

Carotid Endarterectomy versus Medical Therapy in Stroke Prevention

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ABSTRACT

Stroke is one of the leading causes of deaths in different parts of the world affecting individuals of different ages. It is mostly dominant among people having risk factors such as drug abuse, having a background of a mild stroke, and overweight. Various approaches including carotid endarterectomy (CEA) and medical therapy have been used as mechanisms for preventing stroke particularly ipsilateral ischemia. However, there are several studies suggesting that even though CEA has the potential of reducing the risks of stroke, incidences of a high residual risk of stroke after carotid endarterectomy since various cases of increased short-term myocardial infarction after CEA are recorded. Based on the results drawn from randomized trials comparing the effectiveness of CEA and medical therapy, CEA provides better protection from ipsilateral strokes than the latter. The efficacy of CEA is more pronounced in patients presenting symptomatic and asymptomatic carotid artery disease. The aim of this study was to explore the comparative merits and demerits of using carotid endarterectomy and medical therapy to determine the most appropriate of the two approaches to be used in specific cases.

This research concludes that even through both therapeutic methods and carotid endarterectomy have the ability to reduce the predisposition of patients to different events of stroke, each of them have inherent limitations that must be addressed effectively to contribute to overall positive medical outcomes.

Keywords: Carotid Endarterectomy, stroke, medical therapy.

INTRODUCTION

Various diseases and defects in organ functioning threaten public health in virtually every society. Irrespective of the nature of facilities developed to control some of the life-threatening diseases, many of them continue to emerge; existing ones mutate and relapse hence the need to pursue research into the most advanced therapeutic responses. One of the health problems that result in impairment of normal body functioning; attacks both the endocrine and nervous systems. A stroke is a brain deflection caused by a cut in the blood supply to the brain thus depriving its cells of adequate oxygen. The result of this attack is that the brain memory and control of the muscles are lost. Stroke is the commonest cause of mortality after coronary artery disease. Also, it is the commonest cause of chronic adult disability. The lifetime risk of stroke after 55 years of age is 1 in 5 for women and 1 in 6 for men¹. Stroke unit has a

multidisciplinary team comprising medical, nursing, physiotherapy, occupational therapy, speech therapy, and social workers. It has been amply demonstrated that patients treated in stroke units have substantially better outcome of acute stroke².

This study explores the comparative merits and demerits of using carotid endarterectomy and medical therapy to determine the most appropriate of the two approaches to be used in the prevention of stroke.

Literature Search Strategy

An electronic search was conducted in the scientific database PubMed from 1968 to January 2015 with the words “stroke”, “incidence”, “prevalence”, “case-fatality”, “risk factors”, “genetics”, or “disability-adjusted life year”. Relevant articles were also searched in the national journals.

Facts about the Incidences of Stroke

Stroke is one of the leading causes of deaths in even regions with the most advanced medical services such as the United States of America. In the US, stroke ranks as the third most dominant cause of deaths and casualties. The trend implies that the prevention and treatment of mild stroke are important since the people who survive stroke sustain critical disabilities that overly change their lives³. The incidences of stroke among populations do not show a particular trend in age specificity of effects, but most successful preventions occur among patients within the age limits of zero and seventy-five years. While in some regions the elderly account for the greatest proportion of the people affected by stroke, in other areas such as Iran, the condition presents at younger ages⁴. This demographic uncertainty in the effects of stroke on the society imposes different social and economic burdens on public policy makers and health professionals. In countries where the stroke is not age specific and cuts across the age groups, it imposes greater medical costs than in places where it occurs within a particular segment of the population alone⁵. Though stroke itself has far-reaching medical challenges, it also increases the burden of handling other diseases. For instance, stroke is associated with poor medical outcomes for various conditions, increases the complexity of managing other presenting diseases and leads to a surge in the overall medical costs.

The extent of stroke damage depends on factors such as the part of the brain attacked, and the extent to which the brain is damaged. The fact that the brain is the central nervous system implies that any alterations in its standard functions impose high neurological stress on the other parts of the body leading to either a partial defect or complete impairment of their operations⁶. Stroke presents in three different kinds including ischemic stroke, hemorrhagic stroke, and Transient Ischemic Attack (TIA). In the United States of America, stroke resulted in over one hundred and twenty-eight thousand deaths in 2009. A retrospective review of these sets of data on deaths resulting from stroke presents that various risks predispose individuals to the life-threatening attack⁷. Stroke is dominant among the overweight people, elderly, those with a familial background of stroke, the person who do not

participate in an activity, heavy drinkers and users of narcotics.

Ischemic stroke is the most common type of stroke that accounts for more than 85% of reported cases of the attack. It is caused by blockages or narrowing of the blood arteries that supply blood to the brain. On the other hand, either bursting of the arteries supplying blood to the brain or leaking blood causes a hemorrhagic stroke⁸. Hemorrhagic and ischemic strokes cause many cases of premature deaths and increased morbidity of both men and women worldwide. The two most common therapeutic interventions for stroke are carotid endarterectomy and medical therapy. Medical therapy for stroke prevention comprises of different approaches depending on whether the attack is a primary stroke or secondary stroke⁹. The choice of the medication is also dependent on the immediacy of the intervention required. The two broad interventions have different merits and demerits that inform specific choice to use in specific situations.

Carotid Endarterectomy (CEA) and Prevention of Stroke

Different studies in the recent past have indicated that carotid artery stenosis and stroke have a strong correlation. Based on such findings, suggestions have been made, so that carotid artery stenosis requires being correlated as a treatment approach for preventing events of stroke. Therefore, carotid endarterectomy (CEA) has been advanced as a means of treating carotid endarterectomy. Carotid Endarterectomy is a procedure primarily designed for the treatment of carotid artery disease¹⁰. Changes in the structure and operation of arteries that supply blood to the brain cells cause a stroke. This relationship means that treating the carotid artery disease results in a reduction in the damages along the walls of the arteries hence stroke prevention. Carotid artery disease is caused by fatty or waxy deposits along the walls of the carotid arteries resulting in their narrowing and reduced supply of blood¹¹. In the human body, carotid arteries lie on the sides of the neck and directly supply blood to the brain. A build-up of plaques on these carotid artery arteries is called atherosclerosis that is closely associated with risks of stroke. Constriction of the blood vessels means that the amount of blood reaching the brain reduces appreciably thus increasing the risks of stroke. Carotid

endarterectomy removes the plaques thus improving the flow of blood through the carotid arteries and eventually lowering the probability of stroke occurring.

Patients suffering from carotid artery stenosis are at high risk of stroke hence carotid endarterectomy is a recommended and proactive approach for stroke. Despite the fact that CEA is considered as not directly targeting stroke, its use in real situations leads to an elimination of some of the risk factors associated with stroke such as the constriction of arterial walls, especially those that take blood to the brain cells¹⁰. Studies propose CEA as an appropriate way of reducing the risks of stroke, but its associated research shows that it always leads to the various incidences residual risk of stroke. In essence, residual stroke often present after a period of carotid endarterectomy. These residual effects imply a need to explore further therapies that prevent them. For instance, endovascular treatments have been recommended as an alternative for CE. Nonetheless, research on comparative effectiveness of endovascular treatments and surgery in patients with carotid artery stenosis is still inconclusive¹². SAPHIRE trials indicate that administration of CEA significantly increases the probability of short-term myocardial infarction.

Carotid Endarterectomy has some limitations in reducing the possibility of stroke since significantly increases the occurrences of myocardial infarctions, which lead to life-threatening events. In most cases, long-term follow-up of patients who have a history of me CEA administration compared to those who undergo surgery indicates that there are always more cases of stroke in the former case than the latter.

Carotid endarterectomy is a significant intervention especially among the patients presenting with carotid artery stenosis. In such situations, carotid endarterectomy is more appropriate in improving the natural history of the disease more than the alternative medical treatment would. Various considerations are considered before choosing the administration of carotid endarterectomy¹³. For instance, among the symptomatic-good risk patients with surgical morbidity and mortality (stroke and death) of below 6%, proven indications for CEA include one or multiple ischemic attacks in the past six months and reported

carotid artery stenosis of more than 50%. Nonetheless, there are acceptable but not proven indications for CEA administration include cases of Ipsilateral TIA and carotid artery stenosis of more than 70%, and required coronary artery bypass grafting (CABG).

The successful application of CEA in preventing stroke is also age sensitive just like the medical alternatives. For instance, the older adults of more than seventy years show improved outcomes. This positive result is even more pronounced where the arterial anatomy does not inform the need for endovascular intervention. Among the young people, CEA has similar periprocedural complications and prolonged risk for ipsilateral stroke as the elderly.

Traditional medical knowledge points to the fact that emergency application of CEA in an acutely occluded carotid artery can lead to a conversion of ischemic cerebral infarct to a hemorrhagic one thus increasing the risks of death. Nonetheless, with proper timing, CEA has a potential of leading to optimal outcomes in the recovery from stroke. Studies have realized the success of CEA among asymptomatic patients within the age bracket of zero and seventy-five years¹⁴. This information means that the elderly such as those whose age exceed seventy-five years might not give the same positive results with CEA as the younger ones. Among the cohort, if young people, the use of CEA reduces the risks of strokes. Nonetheless, even with successful prevention of stroke using CE, the net benefit resulting from such an intervention depend on the risks of untreated carotid lesions. These carotid lesions often reduce if subjected to proactive medication.

With an early intervention in patients suffering from acute non-hemorrhagic strokes and careful selection of patients, CEA is useful in reducing the severity of the paralysis. Nonetheless, the use of CEA in patients depending on asymptomatic dialysis-dependent patients shows that it portends more risks than benefits¹⁵. Furthermore, the risks are more pronounced among symptomatic patients hence a need to apply it only to a small segment of the population that is carefully selected. In the selection of patients to administer CEA comorbidities are the major risk factors that should be considered. The risk associated with this procedure increase

depending on the particular condition of the patient.

The results obtained from randomized trials of the effectiveness of CEA in stroke prevention show that the procedure has a potential of reducing the risks of the attack both in the short term and long term ¹⁶. Nonetheless, the fact that using CEA influences the emergence of other major vascular events arouses concerns on its efficacy. For instance, the use of only CEA as a process of lowering the risk of a 30-day myocardial infarction. The results obtained from the multiple studies are important indicators of the most appropriate medical choices to use in the case of suspected or actual stroke ⁽³⁾. They also provide evidence that justifies the specific guidelines for the treatment of patients suffering from the risks associated with carotid artery stenosis. The trials have also pointed out a need for recording the adverse effect events of clinical tests. They require normative recording of the negative impact events of clinical trials ⁸. Also, it is important that any procedures involving the use of CEA take into consideration the myocardial infarction events to increase the probability of positive outcome among patients with bit secondary and primary stroke.

The fact that stroke results in permanent deformities and a reduced ability to cope with various life activities imply a need for its prevention. In essence, prevention of stroke is perceivably the most efficient way of reducing an individual and the public burden resulting from the attack. In cases needing stroke medications, the clinicians often ensure a balance between the specific preventive therapies and their inherent risks and costs of use. Randomized trials have proven to be an effective way of assessing the potential of each of the interventions in addressing the problem of stroke and its associated complications. Carotid endarterectomy is among the most comonly applied surgical procedure in the prevention of stroke. Its application has been subjected to various randomized test to determine the potential, weaknesses and possible modifications to ensure efficacy in use.

Medical Therapy for Stroke

In many areas where several cases of stroke are recorders such as in the United States of America, over seven hundred

thousand cases are reported. Most of these reported stroke attacks are caused by the blockage of smooth blood flow resulting in only a little amount of oxygen entering the most critical and high oxygen demanding cells in the brain. This affected blood flow results in impaired operations of some parts of the brain or their permanent damages. Therefore, the function of any forms of medication or prevention is to limit progression to other regions of the brain.

The success of medical interventions depends on the amount of damage, the speed at which therapeutic interventions begin and the efficacy of the chosen approach itself. If medical interventions are ineffective or administered later then, people can lose various bodily abilities including speaking, sight and other standard functions. Statistics by the American Stroke Association indicate that strokes lead to permanent disabilities and even death. Therefore, early treatment and prevention can reduce the severity of brain damage ⁽²⁴⁾. Multiple factors determine the therapeutic choices for stroke prevention. For example, ischemic and hemorrhagic strokes are addressed differently; the length of time between the interventions and when it first presented determine the expected outcome from the medications.

In the very early medical therapies for stroke, especially for the ischemic one, the goal is the need to restore blood flow to the areas of the brain that are already debilitated. This restoration is supposed to be very swift to minimize the potential health complications attributable to the progression of the condition. Within the early periods of stroke treatment, there are two main types of mechanisms used ¹⁷. The first treatment is Intravenous thrombolytic with alteplase while the second is Intra-arterial mechanical thrombectomy. The first procedure is also called bloat buster therapy, and the latter involves the opening up of the blocked artery with devices that retrieve stent. In the administration of treatment and mechanical thrombectomy for stroke treatment or prevention, there is a need to have care in a hospital facility that has a seamless coordination of services, facilitates the quick consultation with neurologists, comprehensive and intense medical care services such as vascular imaging using CT scanners ¹⁸.

Alteplase (thrombolytic therapy) which is a form of Intravenous

thrombolytic therapy uses a treatment called tissue plasminogen activator, which is injected directly to the vein. The medicine works by dissolving the clots in the blood vessels that impede the smooth flow of blood in the arteries that lead to the brain. Nonetheless, the effectiveness of thrombolytic treatment progressively dissipates over time. Therefore, if this treatment is administered at the early periods of stroke detection then it has a greater ability to restore the health of the patient. Random studies have established that alteplase treatment used in the cases of presenting stroke is more than ten times more likely to benefit the patient than to harm them. Nonetheless, in every one out of fifteen patients who undergo thrombolytic therapy experience excessive bleeding in the brain that can be mostly fatal.

Mechanical thrombectomy is another intra-arterial mechanical thrombectomy involving the use of a catheter that contains a stent retriever. This catheter is placed within an artery that leads blood to the brain and guided to the clot that results in blood blockage. The stent-remover in the catheter then restores normal blood flow to the brain cells by capturing and removing the particular clots. The effectiveness of mechanical thrombectomy depends mainly on the timing of use. For instance, it is more beneficial if used within the first six hours when the signs of stroke begin to present. This mechanism is only appropriate for people who have blockages in the major arteries leading to the brain. This fact implies that mechanical thrombectomy cannot be used for all cases of ischemic stroke. When recommended, it should be done as soon as the signs of the stroke begin to show. Randomized controlled trials of patients treated using mechanical thrombectomy demonstrate that they experienced higher rates of functionality compared to those who underwent the conventional treatment (usually intravenous thrombolytic therapy).

Medical therapy for stroke takes into consideration the particular category of the paralysis being treated. In this case, stroke is categorized as either primary or secondary stroke. Primary stroke is one that presents in the patient for the first time while secondary one is that which relapses after a period of perceived successful treatment. In essence,

individuals prescribed for primary stroke prevention must not have a history of the attack. On the other hand, secondary stroke interventions involve restoring the health of people who have experienced either the transient ischemic attack or stroke itself. There are various proven efficacy approaches for the prevention of stroke such as antiplatelet therapy. Through medical treatment, modifications of available lifestyles and risk factors stroke can be prevented. Among any patients suffering from or at the risk of secondary stroke, similar lifestyle and risk factor modifications can be used to treat the condition. The lifestyle and risk factor changes if used together with anticoagulation for victims of cardiac embolus and antiplatelet therapy, stroke can be prevented effectively.

According to the American Stroke Association (ASA), modification of risk factors for stroke involves counseling people against smoking, alcohol and encouraging them to reduce obesity, embrace physical activity and avoid obesity. ASA recommends for small quantities of alcohol as a means of protecting against ischemic stroke but states that its increased use predisposes individuals to incidences of hemorrhagic stroke. In the extremes, heavy alcohol intake leads to increased risk of both hemorrhagic and ischemic stroke. Therefore, psychological therapy involves encouraging lifestyle changes resulting in an overall reduced level of risk. Furthermore, obesity is rated as among the primary causes of stroke hence through treatment, the capacity of patients at risk of the attack are encouraged to embrace practices such as limitation of the caloric intake, increased physical activity and a general shift in behavior patterns. Conceivably, nurturing a change in individual behavior has a greater potential of influencing the overall risk of experiencing a stroke.

In cases of antithrombotic therapy in TIA or noncardioembolic stroke, four antiplatelet regimens are recommended as intervention mechanisms. These interventions have been proven to work for the prevention of secondary ischemic conditions but with varying levels of inefficiencies. These regimens include aspirin (ASA), ticlopidine, clopidogrel and a combination of ASA and extended release dipyridamole⁹. Nonetheless, ticlopidine is not currently used as a

mainstream therapeutic approach for stroke since it resulted in different complication such as increased bleeding and thrombocytopenic purpura among several other defects. These difficulties leave only ASA, clopidogrel and a combination of ASA and extended-release dipyridamole as the only recommended antiplatelet agents for preventing secondary strokes².

The Use of Aspirin as a Prevention /Treatment for Secondary Stroke

Aspirin works to prevent stroke by inhibiting the platelet function through binding irreversibly to the cyclooxygenase enzyme in the platelet. This binding reduces the production of prostaglandins like thromboxane-A₂, which stimulates vasoconstriction and platelet aggregation. During this process, platelets are inhibited from producing cyclooxygenase enzyme during its approximately ten day's lifespan. Many studies have proven effective in reducing the recurrent-event risks of stroke by about 13% and 22%¹⁹. This extent of success points to the limited efficacy of aspirin use in the reduction of incidences of stroke. For instance, proximate studies on aspirin effectiveness in stroke prevention have established that most patients suffering from TIA may fail aspirin therapy. In essence, though aspirin is recommended as a medical approach in the prevention of stroke, it has several limiting implications for the patients. For instance, it is highly susceptible to interference by anti-inflammatory drugs such as ibuprofen.

Aspirin use in stroke prevention also causes the risk of gastrointestinal bleeding and sometimes leads to aspirin allergy¹⁹. Apart from this defectiveness in the use of aspirin, its use is also controversial since that there is no proof of the optimal dosage to be employed in the prevention of stroke. In some studies, ASA dosing regimens do not show any additional benefits and a higher risk non-life threatening major gastrointestinal hemorrhage with higher as compared to lower doses²⁰. Furthermore, no clinical trial evidence supports the effectiveness of increased aspirin dosage¹⁹. In some cases, there has been a controversy on the concept of aspirin resistance if used in the management of stroke. Though the resistance to aspirin may occur in some incidences, its measurement is incomplete since the methods

of there have been a little control for the Non-adherence to aspirin regimen, and the methods of assaying platelet inhibition often do not agree.

Clopidogrel Regimen Use in the Prevention of Stroke

Clopidogrel results in stroke prevention by inhibiting platelet aggregation through binding the adenosine diphosphate (ADP) site of the platelet. CAPRIE, which is the primary clinical approach that supports the use of clopidogrel, argues that clopidogrel monotherapy was more effective than ASA. As a mechanism of preventing stroke, combined therapy with clopidogrel and ASA for up to twelve months has been proven as more efficient than using a monotherapy of ASA in patients presenting acute coronary syndrome. Nonetheless, if ASA is used together with clopidogrel in patients with the acute coronary syndrome, there is always a higher risk of a major bleeding. Bleeding becomes pronounced as the aspirin dosage also increases.

Despite the fact that there has been a view that combined aspirin and clopidogrel used in controlling coronary heart disease can be useful in stroke management, random application of the procedure in actual medical situations show that people suffering from stroke respond differently to antiplatelet therapies²⁰. Practical application of the combined medication of antiplatelet regimens does not prove to be efficient in handling cases of patients with recurrent stroke or TIA. Combined ASA with extended-release dipyridamole is also a recommended medical therapy for Stroke. Dipyridamole is a phosphodiesterase inhibitor that has antiplatelet and endothelial effects. Clinical trials have shown that the use of a combined ASA plus extended-release dipyridamole reduces the risk of stroke appreciably. It also has a moderate risk of severe bleeding compared to when ASA is used alone.

Stroke Recovery and Rehabilitation

In most cases involving medical interventions for stroke, rehabilitation is a recommended approach for ensuring the complete restoration of the normal body functions. In essence, medical therapy alone is not the most efficient way of ensuring that the body resumes its functioning or the severity of the stroke reduce, Stroke recovery and

rehabilitation are therefore indispensable mechanisms of ensuring successful restoration of the health of stroke patients ¹⁰. After a period emergency treatment of stroke, nursing care concentrated on the need to help the patient regain full strength and control of their body.

The extent of the rehabilitation depends on the area of the brain affected and some brain tissues damaged throughout the lifespan of the stroke. For instance, if the stroke affects the right side of the brain, it causes either a partial or a total damage of the left part of the body. Injuries that occur on the left of the brain results in language and speech disorders hence the assistance to recover focuses on helping the patients to overcome these common challenges progressively. The doctor recommends vigorous therapy programs to restore the patients' health ²¹. These treatment programs for rehabilitation takes into account an individual's age, overall health and the amount of disability resulting from the stroke. Furthermore, the physician will also look at the personal lifestyle, interests, and priorities in prescribing the most effective stroke rehabilitation framework. These recovery schemes can begin before the patient leaves the health care facility and continue long after the patient leaves the hospital.

CONCLUSION

The Randomized trials studies included in the present review suggest that with an early intervention in patients suffering from acute non-hemorrhagic strokes and careful selection of patients, CEA is useful in reducing the severity of the paralysis. The medical procedures for addressing the risks of stroke include regimens such as aspirin (ASA), ticlopidine, clopidogrel and a combination of ASA and extended release dipyridamole. Every medical therapy has its associated risks, for instance, aspirin use in stroke prevention causes the potential for gastrointestinal bleeding, and sometimes leads to aspirin allergy.

Medical prevention of stroke also involves psychological therapy, which entails encouraging lifestyle changes leading to an overly reduced level of risk. Furthermore, obesity is rated as among the primary causes of stroke hence through therapy, the capacity

of patients at risk of the attack are encouraged to embrace practices such as limitation of the caloric intake, increased physical activity and a general shift in behavior patterns.

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