

Hub and Spoke Model in Stroke Care

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Background & Aim

The aim of the project is to reduce patients' neurological sequelae, improve functional recovery and reduce lifetime cost of first strokes, by using timely interventions and technology as an enabler in the treatment of acute ischaemic strokes.

Stroke is a condition where a blood clot or ruptured blood vessel interrupts blood flow to an area of the brain. This results in a lack of oxygen supplied to those regions affected leading to damage of brain tissue. Stroke is a common devastating illness worldwide and is the $4^{
m th}$ leading cause of death and the leading cause of serious disability in Singapore [1].

The lifetime cost per peson of first strokes occurring in 1990 is estimated to be US\$90,981 for ischaemic stroke [2]

Intravenous Tissue Plasminogen Activator (TPA) is the only treatment for acute ischaemic stroke approved by the Food and Drug Administration (FDA) [3] but the therapeutic window for treatment is only 3 hours, hence the need for rapid and accurate diagnosis with prompt delivery of thrombolytic therapy.

Conventional approach:

- Bedside or telephone consultation by stroke neurologists
 - Bedside consultation: Accurate diagnosis and evaluation but limited by manpower and time constraints
 - Telephone consult: Can be performed rapidly but decisions are frequently made without all available data which can lead to diagnostic errors
- Telestroke model:
- Innovative technology
- Offers advantage of a telephone consult with benefits of bedside consult

_imitations Strategies Constraints Reorganisation of the evacuation system with triage Due to the narrow window for treatment, it is estimated that less than 2% of Administrative and logistical patients with acute ischaemic stroke are given TPA. This problem is largely and appropriate transfer to a dedicated neurological Difficult for paramedical staff who are not trained to the service. Patients could be accurately assessed by attributed to: same level as medical professionals to make an Lack of neurological expertise in regional hospitals to institute therapy. emergency paramedical staff on-site and accurate assessment in an emergency setting. Requirement of specific and highly trained individuals to perform other transferred to the most appropriate dedicated facility forms of effective acute stroke therapy such as mechanical clot Physical travel of the neurologist to the stroke Unpredictable travel time extraction devices (e.g. Merci Retriever) [4]. Intravenous TPA on the patient at the regional hospital to institute treatment. other hand, can be administered by emergency physicians at the ED. Absence of a good image transfer system for Early diagnosis and rapid transfer to dedicated No direct diversion of patients with suspected neurological emergency to stroke facility. assessment by the neurologist; a challenge for clinical a tertiary neurological service as the public emergency paramedical decision making. service takes patients to the nearest designated emergency service. Telestroke/Telemedicine initiative Unable to replace the personal touch of a conventional Inability to complete diagnostic process and transfer of patients to bedside evaluation. dedicated stroke centre even with excellent road connectivity and short

Methodology

evacuation distance.

TELESTROKE is based on the REACH (remote evaluation of acute ischaemic stroke) and comprises two main components [5-

- 7]: Brain imaging review
- Remote exam via interactive videoconferencing

Aim of system: To provide for remote diagnosis and evaluation of stroke through a web-based service to facilitate thrombolytic therapy for eligible acute ischaemic stroke patients admitted to a hospital without in-house neurology service.

The audio and video links between the Emergency Department (ED) physician, patient and stroke neurologist allow for rapid response time and prompt diagnosis and treatment (Figure 1).

The REACH model is a "Hub and Spoke" service model. The "Hub is defined as a centre with 24 hour neurology service and the "Spoke" is defined as a centre without in-house neurology service and dependent on the "Hub" hospital for services (Figure 1)

Results

The telestroke project was implemented in the first quarter of 2011. 76 telestroke consults were performed with 22 patients satisfying criteria for thrombolytic therapy over a 6 month period. The first 11 patients had completed 3 month follow-up and the results showed that 9 out of 11 (81.8% achieved functional independence within 7 days of the onset of stroke (Figure 2).



Figure 1: The "Hub & Spoke" model serving spoke hospitals from a hospital with remote examination Interactive hub via videoconferencing [8].



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Growth Potential

Growth potential of telestroke service:

- Can be provided to international markets as scan images and video consultation can extend beyond geographical borders, made possible by seamless integration of technology.
- Can be applied to other acute medical emergencies which can be rapidly evaluated via video-consultation with institution of prompt treatment

Conclusion

- Telestroke addresses major health issue with high incidence rate with potential significant morbidity impacting guality of life.
- Capitalises on existing competitive advantage of the NNI and provides life-saving therapeutic option to patients who previously had limited access to thrombolytic therapy.

Creates new value curve by optimising new trends in technology and looking beyond the traditional customer base

Health Facts Singapore, Ministry of Health

The percentage of patients who received TPA treatment since the project started has increased steadily from 26% to 41% at the end of 2013 (Figure 3). This rising trend is an indication that more people are coming to the ED early, i.e. within 3 hours of stroke onset as a result of patient education and greater awareness of TPA.



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