

## Running a stroke unit: lessons from The Stroke Programme, Tan Tock Seng Hospital, Singapore

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### Abstract

Stroke units have been shown to reduce mortality, morbidity, disability, institutionalisation, length of stay and health costs of stroke patients. The benefits of stroke units probably results from patients' early and better access to professionals experienced in stroke care, and better implementation of standardized evaluation and treatment programmes. The Stroke Program, Tan Tock Seng Hospital was set up in 1992 to provide comprehensive care to the 1000-odd stroke patients seen annually. The Stroke Centre has 8 stroke intensive care and 4 stroke high dependency beds, and is supported by the noninvasive Cerebrovascular Laboratory and 24-hour advanced Neuroradiology and operating theatre facilities. All patients have a CT Brain scan on admission. Stable patients are moved out of the Centre to the Neuroscience Wards for continuing management by the neurologists and neurosurgeons till hospital discharge. Stroke Care Paths have been formulated to streamline nursing care. The Multidisciplinary Stroke Team comprising doctors, ward nurses, therapists, medical social workers, dietitian and stroke nurse formulates and implements individualised rehabilitation programs, discharge plans, patient education and care giver training. Patients requiring intensive rehabilitation are transferred to the Department of Rehabilitation Medicine. A hospital Stroke Support Group is being formed. The Program organises Education Programs for healthcare workers, stroke patients, carers and the lay public. A Stroke Clinic has been set up. The Program is also actively involved in stroke research. As the setting up of stroke unit mainly involves a reorganization of services without necessarily demanding greater resources overall, it should also be implemented in the developing world where there is restricted health care resources.

**Keywords:** cerebrovascular diseases, stroke unit, Singapore

### INTRODUCTION

Cerebrovascular diseases are a leading cause of mortality in many countries in South-east Asia<sup>1</sup>, and account for a significant proportion of admissions to Neurology departments in the region.<sup>2</sup> The recent publications of trials, meta-analyses and guidelines<sup>3-5</sup> suggest that there are treatment strategies for optimising the management of patients with stroke, and that more data may emerge from new clinical trials of stroke treatments.<sup>6</sup> There has been recent interest in the role of Stroke Units<sup>7</sup> as part of the strategy to better manage stroke. This paper analyses the evidence in favour of Stroke Units, and illustrates the practical application of the knowledge with the experiences of the Stroke Unit in Tan Tock Seng Hospital, Singapore.

### DEFINATION OF A STROKE UNIT

The definitions found in the literature for the stroke unit generally stem from two early

descriptions: "a team of specialists knowledgeable about the care of the stroke patient and who consult throughout the hospital wherever the patient may be, or a special area of a hospital that provides beds for stroke patients who are cared for by a team of specialists"<sup>8</sup>, and "a geographical location within the hospital designated for stroke and stroke-like patients who are in need of rehabilitation services and the skilled professional care that such a unit can provide".<sup>9</sup>

### TYPES OF STROKE UNITS

From the definitions, with some overlap, stroke units are of 3 types: (1) stroke intensive care unit<sup>10</sup>, (2) non-intensive stroke unit<sup>11</sup>, (3) stroke rehabilitation unit.<sup>12</sup>

*Stroke Intensive Care Unit (SICU):* SICUs are highly specialised intensive care units dedicated to the intensive management of stroke patients. They have not been shown to significantly reduce mortality or morbidity

compared to general wards.<sup>13-19</sup> However, SICUs may have a role in the management of carefully selected cases or for post-operative monitoring. SICUs could also have a role in providing the necessary environment for acute and novel stroke treatments under trial such as thrombolysis, neuroprotection, hyperventilation and hemodilution.

### **BENEFITS OF NON-SICU STROKE UNITS**

A number of trials have shown the beneficial effects of stroke units on mortality. Meta-analysis by Langhorne et al<sup>20</sup> showed that at 17 weeks, odds of death was reduced by 28% (95%CI 0.56-0.95); this was sustained at 1 year with the odds of death reduced by 21% (95%CI 0.63-0.99). Mortality reduction was maintained irrespective of where the patients were managed: in stroke wards, stroke team, intensive rehabilitation, and comprehensive rehabilitation. Extension of the meta-analysis<sup>21</sup> to 12 trials corroborated the earlier findings - odds ratio(OR) for death at 12 months was 0.77 (95%CI 0.62-0.98).

Stroke units have also been shown to reduce morbidity and improve functional outcome in some trials.<sup>20</sup> The meta-analysis<sup>21</sup> of 12 trials showed that poor outcomes defined as death or institutionalisation were seen less frequently in stroke unit patients (OR 0.67—95%CI 0.56-0.80); the trends were similar in trials evaluating different types of care. Barthel Index scores were significantly better among the stroke unit patients.<sup>21</sup> There was no evidence that morbidity was increased by improved survival in any of the trials.<sup>20</sup>

A large community-based study from Denmark<sup>22</sup> showed that there was a 30% reduction in the length of stay of stroke unit patients, with 1313 bed-days saved per 100 stroke patients, and 3 nursing home places saved per 100 stroke patients.

There are a number of reasons why stroke units is beneficial. Stroke units provide complex and varied interventions including medical, nursing, and remedial therapy.<sup>20</sup> It has been found that more stroke unit patients had remedial therapy (physical, occupational and speech therapy) compared to controls.<sup>11,20,23,24,26</sup> Stroke unit patients started therapy earlier than controls in some of the studies.<sup>11,20,23,24,26</sup> This may be the result of the utilisation of standardised evaluation and treatment programmes within the framework of a multidisciplinary integrated approach.<sup>22</sup> The mere concentration of stroke patients on stroke

units leads to increased experience of physicians and teams in handling stroke patients.<sup>22</sup> The early institution of intensive therapy especially directed towards physical/cognitive deficits<sup>27</sup> would allow mobilisation through early training - this may prevent complications such as pneumonia, pulmonary embolism and bed sores.<sup>22</sup> The involvement of family in the care of patients would also ease discharge from hospital and after-care at home.<sup>24,26</sup>

From the perspective of the hospital administration, stroke units provide a means of placing patients together to maximise resources; e.g. nurses, therapists, medical equipment; and allows easier auditing of medical care and use of services.

There will be concerns that stroke units would increase health costs.<sup>28</sup> Studies have already shown the prime reason for increased costs during hospitalisation is length of stay.<sup>29</sup> Stroke units have been shown to reduce length of hospital stay<sup>22,23,25,26</sup>, and the accompanying hospitalisation costs.<sup>30</sup> The impact of stroke units on the cost of community care (as opposed to in-patient care) of stroke has however not been well studied.

Furthermore, stroke units facilitates research. They allow easier data collection on epidemiology, outcomes of management and facilitate the performance of clinical trials.

### **EXPERIENCE IN THE TAN TOCK SENG HOSPITAL, SINGAPORE**

Tan Tock Seng Hospital (TTSH) is a 1100-bedded general hospital serving the surrounding community. The Departments of Neurology and Neurosurgery started in 1973. At present, about 1000 patients are admitted annually to TTSH for stroke. Historically, stroke patients in TTSH were managed by general physicians in 4 (and later 3) medical units, with a referral to the neurologist or neurosurgeon if the physician in charge felt it necessary. In June 1992, it was decided that all patients seen at the Accident and Emergency Department with a diagnosis of stroke should be admitted to the Department of Neurosurgery. If the subsequent evaluation did not reveal a cerebral hemorrhage or other neurosurgical causes, the patient would be transferred to the Department of Neurology. In October 1992, the Stroke Centre was opened, and all patients with a diagnosis of stroke were sent to the Centre on admission. The patients were managed jointly by the Departments of Neurology and Neurosurgery. A full range of

services was further developed under the umbrella of the TTSH Stroke Program.

## **TTSH STROKE PROGRAMME**

### **Goals of the Program**

The Program has the following goals: (1) to provide comprehensive care to patients with acute stroke; (2) to provide support for and to educate stroke patients and their carers, as well as to educate the lay public on stroke; (3) to educate doctors, nurses and other health professionals on stroke; (4) to provide a stroke prevention program; (5) to perform research in stroke.

### **Components of the Program**

(1) *Stroke Centre*: a 8-bedded Stroke Intensive Care Unit with a 4-bedded High Dependency Care Area. The Centre has modern equipment for the aggressive management of patients with stroke, including ventilators, intracranial pressure and blood flow monitors, transcranial Doppler machine. Patients with stroke seen at the Accident and Emergency Room are quickly triaged and admitted to the Stroke Centre, under the care of the neurologists and neurosurgeons. A CT Brain is performed within hours of admission to determine whether the stroke is hemorrhagic or ischemic, and to exclude mimics such as subdural hematoma, tumour or abscess. Guidelines were drawn up to aid the junior doctors in their initial management of the patient till the patient is reviewed by the consultant. Neurosurgical procedures such as hematoma evacuation, aneurysm clipping, AVM excision and carotid endarterectomy are performed where indicated

(2) *Neuroscience Wards*: when stable, the patients are moved out of the Centre and into the Neuroscience. Wards for further management. Hemorrhagic strokes are primarily managed by neurosurgeons, non-hemorrhagic strokes by neurologists. The patients remain in these wards till discharge from Hospital. To streamline nursing care in the wards, Stroke Care Paths have been developed; the Care Paths cover protocols for feeding, bowel and skin care, therapy and patient education. This is to ensure that the appropriate management is provided to all patients, and variances analysed to continually improve the service. Rehabilitation areas are available in the wards to facilitate early therapy.

(3) *Multidisciplinary Stroke Team*: this Team

comprising the attending doctors, therapists (physical, occupational, speech), dietitians, stroke nurse, medical social workers, pharmacists and ward nurses. The Team does daily ward rounds and works with the patient and family, formulating and implementing individualised management and rehabilitation goals and discharge plans for each patient. The Team also coordinates the provision of home care services and care giver training. The aim of discharge planning is to ultimately send the patient back to his own home and family. For those who are unable to be sent home, various avenues are explored, including private nursing homes (which tend to be expensive) and nursing homes run by volunteer organisations (which are cheaper, but have strict admission criteria and long waiting lists). There are no more government-run nursing homes in Singapore

(4) *Non-Invasive Cerebrovascular Laboratory*: the Laboratory is manned by 2 full-time technicians and offered color-coded duplex carotid and vertebral ultrasonography, and transcranial doppler ultrasonography since Apr '92. All patients with non-hemorrhagic stroke are studied. More than 250 patients undergo carotid studies and 120 transcranial Doppler studies monthly. The Laboratory also caters to requests from other hospitals.

(5) *Neuroradiology*: the Neuroradiology Section of the Department of Diagnostic Imaging provides conventional CT imaging, angiography, MRI as well as more recently introduced technologies such as functional MRI, and interventional neuroradiology for the management of AVMs ("glue") and aneurysms (coils).

(6) *Rehabilitation*: rehabilitation begins from the first day of admission. The Multidisciplinary Stroke Team plans and implements the rehabilitation program of the patients. The patient is subsequently sent to the Department of Rehabilitation Medicine (DRM) for further in-patient rehabilitation, or to the various out-patient centres for continuation of therapy, whichever is appropriate. The DRM has a special interest in stroke. The rehabilitation physicians do ward rounds in the Neuroscience Wards to select suitable candidates for intensive rehabilitation at DRM. About 40% of the stroke patients are sent to DRM after discharge from the Neuroscience Wards. DRM has 100 beds, 40 of which are dedicated to stroke. Admission

criteria include the ability to participate in at least 2 out of 3 modalities (physical, occupational and speech therapy) and good family and social support. Age is not a criteria. Length of stay depends on the patient's progress with rehabilitation; ischemic stroke patients stay about 4 weeks, hemorrhagic stroke patients about 6 weeks.

(7) *Patient and Family Education*: education on stroke and care of the patients is provided by the stroke nurse with the help of the other members of the Team. In-house educational brochures on stroke have been published and are distributed to all patients. A book specially written for patients and carers is in press. The principle carer is given specialised training by the Team so as to optimize home care.

(8) *Stroke Support Group*: the Department of Care and Counselling of TTSH has put together an educational program for stroke patients and their carers to meet, share problems and find solutions. In association with the other government hospitals, we spearheaded the effort to set up the Singapore National Stroke Association, which was officially registered with the Registry of Societies in December 1996.

(9) *Nurse Education*: compulsory hands-on workshops for all nurses handling stroke patients are conducted at regular intervals. Seminars on stroke for nurses are held quarterly. An in-house manual on stroke nursing has also been produced.

(10) *Physician Education*: stroke specialists from leading centres in the world were invited to lecture and review the Program. Regional workshops in cerebrovascular surgery and transcranial doppler have also been organised. The Centre also accepts visiting fellows.

(11) *Public Education*: members of the Team have appeared in the press, radio and television to speak on stroke-related issues. Public forums to educate the lay public on stroke were also held.

(12) *Stroke Clinic*: this is a referral clinic for stroke related problems.

(13) *Stroke Research*: the Stroke Program is currently involved in a number of research projects, such as setting up of a Stroke Data Bank. These projects involve the doctors as well as the paramedical staffs.

### Composition of the Stroke Program Team

The following Departments are actively involved in the Program: (1) Neurology; (2) Neurosurgery; (3) Diagnostic Imaging; (4) Anaesthesia; (5) Rehabilitation Medicine; (6) Accident and Emergency; (7) Nursing; (8) Therapy Services; (9) Dietetics; (10) Care and Counselling; and (11) Pharmacy.

The Multidisciplinary Stroke Team consists of members from most of these Departments. The Team presently comprises of 4 physiotherapists, 2 occupational therapists, 1 speech therapist, 1 dietitian, 1 stroke nurse, 4 medical social workers (who also have other duties). These team members serve in the Stroke Centre and the Neuroscience Wards. There is a separate team in the DRM. Based on discussions with the Team, it is felt that the number of full-time staff to adequately serve a 80 to 100 stroke in-patients would be: 10 physiotherapists, 8 occupational therapists, 5 speech therapists, 3 dietitians, 3 stroke nurses and 4 medical social workers.

### Stroke Program workload

In the year 1995, 1464 patients died or were discharged from the Department of Neurology and Neurosurgery for stroke. The average length of stay was 13.9 days (Neurology 8.1 days, Neurosurgery 16.9 days), with a total of 20,309 patient days. This did not include the patients discharged from the DRM, or transferred to the other Departments for management of non-neurological illnesses and complications. Surveys of out-patient attendances to the Neuroscience Departments show that stroke comprised 16% of outpatient attendances in the years 1994 and 1996.

### Impact of the stroke units in Singapore

The number of patients dying from stroke in Singapore has been steadily rising over the last 2 decades. However, when adjusted for age and sex, the mortality rates has been declining since 1970, more-so since the mid-1980's.<sup>31</sup> This has been attributed to better detection and treatment of hypertension and reduction in the prevalence of smoking and hyperlipidemia. The favourable impact of stroke units on this trend could only have started in 1992, and probably did contribute to the falling mortality rates. There is no data available on trends in stroke morbidity in Singapore.

## SETTING UP STROKE UNITS IN DEVELOPING WORLD

Setting up a stroke unit mainly involves the reorganization of services, resulting in better care for the patients and more efficient use of resources. The supportive technology may vary depending on the economic development of the particular community and her available resources. Thus a stroke unit does not necessarily increase the cost of care overall. In the view of the author, limited economic resources as in the developing world should not be the reason against the setting of stroke unit.

For the setting up of a stroke unit, the followings are suggested: (1) identify a doctor, preferably a neurologist with interest or training in stroke to spearhead the project; (2) set up a multidisciplinary stroke team comprising of members of professions interested or trained in the various aspects of stroke care; (3) encourage all physicians treating stroke patients to participate in the stroke unit; (4) conduct team ward rounds; (5) convince the hospital authorities to cohort stroke patients geographically; (6) establish protocols in patient management to guide junior doctors and nurses in day-to-day management. These protocols should be tailored to the health care setting, practices, spectrum of diseases, available services, financial resources of the patients and the community. (7) The stroke unit should be supported by the easy availability of neuroimaging (CT Brain, angiography) and neurosurgical consultancy services, preferably on a 24 hour basis; (8) there should be frequent and continuous audit and review of the services. This is to ensure quality control and facilitate improvement of care.

## REFERENCES

1. Medical Foundation of Japan. SEAMIC Health Statistics. 1990 to 1994
2. Lim SH, Tan CH. Spectrum of neurological diseases in Singapore. *Neurol J Southeast Asia* 1996; 1: 19-26
3. WHO Task Force on Stroke and Other Cerebrovascular Disorders. Recommendations on stroke prevention, diagnosis and therapy. Report of the WHO Task Force on Stroke and Other Cerebrovascular Disorders. *Stroke* 1989; 20: 1407-31
4. Adam HP, Brott TG, Crowell RM, Furlan AJ, Gomez CR, Grotta J, Helgason CM, Marler JR, Woolson RF, Zivin JA, Feinberg W, Mayberg M. Guidelines for the management of patients with acute ischemic stroke. A statement for health care professionals from a special writing group of the Stroke Council, American Heart Association. *Stroke* 1994; 25: 1901-14
5. The European Ad Hoc Consensus Group. European strategies for early intervention in stroke. A report of an ad hoc consensus group meeting. *Cerebrovasc Dis* 1996; 6: 315-24
6. Counsell C, Warlow C, Sandercock P, Fraser H, Van Gjin J. The Cochrane Collaboration Group. Meeting the need for systematic reviews in stroke care. *Stroke* 1995; 26: 498-502
7. Kalra L. Organization of stroke services: the role of stroke units. *Cerebrovasc Dis* 1996; 6: 7-12
8. Bonner CD. Stroke units in community hospitals. A "how-to" guide. *Geriatrics* 1973; 28: 166-70
9. McCann C, Culbertson RA. Comparison of two systems for stroke rehabilitation in a general hospital. *J Am Geriatr Soc* 1976; 24: 211-6
10. Wechsler LR, Ropper AH. Management of stroke in the intensive care unit. *Semin Neurol* 1986; 6: 324-31
11. Strand T, Asplund K, Eriksson S, Hagg E, Lithner F, Wester PO. A non-intensive stroke unit reduces disability and the need for long-term hospitalization. *Stroke* 1985; 16: 29-34
12. Garraway M. Stroke rehabilitation units; concepts, evaluation and unresolved issues. *Stroke* 1985; 16: 178-81
13. Kennedy FB, Pozen TJ, Gabelman EH. Stroke intensive care: an appraisal. *Am Heart J* 1970; 80: 188-96
14. Cooper SW, Olivet JA, Woolsey FM. Establishment and operation of combined intensive care unit for patients with cardiac and cerebrovascular disorders. *NY State J Med* 1972; 72: 2215-20
15. Pittner SE, Mance CJ. An evaluation of stroke intensive care units: results in a municipal hospital. *Stroke* 1973; 4: 737-41
16. Drake WE, Hamilton MJ, Carlsson M, Blumenkrantz J. Acute management and patient outcome: the value of neurovascular care units. *Stroke* 1973; 4: 933-45
17. Norris JW, Hachinski V. Intensive care management of stroke patients. *Stroke* 1976; 7: 573-5
18. Millikan CH. Stroke intensive care units. *Stroke* 1979; 10: 235-7
19. Erila T, Ilmavirta M. Does an intensive care stroke unit reduce early case fatality of ischemic stroke? *Stroke* 1990; 21(Suppl 1): 153
20. Langhorne P, Williams BO, Gilchrist W, Howie K. Do stroke units save lives? *Lancet* 1993; 342: 395-8
21. Stroke Unit Trialists Collaboration. Specialist stroke unit care improves survival and functional outcomes: a statistical overview. *Cerebrovasc Dis* 1994; 4: 258
22. Jorgensen HS, Nakayama H, Raaschou HO, Larsen K, Hubbe P, Olsen TS. The effect of a stroke unit: reductions in mortality, discharge rate to nursing home, length of hospital stay, and cost. A community-based study. *Stroke* 1995; 26: 1178-82
23. Garraway WM, Akhtar AJ, Hockey L, Prescott RJ. Management of acute stroke in the elderly: preliminary results of a controlled trial. *Br Med J* 1980; 280: 1040-44
24. Garraway WM, Akhtar AJ, Hockey L, Prescott RJ.

- Management of acute stroke in the elderly: follow-up of a controlled trial. *Br Med J* 1980; 281: 827-9
25. Wood-Dauphinee S, Shapiro S, Bass E, et al. A randomised trial of team care following stroke. *Stroke* 1984; 5: 864-72
  26. Indrevick B, Bakke F, Solberg R, Rokseth R, Haaheim LL, Holme I. Benefit of a stroke unit: a randomised controlled trial. *Stroke* 1991; 22: 1026-31
  27. Kalra L. Does age affect benefits of stroke unit rehabilitation? *Stroke* 1994; 25: 346-51
  28. Wade DT, Wood VA, Langton-Hewer R. Use of hospital resources by acute stroke patients. *J R Coll Physicians Lond* 1985; 19: 48-52
  29. Holloway RG, Witter Jr DM, Lawton KB, Lipscomb J, Samsa G. Inpatient costs of specific cerebrovascular events at five academic medical centers. *Neurology* 1996; 46: 854-60
  30. Bowen J, Yaste C. Effect of a stroke protocol on hospital costs of stroke patients. *Neurology* 1994; 44: 1961-4
  31. Venketasubramanian N. Trends in cerebrovascular disease mortality in Singapore: 1970-1994. *Int J Epidemiol* 1997(in press)