20 per 100000 individuals annually). Causes of ischemic stroke in young adults are diverse, but it was showed that for up to one-third the cause of a stroke cannot be determined (1).

Stroke in young adults may have a dramatic impact on the quality of life and economy by leaving victims disabled during their most productive years when compared with stroke in older adults (1).

Strokes occur rarely in individuals under the age of 45 and are even more uncommon under the age of 30, the etiology of this pathology in young adults being generally related to unknown or unusual causes. Hematological disorders, developmental cardiac abnormalities, and hypercoagulable states are all documented possibilities. Some uncommon etiologies are also recognized as risk factors for stroke in young patients: drug and alcohol use, oral contraceptives, migraines, non-atherosclerotic-vasculopathy, plasma homocysteine level, mitral valve prolapse, multifocal intracranial stenosis, mono-arterial intracranial stenosis, extracranial dissection and cardiac diseases (2).

Multiple studies have shown that one of every five individuals who experience a stroke is under the age of 65, while 5% of all these individuals are younger than 45 years old. These patients represent a significant category of individuals with some unique rehabilitation needs (2).

CASE SERIES

We briefly present the cases of three young men with unusual etiologies of strokes.

We will discuss afterward all the possibilities of rehabilitation for young adults who suffer a stroke.

FIRST CASE: A 30 years old man, with no chronic pathology, was admitted to our department for nausea, vomiting and headaches, symptoms that started approximately 10 days before presentation. At admission blood, pressure and heart rate were in the normal range. No fever and no other abnormalities were found in the general examination. The neurologic examination was in normal ranges: no cranial nerves pathology, without deficits or coordination problems, no sensitivity abnormalities, normal deep tendon reflexes. It was performed a Cerebral Computed Tomography + Angiography which revealed: bilateral thrombosis of sigmoid and transvers sinuses and thrombosis of superior sagittal sinus. He did not need motor rehabilitation, but he was taught to train his mind in order to avoid a cognitive decline.

The patient was tested positive for different mutations of thrombophilia and received anticoagulation in therapeutic dosage with LWMH. He was discharged with no neurological problems, only a slight headache.

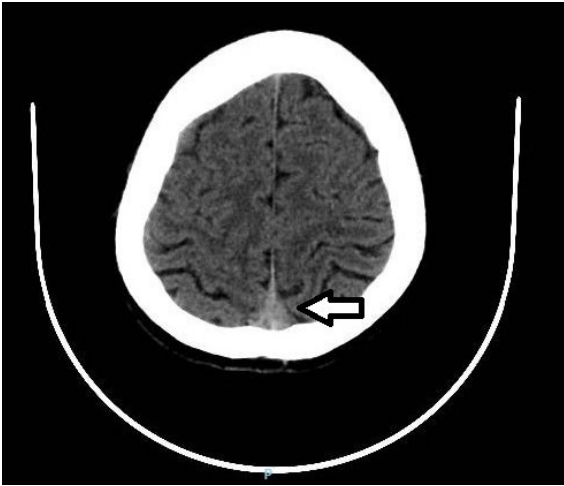


Fig. 1 - Superior sagittal sinus thrombosis – intrasinus thromb – Computed Tomography

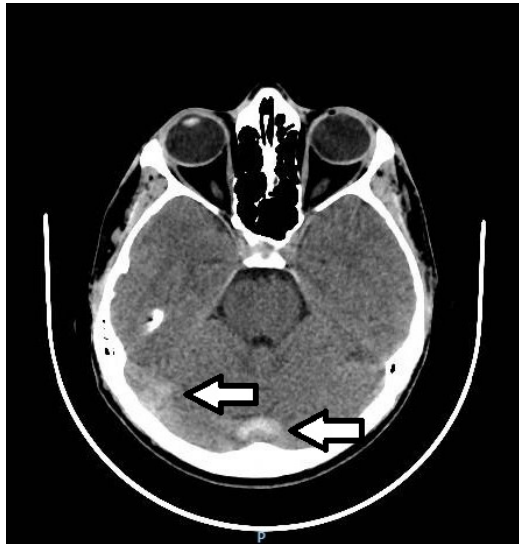


Fig. 2 –Right transverse sinus thrombosis and sigmoid sinus thrombosis – Computed Tomography

SECOND CASE: A 36-year-old patient without any known medical conditions was admitted to our department for headache and dizziness. The actual symptoms started during physical training with intense neck pain that subsequently radiated occipital and decreased with massage and anti-inflammatories. A week ago prior to actual hospitalization, after physical activity the patient accuses intense dizziness followed by faintness. For this symptomatology, he is referred to a neurologist and admitted to the Neurology Department. General clinical examination revealed: good general condition, rhythmic heart sounds, normal blood pressure 140 / 80mmHg, no respiratory symptoms. The neurological examination at admission revealed no pathological findings. Firstly it was performed a Cerebral Computed Tomography revealed a left cerebellar hypodense area – an ischemic stroke. The cerebral CT was completed with a Cerebral MRI that highlighted: a

subacute ischemic lesion in the left PICA territory, with a hemorrhagic component. The MRA performed pointed out a left vertebral artery with linear hyposignal inside and incomplete postcontrast filling, raising the suspicion of a left vertebral artery dissection.

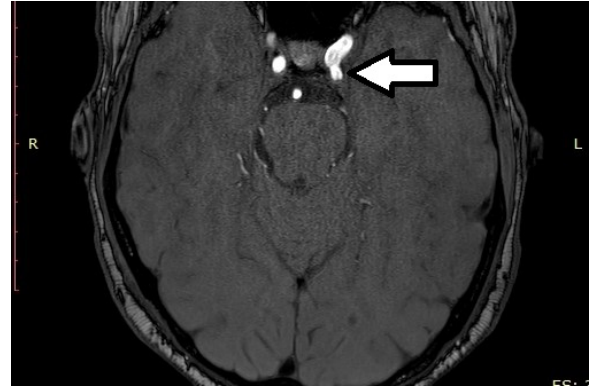


Fig.3 – Left vertebral artery dissection – MRA



Fig. 4 –T2 Flair sequence - subacute ischemic lesion in the left PICA territory, with hemorrhagic component

During the hospitalization, the patient received treatment with cerebral depletion, anticoagulant, antiplatelet agents, lipid-lowering agents, antihypertensives and analgesics. He needed rehabilitation for his gait disturbances. It were used the Rood technique which focuses on the use of peripheral input (sensory stimulation) to facilitate movement and postural responses in the same automatic way as they normally occur and Ayres method which emphasizes the role of sensory stimuli and perception in defining impairment after a brain lesion. Exercises are based on sensory feedback and repetition which are seen as important principles of motor learning. After 14 days he was discharged with no neurological symptoms.

THIRD CASE: A 43 years old man, with no medical history, smoker (approx. 20 years), chronic ethanol and drugs consumer (amphetamine), suddenly presents on the day of admission: a motor deficit in the right limbs and disorders of speaking. He is presented to the neurology department. The neurological exam at admission revealed: right hemiplegia 0/5 MRC, right hemianopsia, anarthria, with a 23 points NIHS score. Was performed a cerebral computed tomography to rule out a hemorrhage that revealed no pathological findings, with a 10 points ASPECT score. Because the patient had less than 4.5 hours from the onset of the symptomatology, it was administered thrombolytic therapy - alteplase 63 ml. The second day after thrombolysis, neurological examination revealed: right hemiparesis 3/5 MRC and moderate dysarthria. He started the very next day the motor rehabilitation: for mobility, he started strengthening exercises (that began in a gravity eliminated plane to allow repetitions without excessive fatigue) and speech rehabilitation with psychological help: words repetition, sentence composition, educational and goal settings. After 24 hours it was performed another cerebral CT which revealed: parcellarischemias in the left cerebellum and left occipital lobe. At discharge, he had no deficits and no speech problems, with a NIHS score of 0 points and 0 points unmodified Rankin Scale.



Fig.5 –Computed Tomography - parcellarischemias in the left cerebellum and left occipital lobe

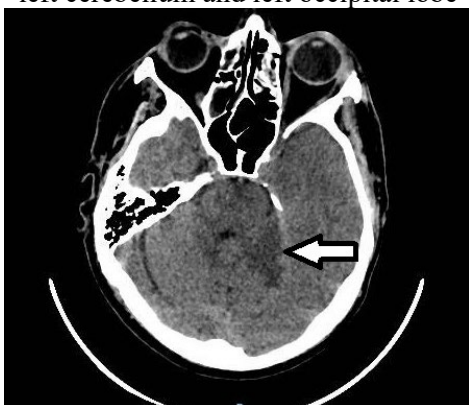


Fig. 6 –Computed Tomography - parcellarischemias in the left cerebellum and left occipital lobe

Discussions

As far as rehabilitation is concerned, in our opinion, this should start from the cause of stroke and its risk factors. Firstly patients should take into account the modifiable risk factors. Modifiable risk factors for stroke include smoking, hypertension, hyperlipidemia, diabetes mellitus, excessive alcohol consumption, and drug use, as well as oral contraceptive use and migraine with aura in women. Smoking and hypertension are the most considerable risk factors for stroke in the young population (4).

Diabetes mellitus, elevated plasma homocysteine level and other hypercoagulable states are risk factors for stroke in the young population, particularly for those older than 35. Drug use is an uncommon risk factor for stroke in general but is more common in the younger population.

It was emphasized in different studies that stroke in the young population is related to the amount consumed: one to two alcoholic beverages daily may reduce the risk of stroke, while excessive alcohol consumption can be a significant risk factor for stroke (4,5).

From the list of non-modifiable risk factors for stroke in young adults we would like to mention race (elevated risk for young black patients), cardiac disease (atrial fibrillation, foramen ovale patent), hypercoagulable states (thrombophilia) and pregnancy and postpartum state in young female patients (5).

It is also necessary to take into account the complications that can appear after a stroke: for example seizures and dementia. For these complications it should be done a differential diagnosis to exclude other pathologies that can cause these problems. For seizures in young adults is imperiously necessarily to rule out a tumour. In time different causes of dementia should be excluded too. In order to rule out a tumour it should be done a cerebral MRI. In young adults one of the tumours discovered are oligoastrocytomas, which even though are rarely reported in the literature, are more prone to localize supratentorial representing separate synchronous tumors and generating epileptic seizures. On the other side, multifocal gliomas are characterized by dissemination along white matter tracts, on the same hemisphere, which can mimic a stroke (5, 6).

In order to rule out other causes of dementia, different biomarkers should be tested. For example, Biomarkers can detect AD in their pre-clinical stage, monitor the disease progression and detect treatment response more objectively. In order to differentiate between AD and other forms of dementia, the p-tau /A β 42 or t-tau/A β 42 ratio is used, with a sensitivity of up to 92% and a specificity of up to 86%. The ratio between A β 42 and p-tau is significantly lower in AD patients compared to those with vascular dementia (7).

When compared to older patients, it is well known that young patients demonstrate greater neurological and

functional recovery following stroke, having a better prognosis. Compared to age-matched controls who have not experienced a stroke, young were found to have a worse prognosis regarding memory, anxiety, and depression despite seemingly excellent functional outcomes (8).

A study by Knoflach et al. (2012) found age to negatively predict good functional outcome according to the Modified Rankin Scale (mRS). The authors observed that the probability of a good outcome decreased by 3.1-4.2% for each 10 year increase in age up to 75 years of age; the probability of a good outcome was found to decrease by 10% for every 10 year increment after 75 (9). These findings are supported by Kato et al. (2015), who reported that the younger stroke population had higher scores for functional ability measured by the mRS and less severe stroke when compared to the older population (10).

Traditional rehabilitation is generally the same for younger and older stroke patients (Teasell et al., 2000). Common rehabilitation regimes for young adults, who have suffered a stroke, include a combination of physiotherapy, occupational therapy, speech-language therapy, and pharmacological therapy. Strategies to improve motor recovery in young patients include: constraint-induced movement therapy, robot-aided rehabilitation, virtual reality training, functional electrical stimulation, increased exercise intensity, and acupuncture (11).

Task-specific training, also referred to as task-oriented, involves therapy in which patients perform practical motor tasks that would be used in their everyday life, such as walking up the stairs. These tasks should be relevant and repetitive (11).

Treadmill walking is a common rehabilitation intervention that is used for patients that suffered a stroke and have walking impairments. It has been shown to increase the total number of steps taken within a training session as compared to a conventional physiotherapy approach. Treadmill training can be used to encourage intensive, repetitive, task-specific training, which has been demonstrated to be an ideal form of gait training to optimize lower limb rehabilitation after stroke. Bodyweight support, provided through a harness above the treadmill, is an increasingly popular approach within rehabilitation programs. It attempts to optimize locomotor-related sensory inputs to all neural regions involved in walking (12).

Dual-tasking training is another rehabilitation method that requires subjects to simultaneously perform complex tasks, such as cognitive and motor tasks, for example walking while holding a conversation. Dual tasks are usually intensively used to further stimulate the damaged brain (12).

Mental practice, involves imagining oneself performing the precise movements involved in the task in the absence of performing the physical movement. The use of mental practice was adapted from the field of sports psychology. The technique has been shown to improve athletic performance when used as an add-on to standard training methods (13).

Mirror therapy rehabilitation is a technique where a mirror is placed beside the unaffected limb, blocking view of the affected limb and creating an illusion of two limbs as if they are both functioning normally. It functions through a process known as mirror visual feedback wherein the movement of one limb is perceived as movement from the other limb. In the brain, mirror therapy induces neuroplastic changes that promote recovery by increasing excitability of the ipsilateral motor cortex which projects to the paretic limb (13).

Speech and language therapy for aphasia and dysarthria rehabilitation can take on many different forms, but the underlying principles remain relatively the same. Treatment is often individualized in different patients because of the different types of aphasia and varying levels of severity. There can be used structured 'lessons' with tasks and instructions, or unstructured conversational therapy. Patients may also be taught to follow commands that are relevant to their day to day activities. Many general speech and language therapies also encourage communication through all forms (eg. gesture, writing) so as to facilitate the patients' day by day living (14).

In the rehabilitation of speech disorders, such as aphasia, music and music-based therapies have been used for over a century. This form of therapy has not been extensively studied in randomized controlled trials. It is thought that music and speech production share the same neural pathways. Rhythmic tapping that is often associated with music-based therapy may engage the right hemisphere sensorimotor network, providing an impulse for verbal production and encourage auditory-motor coupling (15). There are a number of music-based therapies that may be used when treating aphasia. The most prominent is Melodic Intonation Therapy (MIT). This therapy encompasses the two main components of music-based therapy: melodic intonation (singing) and rhythmic tapping while words, and eventually phrases, are repeated (16).

Cognitive behavioural therapy (CBT) has been well established as an effective intervention for depression and numerous other psychological disorders. Suicide ranks first among young people worldwide (WHO), with nearly 1 million young people committing suicide each year. Depression and suicidality have also been associated with an increase in the activity and number of 5-HT_{2A} receptors in the prefrontal cortex and hippocampus, young adults with stroke being a group of risk for this

psychiatric pathology. Studies have shown that dysfunctional thoughts lead to negative emotions and negative behaviors (17). The principal aim of CBT is to evaluate, challenge and modify dysfunctional thoughts, through cognitive restructuring, to promote behavioural change and improve functioning. A psychoeducational approach is often utilized to teach individuals new ways of coping with stressful situations (18).

Conclusions

Young patients have better neurological recovery, less functional disability, and greater long-term survival post stroke than older patients. They tend to achieve higher levels of functional recovery and independence post stroke than older patients, but usually experience different social and adjustment issues.

Conflict of interest - No conflict of interest for any of the authors regarding this paper.

Informed consent

An informed consent was obtained from the patients (or the tutor of the patients) included in this article.

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