A REVIEW OF STRATEGIES TO IMPROVE STROKE CARE SERVICES IN LOW AND MIDDLE-INCOME COUNTRIES: THE INNOVATIVE EXPERIENCE OF LAHORE GENERAL HOSPITAL STROKE PROGRAMME

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ABSTRACT

Stroke, especially ischemic stroke, is the second leading cause of death and disability. The burden of stroke in low and middle-income countries is high and growing, putting already overburdened healthcare resources to the test. To combat the disease's enormous burden, innovative stroke treatment services are needed. This requires the advancement of a nationwide stroke plan in order to offer the right care to all patients who qualify for reperfusion therapy. High levels of coordination, close collaboration with crisis medicinal administrations for pre-emergency clinic evaluation, our comprehensive understanding of stroke singularity, the advancement of pre-assessment tools, a high level of responsibility of all stroke groups at stroke centres, the accessibility of a stroke-specific registry, and the local government to seize the initiative are all key components of success. In this study, we look at different systems in low and middle-income countries that deal with various aspects of stroke treatment. We can use the achievement of the Lahore General Hospital stroke programme as an indicator of progress. Reperfusion therapy has only recently started in Lahore General Hospital, and this paper describes a one-of-a-kind experience in Pakistan of using a limited number of resources to help the country's first stroke centre grow. The aim of this research is to compare and contrast the approaches to stroke care control and treatment in Pakistan, Thailand, and Egypt. While these countries have equal economic standings, Egypt and Thailand have stronger stroke-management healthcare networks than Pakistan. As a result, this paper investigates these disparities and proposes possible options for improving stroke care treatment in Pakistan. In addition, the present state of stroke treatment in Pakistan is examined. In conclusion, public and governmental awareness is more important as a first step as compared to structural stroke care establishment in developing countries such as Pakistan.

Keywords: Stroke Prevention; Acute Stroke Care; Stroke Unit; Low and Middle Income Countries

ABBREVIATIONS

AAFITN: Asian-Australasian Federation of Interventional and Therapeutic Neuroradiology
AIDS: Acquired Immunodeficiency Syndrome
CAST: Cardiac Arrhythmia Suppression Trial
CT : Computed Tomography
DALYs: Disability Adjusted Life Years
DWI: Diffusion Weighted Image
ED: Emergency Department
EMTs: Emergency Medical Technician
FAST: Face Arm Speech Test
FLAIR: Fluid-attenuated inversion recovery
HICs: High Income Countries
HIV: Human Immunodeficiency Virus
IST: International Stroke Trial
IV tPA: Intravenous tissue plasminogen activator
LMICs: Lower Middle Income Countries
MENA SINO: Middle East North Africa Stroke and Interventional Neurotherapies Organization
MSUs: Mobile Stroke Units
MRI: Magnetic Resonant Imaging
NRSP: NeuroRadiological Society of Pakistan
SU: Stroke Unit
TIA: Transient Ischemic Attack
PFO: Patent Foramen Ovale
WHO: World Health Organization

INTRODUCTION

Stroke, especially ischemic stroke, is the leading cause of death and disability worldwide. Stroke has become more common among both men and women around the world. Increased public understanding of early symptoms, accuracy of modern brain imaging, and the advancement of acute therapies help to reverse this pattern. Innovation in stroke-care systems is needed to remodel and train them to face this challenge. (1)
Stroke mortality rates have decreased by half in high-income countries. Stroke victims in low- and middle-income countries are younger than people in high-income countries. According to Pakistan's 2017 Census, the country's population is 207 million people and the world's sixth-most populous country (2). Pakistan is classified as an emerging economy with a lower to middle financial benefit (3).
Aim: The aim of this study is to do a comparative analysis between Pakistan, Thailand and Egypt and their approaches to stroke care management and treatment, which have been summarized in Table 1.

METHODS

A review of the literature was undertaken using PubMed and Google Scholar to find publications that detailed stroke treatment and developments in LMICs. We used the World Bank's 2019-2020 classification for this research. A country was categorised as “low income” if its total national income per capita for the previous year was less than USD 1,025; income between USD 1,026 and USD 4,035 was classified as “lower-middle income.” (21)

Acute stroke, stroke care, stroke therapy, developed nations, low and middle-income countries were all included in a single search word. Articles on stroke treatment from low- and middle-income countries were included in this study and reports from high-income countries were excluded.

RESULTS

Current Resources in Stroke Prevention

Pre-medical service recognition, assessment, and evacuation, urgent stroke treatment (fast triaging in the emergency room), SU care and rehabilitation, and network assistance are all included in stroke care administrations. There are several roadblocks in the foundation of stroke treatment administrations in LMICs. A typical stroke pathway is depicted.

Prehospital Services

With rapid developments in prehospital stroke treatment mostly in high-income countries (HIC), it is critical to consider the conditions, difficulties, and applicability of these approaches in low and middle-income countries (LMIC). The strain of stroke is becoming more disparate between LMICs and HICs. LMICs account for over 75% of stroke deaths and about 80% of disability-adjusted life years (DALYs). In addition, there has been a 42 percent reduction in stroke occurrence in high-income countries and a 100 percent increase in LMICs over the last four decades. Regrettably, there is little data on the benefits of prehospital stroke treatment in these situations. (5)

Prehospital obstacles include inadequate transportation and a scarcity of qualified stroke

specialists. Ambulances are, for the most part, unprepared and lack trained personnel. Ambulances are often used to transport patients with burn wounds and obstetric emergencies in these conditions. (5)

Rescue 1122, a model of pre-clinical emergency management, was developed in Pakistan's Punjab province with a population of about 90 million people. In either situation, crisis management relies on decades-old crisis centres, no triage, no permanent doctor personnel, and virtually no pre-hospital emergency services. (6) The rescue1122 administration operates by a toll-free emergency code, 1122, which can be dialled on both landlines and mobile phones. This administration has provided emergency treatment to 498000 people while maintaining a regular and natural response time of 7 minutes in all locations. (6)

One driver and two EMTs make up the emergency vehicle crew. They have emergency care, bracing, basic life support in the event of heart failure, and transport of patients with immobilisation on the scene. Until now, they will only recommend the lack of discomfort and the use of sublingual glyceryl triturate if chest pain occurs. EMTs are instructed to spend the least amount of time on the scene and to transport patients to pre-assigned emergency departments as soon as possible. A 'scoop and chase' technique is used in the case of a large number of setbacks. The proximity of a pre-hospital set-up will likewise demonstrate to be useful in reinforcing crisis drug and further preparing of paramedics and cooperation programs for specialists. (6)

The Pakistan National Emergency Department Surveillance (Pak-NED) is another initiative. It was a pilot complex surveillance directed in seven notable tertiary care crisis divisions in six fundamental urban communities of Pakistan. Ambulance and patient care systems should be improved to save lives. Furthermore, the EDHI foundation, the country's largest volunteer ambulance organisation, has over 1800 vehicles and two air-ambulance planes. (7)

Early recognition of neurological symptom by ambulance paramedics utilizing FAST evaluation shows concurrence with neurologist evaluation. The high predominance and great understanding for forearm weakness recommends that early recognition is the most optimal method to identify early stroke and getting the proper treatment. (8)

Cost Effectiveness

Although the Mobile Stroke Unit's approach is an innovative way to cope with prehospital acute stroke, it is costly. A retrospective analysis was conducted in Siriraj Hospital in Bangkok in 2018. The study demonstrated that extremely low incidence of emergency medical services (EMS) use and the delay in referral of patients from other hospitals were two factors that greatly affected hospital arrival time after acute stroke in Thailand. (10) Since Thailand is classified as an LMIC, a study of stroke treatment approaches will aid in the development of improved models.

Acute Management Investigations and Imaging

Around 2005 and 2006, 464 patients with presumed acute stroke had their qualities, time intervals, and rtPA values tested. Consistent quality management is required to achieve the best results in each setting and to ensure that acute stroke patients in LMICs receive the best care possible. (11)

Emergency Department

Junaid et al conducted a pilot study in two districts of Pakistan where they collected data from rural and urban healthcare setups showing a high percentage of dissatisfaction (98%) among the community participants regarding emergency medical services. When it comes to the standard of treatment, 68 percent of those polled believe paramedics aren't well qualified to treat patients. Ambulances are usually only a means of transportation to and from the hospital, with a driver but no other paramedics. And if they are present, no additional management is provided before the patient arrives at a healthcare facility, resulting in a substantial delay in the provision of appropriate emergency services, leading to a rise in morbidity and mortality, particularly among stroke patients. (12)

Another research was conducted in India to determine the causes that contribute to the delay in the treatment of acute stroke. According to the findings, the average prehospital time delay for all clinically suspected stroke patients at the institute

was 716 minutes. The average cumulative in-hospital wait was 94.17 54.5 minutes. (14) Medical entry process delays, a lack of resources to move the patient, and the gap between the stroke unit and the CT room all contributed to the in-hospital delay. (14)

Stroke Unit

Since patients who are treated in SUs have improved results, all-district or primary government hospitals and teaching institutes should aspire to have at least one primary SU. If primary government hospitals operated by doctors are unable to establish autonomous SUs, they may be connected to SU-equipped tertiary teaching hospitals. The establishment of a telestroke system would be the next step in increasing stroke patients' access to superior medical services while also lowering the rate of thrombolysis. (15)

The use of protocols in different third-world countries is depicted in Figures 1,2, and 3. In Thailand, the average gross direct medical cost per admission to a tertiary level hospital is THB 42,400. In 2003, Khealani et al conducted a study on stroke and discovered that overall expenses on stroke services for a single patient was USD 1,179. (16)

In Egypt, about 1% of acute stroke patients receive alteplase (tPA) thrombolysis. They explain that there is such a poor incidence of reperfusion procedures and take steps to increase it. The inaccessibility of alteplase, the incorrect medication decision, the missing window when doing cerebral imaging, and the inaccessibility of bed were the main reasons for not giving thrombolytic treatment. (18)

Likewise, with the help of these models, we have developed our institutional stroke protocol in Pakistan in 2014 and started working on a pilot project, with minimum resources and without governmental support, in one of the eminent public hospitals.

Caregiver Burden and Support Systems

Secondary prevention

Secondary prevention includes reducing the risk of another stroke or TIA, as well as other vascular disease and other difficulties such as learning impairment, diabetes, and poor quality of life. Secondary prevention will reduce stroke recurrence by up to 80% of almost all patients who have had a stroke or TIA. Examination and recovery must occur in the hospital (stroke unit or stroke centre) and continue throughout the community throughout one's life. (19)

Investigations into stroke prevalence, aetiology, and risk factors should follow principle-based local guidelines, including rapid and effective cerebral imaging; repeated strokes should be investigated because the cause might not be the same as the initial. If MRI is performed, it should include T2, FLAIR, DWI and blood-sensitive sequences. On the unlikely possibility that there is no conspicuous explanation for stroke, distinguishing the heart causes like AF can still be checked out. (19)

Secondary prevention should include dietary counselling and blood pressure control; in patients with ischaemic episodes, antithrombotic therapy, a statin, and carotid endarterectomy (if appropriate) should all be used. Both health care professionals should have patient and attendant instruction on preventive measures at each level. (19)

Following the diagnosis of ischaemic stroke or transient ischemic attack (TIA), the aetiological cause should be determined. This approach allows for secondary prevention methods to be used in conjunction with the procedure. Surgical and radiological procedures such as carotid endarterectomy and stenting, as well as the closing of the PFO and the atrial appendage, are highly dependent on the operator. Success rates can be monitored, as they are dependent on proper preparation. (19)

According to available research, more than 60% of patients who present with a stroke are hypertensive; even though 80–90% of these patients are monitored on the first visit, less than 40% may have their blood pressure properly controlled. Essentially, despite the fact that any patient is given a statin upon release, long-term enforcement is low. Furthermore, many patients with AF are also not receiving oral anticoagulation. (19)

The medicines could be added to specific countries' WHO "lists of important medications" and made available in essential/local hospitals or government health centres in remote areas. They can be made available at a lower cost. The WHO's

(World Health Organization) strategy (Package of Essential Noncommunicable Disease Interventions) is as follows: This is a series of procedures, like dietary modifications, that can be easily communicated by a doctor or a health care assistant. (5)

Role of NRSP And Development of First Stroke Center Of Pakistan

The NeuroRadilogical Society of Pakistan (NRSP) is a non-profit medical association that works to develop and support standards for the training and practice of neuroradiologists and neuro interventionalists.

The first catheter-based treatment of ischemic stroke was performed in December 2014 at an international workshop organised by local experts from Lahore General Hospital, Alexandria University School of Medicine, Egypt, in partnership with MENA-SINO, AAFITN, and NRSP. Two cases of acute ischemic stroke were treated with mechanical thrombectomy for the first time in the country's history during this workshop, and a stroke treatment programme was developed. International seminars on stroke care are held every year at the hospital, with international speakers. Furthermore, the information campaign is disseminated on a wide scale by using the Quick protocol to distribute pamphlets.

DISCUSSION

Stroke is one of the leading causes of death and disability in South Asia. Fortunately, there is compelling evidence that stroke is strongly preventable, treatable, and manageable, and that the burden of stroke and its long-term consequences can be significantly reduced. This, however, necessitates collaboration between the government and healthcare experts. In the case of acute stroke treatment in LMICs, some countries can never be able to adopt complex healthcare services capable of successfully delivering time-sensitive treatments.

We emphasise two main focuses for development assistance in order to achieve long-term impacts and reduce the burden of stroke in LMICs. To begin, assistance should be provided to help, integrate, and organise both primary health and emergency care services in order to prevent stroke and improve stroke control, respectively. Second, aid should focus on community-based programmes that reduce stroke risk factors in an increasingly sustainable manner and increase stroke outcomes more efficiently. (20)

Governmental Based Approach to Prevent and Manage Stroke in LMCI's

In LMICs, ambulance services are available, but they are underutilised for stroke patients. Training EMTs (emergency medical technicians) to recognize a stroke, notify the ED, neurologists, and radiologists before the arrival of a stroke patient can reduce time lost in transit, ED and investigations. If the closest centre does not have an imaging service, patients may be transferred to one that does after being pre-notified. Establishing common stroke procedures that are specific to state and local requirements will also minimise time spent in the emergency room. (5)

In areas where the healthcare infrastructure is small, reserving 3–6 beds may initiate creating a minimum model of Stroke Units for stroke patients. Patients may be moved to advanced SU after initial management. More patients profit from SU services as a result of decentralising SUs and supplementing nursing care. (5)

Many facets of supportive care for acute ischemic stroke and acute intracerebral haemorrhage are the same, such as maintaining euglycemia and euthermia, providing proper hydration and nutrients, treating seizures, preventing aspiration, preventing deep vein thrombosis, and early patient mobilisation. (21)

Unless thrombolytic treatment is administered, blood pressure is often able to auto-regulate after an acute ischemic stroke. When a CT scan is unavailable, it might be prudent to recommend lowering all patients' systolic blood pressure to less than 180mmHg. Offer a bolus of intravenous saline to patients with unexplained aetiology strokes that intensify clinically when blood pressure is reduced and then enable them to self-regulate. (21)

Where CT is unavailable and IV tPA is not an option, the only antithrombotic agent available is aspirin. When neuroimaging is scarce, an

alternative to the risk-averse approach of refusing aspirin in all patients with acute stroke with uncertain aetiology is to giving aspirin to all of these patients. The probability of this technique is determined in part by the proportion of ischemic or hemorrhagic acute strokes. Thus, treating all patients with acute stroke with aspirin in the absence of CT could benefit at least two-thirds of the stroke population. There was little disparity between the results of the IST and CAST experiments, which looked at the effects of aspirin and placebo on a population of 40,000 people. Based on this research, it seems that giving aspirin to all patients who have had an acute stroke of uncertain aetiology can be helpful. Taking aspirin in reduced doses for 24 to 48 hours following a stroke of uncertain aetiology reduces the risk of ischemic stroke thus reducing the risk of haemorrhagic stroke. (21)

An expert panel should be convened to formulate consensus guidelines for the management of acute stroke of unknown etiology in settings where there is no rapid access to neuroimaging. (21)

Since tPA is not registered in our region, only a few private companies provide IV thrombolysis at a very high cost, and no figures are available at this time. The cost of tPA is also a limiting factor; however, medicine registration and government subsidies or free tPA in government hospitals can help to increase the thrombolysis rate.

In LMICs, smartphone use has risen dramatically in recent years. Improved enforcement can be achieved by creating web-based apps that notify patients of their prescriptions, investigations, and medical visits. Another approach is to create applications that warn patients and the general public about early stroke diagnosis using the Quick protocol, as well as apps to direct stroke victims to the closest primary or local health care centre that specialises in stroke treatment, including in rural parts of the world.

Community-Based Approach To Prevent And Manage Stroke In LMIC's

Given the concurrent existence of stroke, the most useful interventions for development assistance in LMICs should be centred at the level of the population. Researchers have created a handful of important impact concepts and techniques that they can apply and repeat so that others can benefit after years of diligent study and experience. (20)

About 5 million people in Thailand stopped contracting HIV thanks to a highly successful influence technique devised by an influence genius. AIDS in Thailand have previously been limited to inmates who spread the disease by exchanging discarded needles. The illness was imprisoned with its hosts for many years. However, in 1988, King George VI granted amnesty to over 30,000 detainees. The AIDS virus, once free of its confinement, enjoyed its newfound liberation by wreaking havoc on a much wider intravenous drug patient population. In just a few months, over half of all users in the United States had been poisoned. (20)

Infectious disease specialists around the world watched with shock as the disease spread from one population to another month after month. Sex employees were targeted at the same time as IV opioid users. Within a year, one-third of the sex workers had fallen victim. In some provinces, up to one-third of sex workers tested positive for HIV within a year. Married men then took the scourge home to their unsuspecting wives, who then passed it on to newborn babies. HIV had affected an estimated 1 million Thais by 1993. Health researchers estimated that Thailand will lead the world in contagious per capita in just a few years, with one out of every four adults carrying the virus. (20)

But it never came to be. The virus reached a plateau after two years and then withdrew. By the late 1990s, new diseases had been reduced by 80%, thanks in large part to Dr. Wiwat's impressive influence policy. (20)

As AIDS was taking Thailand by surprise, Dr. Wiwat fought the disease alongside a few of his colleagues in the Ratchaburi province. His experience had shown him that the trick to combating the outbreak of any epidemic was in keeping the public aware of the danger. (20)

Dr. Wiwat took a job with Thailand's Ministry of Public Health with this notion in mind, and he addressed the challenge of educating an uninformed public in the same manner as business marketers aim to boost consistency, customer experience, or coordination. Wiwat's unit was in

charge of distributing flyers. They conducted classes for the public. They persuaded actors to air commercials on television and radio. (20)

Wiwat concluded that if he could convince 100 percent of the country's sex-workers to insist that their clients use contraceptives, he could nearly stop the spread of HIV in Thailand. That became his main plan of attack. He'd figure out a way to make any sex-worker follow the condom rule. And much to the dismay of the world's epidemiologists, Wiwat's scheme succeeded. (20)

Later, we'll look at how Dr. Wiwat was able to persuade sex workers to follow the plan. The point we want to emphasise right now is that by carefully looking for and targeting a critical behavior. Wiwat was able to break from conventional untested approaches and find one that really worked. It's no surprise that we need to concentrate on critical behaviours. Seeing the most important behaviour will help you solve a dilemma. The next step is to tailor the behaviours to the individual's local circumstances. (20)

Verbal manipulation is the most popular technique we use to influence people, but it does not always succeed. A personal experience with a great persuader. The mother of all perceptual map changers is personal knowledge. Vicarious experience serves as a stand-in for real-life experience. Indeed, when used effectively for social transformation over the last few decades, vicarious models have saved millions of lives and increased the quality of living for tens of millions more. (20)

We would potentially have the best stroke treatment by preventing as many strokes as possible. A shortage of qualified neurologists, mostly in urban areas, a high number of mostly rural patients, a lack of general education and information about stroke risk factors and treatment, and the prohibitive cost of stroke care are all challenges in stroke care. There is a lack of standardisation and uniformity in secondary and tertiary stroke care, and primary care is highly inadequate.

The goal of reducing stroke morbidity and mortality requires both community-based and government-based approaches to stroke recognition and care. This influencer model, in our view, can also be used to shift group attitudes toward stroke. We can recognise the critical behaviours that can be used to bring about a transformation in the community's thought habits by educating them by vicarious interactions, using tools such as TV, radio, and tablets, and positively propagandising. To carry out these activities, we must identify influencers from within our own society; these influencers include physicians, emergency personnel, and others.

In rural areas, we will recruit and train a few people from their provincial communities to serve as team leaders in their societies. Stroke plans, including those for communicable diseases, should be established at the national level to cope with a big disability. Many strokes are currently caused by modifiable risk factors like obesity, asthma, and smoking. It is important to raise visibility and reduce preventable strokes as soon as possible. The use of mass screening to identify individuals at high risk of stroke has been proposed as a way to reduce the burden of stroke. The current stroke services should be focused on successful execution, supervision, and assessment. A stroke that is reversed is much preferable to one that is treated. Furthermore, government-based approaches should look at strengthening health-care services related to stroke care, such as first-responder care, which is critical in the early stages of stroke management. Ambulances and first responders need to be updated, and staff need to be properly qualified in how to treat stroke patients. Furthermore, such advancements must take into account the economic, sociocultural, and financial conditions of LMICs, which are vastly different from those of high-income countries. As a result, advances in stroke treatment must consider these features in order to be effective in LMICs, as well as a rise in educational knowledge about these health problems such that patients obtain medical assistance as soon as possible, which is actually inadequate and one of the reasons why this disorder has such a high morbidity and mortality rate in Pakistan.

CONCLUSION

Several solutions that are cost-effective, practical, and repeatable were discovered in our research, but they have yet to be tried. Such advancements must take into account the LMICs' economic, sociocultural, and financial conditions, which are

vastly different from those of high-income countries. In LMICs, more studies into the introduction of regionally and geographically tailored stroke systems should be prioritised. The most critical thing is to raise public consciousness about these health problems so that patients seek medical treatment as soon as possible, which is still missing and one of the reasons why this disorder has such a high morbidity and mortality rate in Pakistan.

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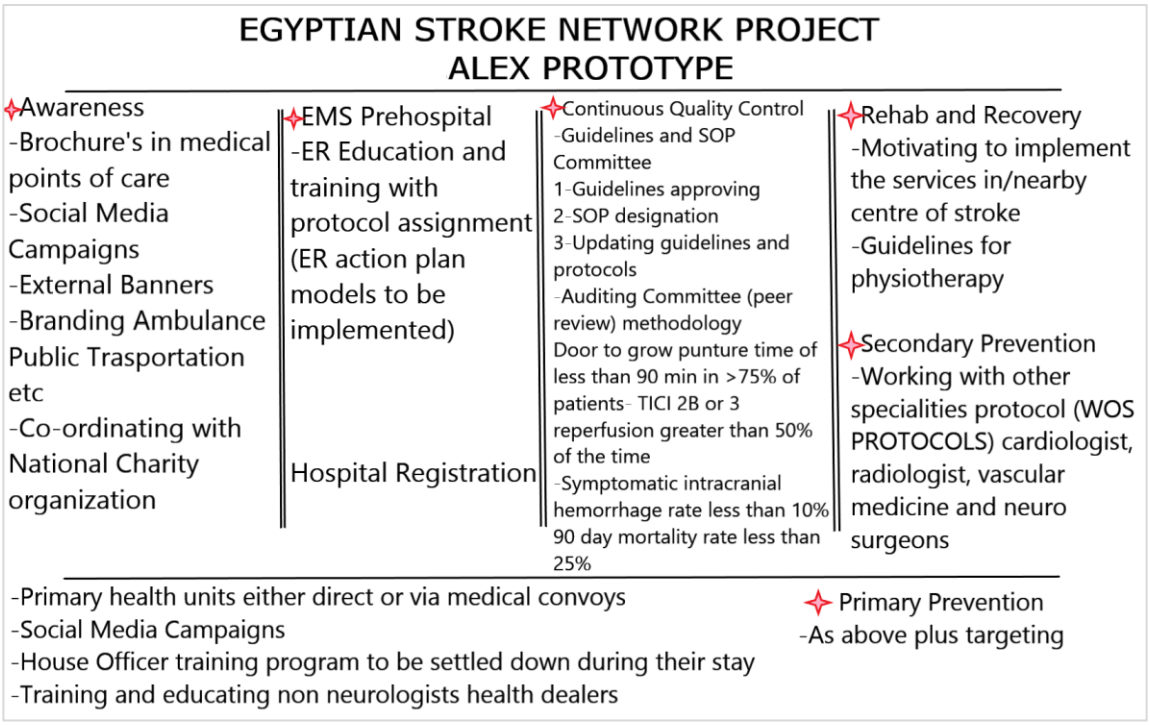
FIGURE LEGEND:



Figuire1: Protocol used in stroke unit of Alexandria University Egypt.

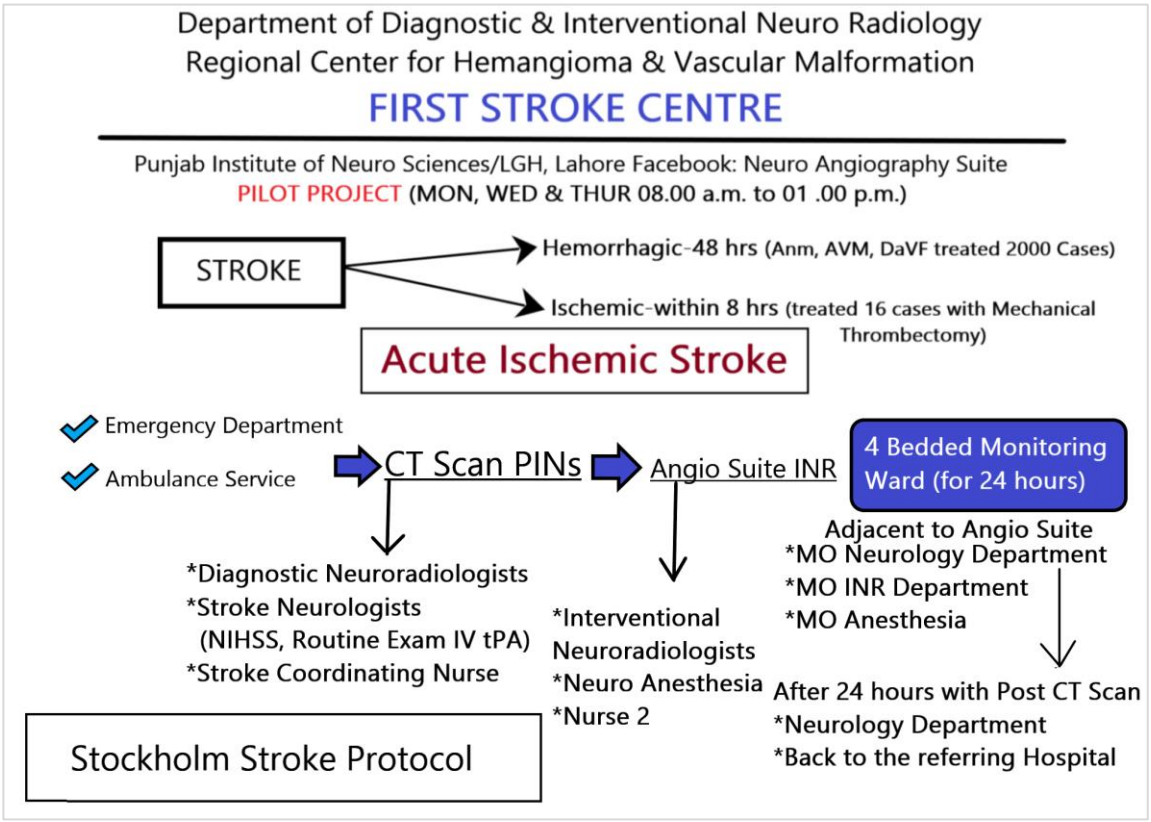


Figure2: Protocol used in stroke unit of LGH Lahore

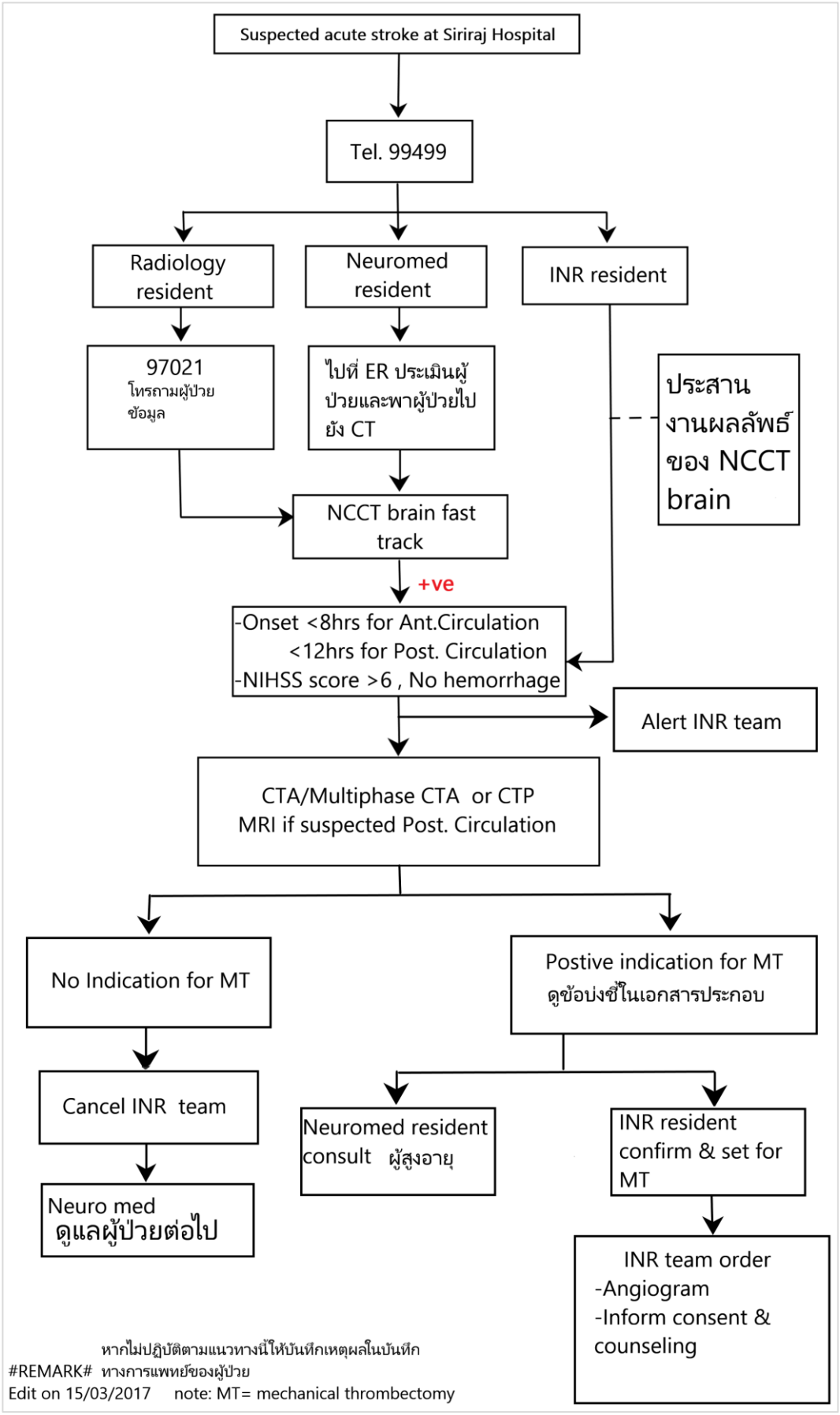


Figure3: Protocol use in stroke unit of Siri Raj Hospital Thailand.