



Stroke (Cerebrovascular Accident (CVA) or Brain Attack) and Its Management - Literature Review

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ABSTRACT

Stroke also known as Cerebrovascular Accident (CVA) or brain attack is a medical emergency, a clinical syndrome consisting of ‘rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, which can last more than 24 hours or leading to death with no apparent cause other than that of vascular origin’ (World Health Organization). Stroke, when resolved may lead to hemiparesis or hemiplegia depending on the severity of the damages to the brain. Two types of stroke or CVA is ischemic and hemorrhagic. A Transient Ischemic Attack (TIA) is defined as stroke symptoms that resolve within 24 hours. Some of the symptoms of stroke include changes in alertness, hearing, taste; clumsiness, confusion or loss of memory; difficulty in swallowing, reading or writing; dizziness or vertigo, loss of balance, coordination: muscle weakness in the face, arm or leg (normally on one side) and so on. Management of stroke involves many professionals including physician, physiotherapist, occupational therapist, speech language therapist, medical social worker, prothetist and orthotist, nurse and so on. Rehabilitation of a person who suffers from stroke can bring him/her back on his/her feet and a normal or near normal life.

Keywords: Cerebro-Vascular Accident (CVA), Transient Ischemic Attack (TIA), Ischemic, Hemorrhagic, Dysarthria, Thrombosis

INTRODUCTION

Stroke (also known as Cerebro-Vascular Accident (CVA) or brain attack) is defined by the World Health Organization as far back as 1976, as a clinical syndrome consisting of ‘rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 h or leading to death with no apparent cause other than that of vascular origin’ (World Health Organization (WHO) MONICA, 1998). A stroke is the loss of brain function due to a disturbance in the blood supply to the brain. It occurs when a blood clot blocks the blood flow in a vessel or artery or when a blood vessel breaks, interrupting blood flow to an area of the brain. When either of these things happens, brain cells begin to die. When brain cells die during a stroke, abilities controlled by that area of the brain are lost. These include functions such as speech, movement, and memory. The specific abilities lost or affected depend on the location of the stroke and on its severity (i.e., the extent of brain cell death). For example, someone who has a small stroke may experience only minor effects such as weakness of an arm or leg.

Someone who has a larger stroke may be paralyzed on one side or lose his/her ability to speak. Some people recover completely from less serious strokes, while other strokes can be fatal (National Stroke Association complete Guide to Stroke (NASCOS), 2014). This disturbance is due to either ischemia (lack of blood flow) or hemorrhage (Sims & Muyderman, 2009). It is a medical emergency and can cause permanent neurological damage or death.

A Transient Ischemic Attack (TIA) is defined as stroke symptoms and signs that resolve within 24 hours (Donnan et al., 2008; Brass, 2014). A TIA is a transient episode of neurologic dysfunction caused by ischemia (loss of blood flow) – either focal brain, spinal cord or retinal – without acute infarction (tissue

death). TIAs have the same underlying cause as strokes: a disruption of cerebral blood flow (CBF), and are frequently referred to as mini-strokes, because they cause the same symptoms associated with stroke, such as contralateral paralysis (opposite side of body from affected brain hemisphere) or sudden weakness or numbness. A TIA may cause sudden dimming or loss of vision (amaurosis fugax), aphasia, slurred speech (dysarthria) and mental confusion. But unlike a stroke, the symptoms of a TIA can resolve within a few minutes or 24 hours. Brain injury may still occur in a TIA lasting only a few minutes. Having a TIA is a risk factor for eventually having a stroke or a silent stroke (Ferro et al., 1996; Easton et al., 2009; Brass, 2014).

Stroke is a preventable and treatable disease. Over the past two decades a growing body of evidence has overturned the traditional perception that stroke is simply a consequence of aging that inevitably results in death or severe disability. Evidence is accumulating for more effective primary and secondary prevention strategies, better recognition of people at highest risk, and interventions that are effective soon after the onset of symptoms. Understanding of the care processes that contribute to a better outcome has improved, and there is now good evidence to support interventions and care processes in stroke rehabilitation (National Institute for Health and Clinical Excellence (NHS), 2014). For instance, in the UK, the National Sentinel Stroke Audits have documented changes in secondary care provision over the last 10 years, with increasing numbers of patients being treated in stroke units, more evidence-based practice, and reductions in mortality and length of hospital stay (NHS, 2014).

TYPES OF STROKES

There are two broad categories of stroke: ischemic and hemorrhage.

Ischemic Strokes

Ischemic strokes are caused by a lack of blood flow to the brain and account for about 70 percent of all strokes. Within the category of ischemia, there are several subcategories of stroke. One common type, called cerebral athero-thrombosis (also referred to as large artery disease), is caused by a clot (thrombus) that blocks blood flow in an artery. The narrowing leads to a low flow state referred to as watershed (or distal field) ischemia. If the resulting lack of oxygen results in death of brain tissue and permanent damage, the term cerebral infarction is used. Clots usually do not occur in healthy arteries, but tend to form at or adjacent to an area of a vessel damaged by atherosclerosis. In the atherosclerotic process, plaque—an amalgam of fatty substances, cholesterol, and waste products of cells, calcium, and a blood-clotting material called fibrin—builds up as thick, irregular deposits on the inner lining of an artery (Brass, 2014).

Hemorrhagic Stroke

Hemorrhage accounts for about 20 to 25 percent of all strokes, in which blood seeps from a hole in a blood vessel wall into either the brain itself (intra-cerebral hemorrhage) or the space around the brain (subarachnoid hemorrhage). In intra-cerebral hemorrhagic stroke, blood leaks from small vessels at the base of the brain. Long-term exposure to high blood pressure is thought to weaken the walls of these small arteries, and eventually they burst. About two-thirds of patients with an intra-cerebral hemorrhage have a history of hypertension; diabetes and atherosclerosis accelerate the damage. Other causes of bleeding into the brain include brain tumor, trauma, arterio-venous malformation (AVM), and stimulant drugs such as amphetamines and cocaine. Intra-cerebral hemorrhage accounts for about 10 to 15 percent of all strokes. The onset of symptoms is usually acute, with severe headaches and decreased consciousness. Other symptoms depend on the size and location of the hemorrhage.

One type of brain hemorrhage, cerebellar hemorrhage, is especially important to recognize because prompt evaluation, often followed by surgery, can be lifesaving. Cerebellar hemorrhage means bleeding into the cerebellum with symptoms that usually include disequilibrium or dizziness, incoordination (especially trouble in walking), headache, nausea, and vomiting. Subarachnoid hemorrhage is usually caused by an aneurysm or a vascular malformation (Jasmin *et al.*, 2013; Wu *et al.*, 2013; Brass, 2014; NSA, 2014).

Epidemiology, Incidence and Prevalence Of Stroke

Stroke is a leading cause of morbidity and mortality worldwide, and it is likely to worsen in developing countries over the next two decades based on the projections by the World Health Organization (WHO) (Wahab, 2008). Stroke is a major public health problem worldwide. It is the third leading cause of death in industrialized countries (after cancer and ischemic heart disease); accounting for approximately 4.6 million deaths annually (Bonita, 1997; Nwosu, 2001) and ranks among the 5 most common causes of hospital deaths in adults in Africa. The incidence rate for all strokes and for stroke subtypes varies widely between and within populations. In industrialized countries of Europe and North America – where half of the strokes occur before age 75 years, - 25,000 to 85,000 new cases of a significantly ischemic strokes occur yearly (Nwosu, 2001).

In Southeast Asia and also in Africa – where peak age is 1 to 2 decades earlier than in industrialized countries and 0.9% - 4% of hospital admissions are due to strokes – a significantly higher proportion of hemorrhagic strokes occur. Approximately for every 3 female stroke patients there are 5 to 4 males up to the age of 85yrs (in industrialized countries). Beyond this age females predominate.

Stroke is a medical emergency, with a mortality rate higher than most forms of cancer. It is the second leading cause of death in developed countries (WHO, 2004; Alkali *et al.*, 2013) and is the most common cause of serious, long-term disability in adults (Zweifler, 2003; Amu *et al.*, 2005; Alkali *et al.*, 2013).

Stroke is third leading cause of death in America (Hoyert *et al.*, 1999; American Heart Association, 2008), killing 160,000 Americans every year (Hoyert *et al.*, 1999).

From 1997 to 2007, the annual stroke death rate fell approximately 34 percent, and the actual number of deaths fell by 18 percent (American Heart Association, 2011). Approximately 55,000 more women than men have a stroke each year (NSA, 2014). Every year more than 750,000 Americans have a new or recurrent stroke (Williams *et al.*, 1999); every forty-five seconds in the United States, someone experiences a stroke. Over the course of a lifetime, four out of every five American families will be touched by stroke (American Heart Association, 1999) and approximately one-third of all stroke survivors will have another stroke within five Years (National Institute of Health, 1999). Of the 590,000 Americans who survive a stroke each year, approximately 5 to 14 percent will have another stroke within one year. The rate of having another stroke is about 10 percent per year thereafter (NSA, 2014).

In the UK, Stroke is also a major health problem. It accounted for over 56,000 deaths in England and Wales in 1999, which represents 11% of all deaths (Mant *et al.*, 2004). Most people survive a first stroke, but often have significant morbidity. Each year in England, approximately 110,000 people have a first or recurrent stroke and a further 20,000 people have a TIA. More than 900,000 people in England are living with the effects of stroke, with half of these being dependent on other people for help with everyday activities (National Audit Office, 2005).

In Africa, stroke account for 0.9% to 4% of all hospital admissions, and 2.8% to 4.5% of total deaths (Oni *et al.*, 2008). The incidence of stroke in Africa is on the increase, because, access to safe and effective blood pressure control medication is limited; consequently, the mortality, case fatality and morbidity remains high (Oni *et al.* 2008). According to WHO estimates, death from stroke in developing countries in 2001 accounted for 85.5% of stroke death worldwide, and the number of disability-adjusted life years (DALYs) which comprises years of life lost and years lived with disability in these countries was almost seven times that in developed (high-income) countries (Connor *et al.*, 2007; Lavados *et al.*, 2007). The phenomenal increase in the incidence of stroke in Nigeria Africans and in other developing Africans has been described as “the Epidemiologic Transition” from infectious and nutritional disease burdens to diseases related to hypertension, high-fat diets, cigarette smoking and sedentary lifestyles (Obiako *et al.*, 2011). The current prevalence of stroke in Nigeria is 1.14 per 1000 while the 30-day case fatality rate is as high as 40% (Wahab, 2008). The frequency of stroke in hospital populations in Nigeria varied from 0.9% to 4.0% (Ogun *et al.*, 2005). Stroke has also been reported, in various studies in Nigeria, to be the commonest cause of neurological admissions. At the Aminu Kano Teaching Hospital (AKTH) Kano, stroke accounted for 77.6% of neurological admissions (Ogun, 2000; Ojini & Danesy, 2003; Talabi, 2003).

At the University College Hospital (UCH) Ibadan, LUTH, and OSUTH, stroke accounted, respectively, for 5%, 8%, and 17% of medical deaths (Owolabi & Nagoda, 2012). The frequency of ischemic, hemorrhagic and their respective etiologies also vary in different regions of the world (Owolabi & Nagoda, 2012). In Nigeria, previous reports showed that infarctive stroke is commoner than hemorrhagic stroke (64% and 25% respectively) as far back as 1979 (Osuntokun et al., 1979), however, a changing pattern with an increasing frequency of hemorrhagic stroke has been suspected (Owolabi & Nagoda, 2012). Also, in Obafemi Awolowo University Teaching Hospitals Complex, it is responsible for 0.9 to 4% of total admissions to hospitals and 0.5 to 45% of neurological admissions (Komolafe *et al.*, 2007).

RISK FACTORS FOR STROKE

Various risk factors for stroke include: high blood pressure, heart disease, smoking, diabetes, cholesterol, obesity and inactivity, oral contraceptives and estrogen replacement therapy, history of ischemic attacks, heredity and family history, age, an earlier stroke, carotid bruit, race, an elevated hematocrit (number of red cells in the blood), geographic location (especially in the southeastern United States)

DIAGNOSING AND ASSESSING STROKE

A variety of diagnostic tools are available, from history-taking and trained observation to sophisticated radiologic imaging studies. The tests performed will vary with the type of stroke, its severity, and the planned therapies. Regardless of the tests used, the goals are the same: to exclude nonvascular reasons for the neurological symptoms and to pinpoint the cause, location, and extent of the stroke. Perhaps the most important diagnostic tool is the initial history and physical examination of the patient. Critical details about the medical history may have to be obtained from a family member if the patient is disoriented or unable to speak.

During the examination, a variety of neurological functions will be tested: orientation, memory, emotional control, motor skills, tactile sensation, hearing, vision, and the ability to read, write, and speak.

The general examination should also include a search for evidence of high blood pressure, coronary heart disease, or disease in other parts of the vascular system. Using findings from the history, neurological examination, and general examination, the physician will formulate an initial opinion about the location and type of stroke. Laboratory and radiological tests will then be ordered to help confirm or exclude the physician's initial suspicions. Tests are usually done on samples of blood, urine, and, occasionally, cerebrospinal fluid. They focus initially on excluding conditions that can mimic or worsen a stroke, such as infection or low levels of blood sugar. Screening may also be done for diabetes, elevated blood cholesterol, bleeding disorders, and abnormalities in blood proteins—risk factors for cardiac disease and recurrent stroke.

The following tests also have to be done to help find the type, location, and cause of the stroke and rule out other disorders:

- Angiogram of the head: to look for a blood vessel that is blocked or bleeding
- Carotid duplex (ultrasound): to see if the carotid arteries in your neck have narrowed
- Echocardiogram: to see if the stroke could have been caused by a blood clot from the heart
- Magnetic resonance angiography (MRA) or CT angiography: to check for abnormal blood vessels in the brain (Jasmin *et al.*, 2013; Brass, 2014).

SIGNS AND SYMPTOMS OF STROKE

The main initial signs of a stroke can be identified by remembering the word F.A.S.T., which stands for Face-Arms-Speech-Time.

- **Face** – Does one side of the face droop or is it numb? The person is asked to smile, is the smile uneven?
- **Arms** – the person may not be able to raise both their arms and keep them there due to weakness or numbness in the arms. Ask the person to raise both arms. Does one arm drift downward?

- **Speech** – the person may have slurred speech. Is the person's able to speak or hard to understand? Ask the person to repeat a simple sentence like "the sky is blue". Is the sentence repeated correctly?
- **Time** – if any of these signs or symptoms are present, it is time to get the person to the hospital immediately (Harbison, 1999).

The symptoms of stroke depend on what part of the brain is damaged. In some cases, a person may not know that a stroke has occurred. Most of the time, symptoms develop suddenly and without warning. However, symptoms may occur on and off for the first day or two. Symptoms are usually most severe when the stroke first happens, but they may slowly get worse.

A headache may occur if the stroke is caused by bleeding in the brain. The headache:

- Starts suddenly and may be severe
- Occurs when lying flat
- Wakes the person up from sleep
- Gets worse when the person changes positions or when he/she bends, strains, or coughs

Other symptoms depend on how severe the stroke is and what part of the brain is affected. Symptoms may include:

- Change in alertness (including sleepiness, unconsciousness, and coma)
- Changes in hearing
- Changes in taste
- Changes that affect touch and the ability to feel pain, pressure, or different temperatures
- Clumsiness
- Confusion or loss of memory
- Difficulty swallowing
- Difficulty writing or reading
- Dizziness or abnormal feeling of movement (vertigo)
- Lack of control over the bladder or bowels
- Loss of balance
- Loss of coordination
- Muscle weakness in the face, arm, or leg (usually just on one side): this may be hemiplegia, hemiparesis or monoplegia/monoparesis depending on the part of brain being affected.
- Numbness or tingling on one side of the body
- Personality, mood, or emotional changes
- Problems with eyesight, including decreased vision, double vision, or total loss of vision
- Trouble speaking or understanding others who are speaking
- Trouble walking (Jasmin et al., 2013).

PREVENTION OF STROKE

Reducing one's stroke risk factors lessens one's chance of having stroke. Stroke may be prevented by changes in lifestyle. These include:

- Avoiding smoking
- Cutting down on fats to help reduce the amount of plaque build up
- Eating a healthy diet including plenty of fruits and vegetables
- Limiting sodium in the diet, thereby reducing blood pressure
- Exercising regularly
- Moderating alcohol intake
- Maintaining a normal weight
- Controlling blood pressure and keeping blood sugars under control (Reynolds et al., 2003; Elderle & Brown, 2006; American Heart Association, 2007; Larsson et al., 2011; Krucik, 2013; NSA, 2014).

MANAGEMENT OF STROKE

Medical Treatment

Because stroke is a medical emergency, acute case of it is normally treated in a unit of the hospital known as 'Stroke Unit' (Davis et al., 2006; Donnan et al., 2008). A stroke unit is a geographically localized treatment facility involving a multidisciplinary stroke team of medical, nursing and allied health staff, incorporating best-practice stroke treatment protocols (Adams et al., 2003; Kwan et al., 2004). It has been shown that people admitted to a stroke unit have a higher chance of surviving than those admitted elsewhere in hospital, even if they are being cared for by doctors without experience in stroke (Bamford, 2000; Donnan et al., 2008). Rapid triage of patients to a stroke unit has been shown to reduce mortality by $\geq 20\%$ (Stroke Unit Trialist Collaboration, 1997a) and improve functional outcomes (Stroke Unit Trialist Collaboration, 1997b), reducing disability and the need for institutional care compared with treatment in a general medical ward. Adherence to guidelines reduces costs with shorter hospital stays (Davis et al., 2006). However, access to stroke unit care remains a problem, even in countries with well-developed stroke systems (Davis et al., 2006).

Stroke units can be supervised by a neurologist or a general physician with stroke training and expertise (Davis et al., 2006). Patient who oxygen saturation level drops below 95% will be given supplemental oxygen (Prasad et al., 2011). Treatment of stroke depends on the type. Most treatment of stroke during the acute phase centers on maintaining fluids and electrolytes, such as sodium and potassium, avoiding low blood pressure (hypotension), and avoiding the secondary complications of stroke and paralysis. The latter includes pneumonia, urinary tract infections, muscle contractures, and pressure breakdown of the skin (bedsores). The physician will also attempt to anticipate and avert deterioration after a stroke. This will require constant monitoring and evaluation and may necessitate a number of laboratory tests. For ischemic stroke, anticoagulant medications such as heparin are sometimes used to treat an acute ischemic stroke. While heparin does not dissolve existing clots, it can prevent the formation of new ones. Thus it may help prevent subsequent strokes, which occur in up to 20 percent of ischemic stroke cases.

Patients are placed on antiplatelet medications like aspirin daily in a dosage between 300 – 1200mg per day to prevent heart attack (Brass, 2014; NHS, 2014). A combination of aspirin (25mg) and extended release of dipyridamole (200mg) twice or clopidogrel (75mg OD) are all acceptable for initial therapy (Prasad et al., 2011). If aspirin failed, anticoagulant like warfarin (Coumadin) is also normally used. This is used when it is diagnosed that the patient has atrial fibrillation (Brass, 2014). Blood pressure lowering treatment is recommended for those patients with history of TIA (Prasad et al., 2011). Those patient with the history of TIA whose total cholesterol level is $>200\text{mg\%}$, or LDL cholesterol $> 100\text{mg\%}$ should be started with Statin, but caution is said to be exercised in a patient with history of hemorrhagic stroke.

Thrombolytic and anticoagulant drugs are not used for a hemorrhagic stroke because they will cause further bleeding into the brain. For some people a surgical procedure called carotid endarterectomy may be an option to prevent a CVA or a recurrent CVA. This surgery removes the build-up plaque in the arteries and improves flow to the brain. Certain hemorrhagic CVA caused by a brain aneurysm may be treated with surgery to relieve pressure in the brain aneurysm (Right Diagnosis, 2014).

STROKE REHABILITATION

Stroke rehabilitation is the process by which those with disabling strokes undergo treatment to help them return to normal life as much as possible by regaining and relearning the skills of everyday living. It also aims to help the survivor understand and adapt to difficulties, prevent secondary complications and educate family members to play a supporting role. The rehabilitation process becomes more active as the patient becomes medically stable (usually within a day or two). Beyond the patient and family, rehabilitation is a team effort with input from physiatrists (rehabilitation physicians), neurologists, nurses, physical therapists (PTs), occupational therapists (OTs), speech-language therapists (SLT), and social workers, orthotists. Some team may even involve psychologists because of post-stroke depression. Their common goal is to help the patient and family achieve the maximal level of functioning possible. Rehabilitation involves working on the ability to produce strong movements or the ability to perform

tasks using normal patterns. Emphasis is often concentrated on functional tasks and patient's goals (Brass, 2014).

Good nursing care is fundamental in maintaining skin care, feeding, hydration, positioning, and monitoring vital signs such as temperature, pulse, and blood pressure. Stroke rehabilitation begins almost immediately.

PTs and OTs have overlapping areas of expertise, however PTs focus on joint range of motion and strength by performing exercises and re-learning functional tasks such as bed mobility, transferring, walking and other gross motor functions. Physiotherapists can also work with patients to improve awareness and use of the hemiplegic side. The primary objective of physical therapy is to help patients who are partially paralyzed learn to walk again.

OT ultimate goal is to help the patient resume some sort of employment; if possible, occupational therapy encompasses all aspects of everyday life. Occupational therapists help patients regain the muscular coordination necessary to perform activities of daily living such as dressing, bathing, and using the toilet. A patient who is paralyzed on one side is taught how to maneuver clothing using the able side of the body, and is advised about clothing styles-such as pullover rather than buttoned shirts-that are easiest to maneuver. Patients are taught how to use a wheelchair, and how to transfer from bed to wheelchair and vice versa. The occupational therapist will also advise the family about changes that can make a patient's move back home easier and safer: handrails in the bathtub and by the toilet, a raised toilet seat, and ramps in place of stairs, and widened doorways to accommodate a wheelchair, if one is still necessary (Brass, 2014).

A speech therapist should lay the groundwork while the patient is in the hospital, first working to obtain from the patient reliable (verbal or nonverbal) yes or no responses to questions. Then the therapist uses a variety of techniques, including repetition and pointing to pictures, to reestablish the fundamentals of language (Brass, 2014).

Orthotists will prepare orthotic devices that have been prescribed by the PTs, for example, ankle foot orthosis. Apart from the above treatment means, the following new methods of treatment are also incorporated according to NSA (2012):

Modified constraint-induced therapy (mCIT) is an intensive motor practice. The therapy involves restricting the use of a less affected part of the body, which forces the patient to use the weakened part of the body. While mCIT is a behavior therapy, regular practice can improve nerve function in the central nervous system. The therapy is applied with varying intensity and duration over time depending on the individual's motor functioning.

Cortical stimulation is a type of electrical stimulation, but instead of directly on the arm or hand, the electrodes stimulate the part of the brain called the cortex. The tiny electrode is placed on the dura, the tough membrane that covers the brain. The electrode sends an electrical current to the brain while the stroke survivor undergoes rehabilitation exercises. This treatment is a safe way to regain mobility.

Motor imagery is the process of imagining the movement of the affected part of the body. This mental practice activates areas of the brain and muscles as if the patient is actually doing an activity. The network of nerves in the brain involved in visualization and physical movement overlap, making this an effective activity when paired with other therapies.

CONCLUSION

Stroke otherwise known as cerebrovascular accident or brain attack is a medical emergency that needs urgent medical care immediately it is diagnosed. Transient Ischemic Attack (TIA) is a mini-stroke because all the symptoms resolve before or within 24 hours. Any person who suffered TIA is also prone to having a full stroke. The FAST sign is normally being used for initial diagnosis which warrants the person to be taken to the hospital if those symptoms are there. Stroke is one of leading causes of death worldwide and is the leading cause of disability worldwide. It constitutes a lot of economic burden on developed nations of the world. Major types of stroke are Ischemic and hemorrhagic stroke. Stroke is preventable and treatable. Rehabilitation of a stroke patient is normally done in a stroke unit where several health professionals such as Physiatrist, Physical therapist, Occupational therapist, Nurse, Speech-

Language therapist, Orthotist, Social worker, Psychologist and so on work on the patient to bring him/her back on his/her feet and a normal or near normal life.

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