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Telemedicine for the implementation of stroke therapy for patients in rural and remote areas.

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PRIORITISING SUMMARY

REGISTER ID: **000191**

NAME OF TECHNOLOGY: **TELEMEDICINE FOR THE IMPLEMENTATION OF STROKE THERAPY**

PURPOSE AND TARGET GROUP: **TIMELY STROKE THERAPY FOR PATIENTS IN RURAL AND REMOTE AREAS**

STAGE OF DEVELOPMENT (IN AUSTRALIA):

- ☒ Yet to emerge
- ☐ Experimental
- ☐ Investigational
- ☐ Nearly established
- ☐ Established
- ☐ Established *but* changed indication or modification of technique
- ☐ Should be taken out of use

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

- ☐ Yes — ARTG number
- ☐ No
- ☒ Not applicable

INTERNATIONAL UTILISATION:

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
United States	✓		
Germany	✓		

IMPACT SUMMARY:

Rural and remote hospitals and medical practices, in partnership with major tertiary hospitals would offer telemedicine for the evaluation of patients experiencing acute stroke, where local stroke care specialists were not available. The aim of this program is to provide an appropriate thrombolytic therapy to stroke patients within the short therapeutic time frame for these drugs to be effective.

BACKGROUND

Acute stroke occurs when there is a disturbance of blood flow to the brain. This results in the death of parts of the brain due to lack of oxygen and nutrients and subsequently loss of functions associated with the affected part of the brain such as movement of body parts, vision, swallowing and may lead to death. Stroke is caused by either a blood clot occluding an artery supplying blood to the brain (ischaemic stroke) or when blood vessels supplying the brain bleed (haemorrhagic stroke). The majority of stroke patients suffer from ischaemic stroke (85%) (Senes 2006).

Treatment of ischaemic stroke focuses on either re-establishing normal blood flow to the ischaemic area and/or to block the mediators of ischaemic injury. Prompt treatment with a thrombolytic drug such as tissue plasminogen activator (tPA), dissolves the obstructing blood clot restoring blood flow before major brain damage has occurred (Wardlaw et al 2003; Mohammad et al 2004). A Cochrane review reported that for patients treated within three hours of symptom onset, thrombolysis appeared effective in reducing death or dependency (OR[1] 0.66, 95% CI 1.15, 1.53) (Wardlaw et al 2003).

Although the United States Food and Drug Administration approved the use of tPA for treatment of acute ischaemic stroke within three hours of symptom onset in 1995, uptake of this treatment practice has been slow. The New Zealand Guidelines for the Management of Stroke recommend that tPA be given to eligible patients but only by clinicians with expertise in the assessment and management of people with acute ischaemic stroke working in specialist centres. Currently in New Zealand thrombolysis with tPA is only offered as standard treatment at Auckland and Christchurch Hospitals (Barber & Gommans 2005; Fink 2005). In Australia, tPA was licences for use in 2003 but is not widely used (personal communication, Department of Neurology, Royal Melbourne Hospital, February 2006). The National Stroke Foundation of Australia recommend that tPA be administered in stroke units with experience in its use (National Stroke Foundation 2003).

Appropriate administration of tPA requires that patients recognise that they are having a stroke, get transported to a medical facility, have the diagnosis confirmed clinically and receive a brain scan to eliminate haemorrhagic stroke within three hours (Barber & Gommans 2005). In rural areas, the distances necessary to travel to treatment centres along with a lack of consulting stroke specialists able to evaluate the patient and administer the appropriate therapy, may prevent the prompt administration of tPA therapy within the required timeframe. In New Zealand in 2001, only five out of 41 hospitals admitting stroke patients had identified stroke specialists on their staff. A recent Australian study found considerable variation in stroke care practices in metropolitan teaching hospitals and no published data on stroke care practices in regional Australia. Differences in stroke care management in regional areas might be expected on the basis of different levels of resources and access to specialist expertise in stroke management (Read & Levy 2005)

Telemedicine has been designed to make available a means of emergency patient evaluation which can be utilised to provide specialised stroke treatment to patients in rural and remote areas. Telemedicine employs the use of an interactive two-way audio-video system between hospitals without on-site stroke expertise and a stroke specialist. Patient assessment - history, neurologic examination and computed tomography of the head, are all able to be reviewed by the stroke specialist using telemedicine, who is able to guide the local physician throughout the process including administration of treatments such as tPA. The primary benefit of telemedicine for acute stroke is the provision of speciality resources not available in regional hospitals (LaMonte et al 2003).

CLINICAL NEED AND BURDEN OF DISEASE

Stroke is a significant health problem in Australia and New Zealand, which mainly affects older individuals, with rates of stroke increasingly markedly in people aged over 65 years. In Australia, approximately 346,700 had experienced a stroke at same stage in their lives in 2003. Each year

[1] OR = odds ratio

there are approxiamtely 40-48,000 stroke events among Australians. Nearly seven per cent of all deaths in Australia are caused by stroke, with 9,006 deaths from stroke in 2003. During the same period approximately 282,600 Australians with stroke had a disability and in 146,400 of these individuals the disability resulted from their stroke (Senes 2006).

In New Zealand during 2003-03, the prevalence of stroke was 2.1 per cent (95% CI 1.8, 2.4), which corresponds to one in 48 adults having been diagnosed with stroke at some stage in their lives (Ministry of Health 2004).

In Australia during the period 2003-04, there were 40,791 hospital separations for cerebrovascular diseases (ICD 10 coded I60-I69), each involved an average stay of 10.5 days (AIHW 2006). In New Zealand during 2001-02 there were 8,787 public hospital separations for cerebrovascular diseases (ICD 10 coded I60-I69), with a mean stay of 43.1 days (New Zealand Health Information Service, Ministry of Health).

DIFFUSION

Although telemedicine is utilised in some clinical areas, to the knowledge of the Evaluators, it is not used in the diagnosis and treatment of stroke patients in Australia. The Department of Neurology in the Royal Melbourne Hospital has expressed an interest in using this technology if they had the platform (personal communication, Department of Neurology, Royal Melbourne Hospital, February 2006).

COMPARATORS

In the absence of a telemedicine option, treatment of stroke patients should be conducted according to the recommended National Stroke Foundation Guidelines. Appropriate diagnosis of stroke and immediate referral to a stroke team is important to minimise the risk of complications in the early stages of stroke, therefore patients should be triaged and responded to in an appropriate manner by emergency or medical staff. However, as these options (CT scan and neurologic examination) require the interpretation of a specialist, in their absence appropriate treatment would include general stroke management including oxygen supplementation for hypoxic patients and administration of aspirin if an ischaemic rather than a haemorrhagic stroke is diagnosed (National Stroke Foundation 2003).

EFFECTIVENESS AND SAFETY ISSUES

In the study by Audebert et al (2005), 356 patients presented to the emergency departments of regional hospitals in Bavaria (level IV Diagnostic evidence). Patients were assessed via telemedicine by specialists working in either one of two hospitals which had comprehensive stroke care centres. Mean delay between onset of symptoms and hospital admission was 65 ± 25 minutes and the mean time from door-to-needle was 76 ± 24 minutes. The mean time to treatment (administration of tPA) was 141 ± 27 minutes. The average time of the teleconsultation was 15.6 minutes, with a standard deviation of 8.2 minutes. Of the patients assessed, 106 patients were eligible to receive thrombolysis with tPA. Of the patients excluded from tPA treatment, the three hour treatment time window was exceeded before (n=23) or during (n=10) teleconsultation. Audebert et al (2005) et al reported an in-hospital mortality of rate of 10.4% and mortality within seven days of 5.7 per cent. In-hospital mortality from strokes in hospitals within the same community, which did not have access to telemedicine, was reported to be 24.1%. This rate was statistically higher when compared to the rate of hospitals participating in the telemedicine trial (p=0.02). Follow-up CT scans were performed after a median of 21 hours administration of tPA

and a haemorrhage was detected 27 patients (25%). Of these nine patients had a symptomatic bleed and three clinically deteriorated with haemorrhagic complications.

Hess et al (2005) reported the results of a rural hospital telestroke network in Georgia, United States (level IV Diagnostic evidence). The network consisted of eight hospitals, only one of which had formalised acute stroke care guidelines. During the study 194 acute stroke consultations presented to the emergency departments and after telemedicine assessment by the stroke consultant, a decision to treat 30 of these patients with tPA was made. The mean onset of symptoms to treatment time (OTT) was 122 minutes with the majority of patients (60%) being treated within two hours. CT imaging within 36 hours of tPA administration revealed no intracerebral haemorrhages and a decrease in the NIHSS[2] of ≥4 points was noted in 18/30 (60%) of patients within 24 hours. The in-hospital mortality rate was 2/30 (7%). Twenty-nine patients presented to the emergency department beyond the three hour treatment time window. To assess the progress and improvement of the stroke network, the authors compared the OTT of the first 10 to the last 20 patients. The mean OTT was reduced from 143 to 111 minutes (t=2.61, p=0.014). Two other papers reported on the initial stages of this project (Wang et al 2003; Wang et al 2003).

A retrospective review of 50 consultations by an acute stroke specialist, delivered to a tertiary hospital in Maryland, United States from community hospital emergency departments was conducted by LaMonte et al (2003). This study compared telemedicine consultations with traditional telephone consultations (level IV Diagnostic evidence). Telemedicine was utilised in 23/50 (46%) of cases. Of these attempted telemedicine links, two were aborted due to technical difficulties. On two occasions, temporary phone wire problems caused problems in initiating the computer link, however a telephone consultation was ongoing while the telemedicine connection was re-established. A stuttering transmission occurred once but did not impede the consultation.

COST IMPACT

There is currently no cost-effectiveness data or simple costing studies for the use of telemedicine to diagnose and treat stroke patients in remote or regional areas of Australia and New Zealand. A systematic review on the cost-effectiveness of telemedicine concluded that there was good evidence to suggest that telemedicine was a cost-effective means of delivering health care, although only 7/24 (29%) studies included in the review attempted to investigate the level of utilisation that would be needed for telemedicine services to compare favourably with traditionally organised health care. In addition most studies included equated benefits with cost-savings with no analysis of changes in benefit to patients (Whitten et al 2002).

The study by Audebert et al (2005) reported that a 24-hour, on-demand telemedicine service staffed by stroke experts would cost €300,000 per year. They calculated savings of between €3,200 and €4,200 per thrombolysis and with an absolute increase in the number of tPA treatments (n=76) within one year, reductions in subsequent costs would be between €243,200 and €319,200. After the subtraction of the teleconsultation expenses, the net expense would vary between €56,800 and – €19,200, meaning that the service is cost-effective only with regard to consultations for possible thrombolyses.

The technology and equipment required for telemedicine may already be available in institutions for other functions. Basic requirements are equipment to capture the clinical information at each site, telecommunication links to transmit the information and equipment to display the

[2] NIHSS = National Institutes of Health Stroke Score

information at each site. These requirements will vary according to the type and complexity of the information to be transmitted, the quantity of information to be transmitted and security requirements of the transmitted data. In addition, training personnel in the use of the equipment would be required (Harnett 2006).

In Australia, expenditure for cerebrovascular disease amounted to $896 million in 2000–01, which is 1.8% of total health system expenditure. Aged care homes accounted for half of the funds allocated to cerebrovascular disease and hospitals accounted for 40% (Senes 2006). It is likely that telemedicine for the detection of stroke may provide cost-savings in these areas if it enables the administration of tPA to a larger proportion of patients, reducing the morbidity and mortality associated with stroke.

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

Currently people living in rural and regional areas of Australia and New Zealand do not have access to stroke specialists in their health care settings. Telemedicine for the diagnosis of stroke would increase access to neurological specialists for these communities and may result in better health outcomes and quality of life for stroke patients.

OTHER ISSUES

No issues were identified/raised in the sources examined.

CONCLUSION:

The evidence for the effectiveness of telemedicine for the early detection of acute ischaemic stroke, followed by prompt treatment with tissue plasminogen activator is limited. However, there is a good evidence base for successful outcomes for stroke patients when they are treated with tPA.

HEALTHPACT ACTION:

This technology is part of an existing communication network in the Australian health care system,therefore it is recommended that this technology be archived.

SOURCES OF FURTHER INFORMATION:

AIHW (2006). *National Hospital Morbidity Database* [Internet]. Australian Institute of Health and Welfare. Available from: http://www.aihw.gov.au/cognos/cgi-in/ppdscgi.exe?DC=Q&E=/AHS/principaldiagnosis0304 [Accessed 24th January 2006].

AIHW and NHF (2004). *Heart, stroke and vascular diseases - Australian facts 2004,* Australian Institute of Health and Welfare and National Heart Foundation of Australia, Canberra.

Audebert, H. J., Kukla, C. et al (2005). 'Telemedicine for safe and extended use of thrombolysis in stroke: the Telemedic Pilot Project for Integrative Stroke Care (TEMPiS) in Bavaria', *Stroke,* 36 (2), 287-291.

Barber, A. & Gommans, J. (2005). 'Tissue plasminogen activator approved for stroke', *N Z Med J,* 118 (1214), U1432.

Crome, O. & Bahr, M. (2003). 'Editorial comment--Remote evaluation of acute ischemic stroke: a reliable tool to extend tissue plasminogen activator use to community and rural stroke patients?' *Stroke,* 34 (10), e191-192.

Fink, J. (2005). 'Twelve-month experience of acute stroke thrombolysis in Christchurch, New Zealand: emergency department screening and acute stroke service treatment', *N Z Med J,* 118 (1214), U1430.

Harnett, B. (2006). 'Telemedicine systems and telecommunications', *J Telemed Telecare,* 12 (1), 4-15.

Hess, D. C., Wang, S. et al (2005). 'REACH: clinical feasibility of a rural telestroke network', *Stroke,* 36 (9), 2018-2020.

LaMonte, M. P., Bahouth, M. N. et al (2003). 'Telemedicine for acute stroke: triumphs and pitfalls', *Stroke,* 34 (3), 725-728.

Ministry of Health (2004). *A Portrait of Health: Key results of the 2002/03 New Zealand Health Survey,* Ministry of Health, Wellington.

Mohammad, Y. M., Divani, A. A. et al (2004). 'Acute treatment for ischemic stroke in 2004', *Emerg Radiol,* 11 (2), 83-86.

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Read, S. J. & Levy, J. (2005). 'Differences in stroke care practices between regional and metropolitan hospitals', *Intern Med J,* 35 (8), 447-450.

Schwamm, L. H., Rosenthal, E. S. et al (2004). 'Virtual TeleStroke support for the emergency department evaluation of acute stroke', *Acad Emerg Med,* 11 (11), 1193-1197.

Senes, S. (2006). *How we manage stroke,* Australian Institute of Health and Welfare, Canberra.

Szoeke, C. E., Parsons, M. W. et al (2003). 'Acute stroke thrombolysis with intravenous tissue plasminogen activator in an Australian tertiary hospital', *Med J Aust,* 178 (7), 324-328.

Wang, S., Gross, H. et al (2004). 'Remote evaluation of acute ischemic stroke in rural community hospitals in Georgia', *Stroke,* 35 (7), 1763-1768.

Wang, S., Lee, S. B. et al (2003). 'Remote evaluation of acute ischemic stroke: reliability of National Institutes of Health Stroke Scale via telestroke', *Stroke,* 34 (10), e188-191.

Wardlaw, J. M., Zoppo, G. et al (2003). 'Thrombolysis for acute ischaemic stroke', *Cochrane Database Syst Rev,* (3), CD000213.

Whitten, P. S., Mair, F. S. et al (2002). 'Systematic review of cost effectiveness studies of telemedicine interventions', *BMJ,* 324 (7351), 1434-1437.

LIST OF STUDIES INCLUDED

Total number of studies
Level IV Diagnostic evidence 3

SEARCH CRITERIA TO BE USED:

Cerebrovascular Accident/diagnosis/*drug therapy
*Emergency Service, Hospital
Hospitals, Community
Hospitals, Rural
*Remote Consultation
*Rural Population
*Thrombolytic Therapy
Tissue Plasminogen Activator/*therapeutic use
Brain Ischemia/complications/*diagnosis
Telemedicine/instrumentation/*methods