

National survey of management of transient ischaemic attack in Australia: *Take Immediate Action*

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Over the past decade, there has been an explosion of knowledge about the clinical course and neuroimaging findings in transient ischaemic attack (TIA). This has led to a proposed redefinition of TIA, based on symptoms that last less than 1 hour, rather than symptoms that resolve within 24 hours,¹ as well as increased recognition of the need for urgent evaluation and treatment.² Recent studies suggesting that the rapid institution of a package of investigations and early therapy can reduce the incidence of subsequent stroke by 80%^{3,4} have stimulated interest in models of TIA management. However, many questions remain, including whether to manage TIA in inpatient or outpatient settings.⁵

In 2007, a National Stroke Foundation (NSF) survey identified a decrease in the number of acute hospitals in Australia that reported using an outpatient TIA clinic, from 40 in 2004 to 27 in 2007.⁶ Practice appears to vary greatly throughout Australia and also worldwide. We conducted a follow-up survey with the aim of understanding both the current organisation of services for people with TIA in Australia, and the processes of assessment and management.

METHODS

A simple questionnaire was devised after consultation with an expert group of clinicians. Questions covered organisation of services, assessment, early management and follow-up (available on request from the authors).

We used a convenience sample of the 89 hospitals who participated in the clinical audit component of the 2007 NSF National Audit of Acute Stroke Services. In addition, 45 hospitals that did not participate in the clinical audit were nominated by state clinical networks, based on having a moderate-to-high volume of stroke admissions.

The survey was distributed by email in April 2008 to a designated contact person at each of the 134 Australian hospitals. To facilitate participation, a follow-up email was sent 2 weeks later, followed by a telephone reminder within another 2 weeks if no response had been received.

ABSTRACT

Objective: To understand the current organisation of services for people with transient ischaemic attack (TIA) and the processes of assessment and management across Australian hospitals.

Design and setting: Cross-sectional survey in 2008 of 134 Australian hospitals, mostly urban centres that treat large numbers of stroke patients.

Main outcome measures: Survey questions covered assessment, early management and follow-up practices, as well as organisation of services for TIA.

Results: Seventy-four hospitals (55%) responded: 47 (64%) reported access to a stroke unit, and 19 (26%) to a specialist clinic for TIA. Initial assessment included blood tests, electrocardiogram and brain computed tomography at most sites (92%–94%), and carotid imaging at more than half (65%), but magnetic resonance imaging at only 3% of sites. A tool to stratify the risk of subsequent stroke was used at 38 sites (51%), more commonly in hospitals with a stroke unit than in those without such a unit (64% v 30%; $P=0.005$). Treatment was initiated at the initial assessment at 42 sites (58%), more commonly at stroke unit than non-stroke unit sites (68% v 37%; $P=0.007$). Formalised policies for management of TIA patients were used at 38 sites (54%), with clear differences between sites with a stroke unit and those without (70% v 25%; $P<0.001$).

Conclusion: Access to rapid assessment and management services for TIA varies considerably between Australian hospitals. The presence of organised stroke care at a hospital leads to improved processes of care for patients presenting with TIA.

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Results were analysed with Intercooled STATA version 10.0 for Windows statistical software (StataCorp, College Station, Tex, USA), and results for groups were compared by non-parametric tests. As the survey was deemed a quality improvement project, ethics approval was deemed unnecessary.

RESULTS

The survey was returned by 74 of the 134 hospitals (55%). Of these, 47 (64%) were defined as urban (population over 25 000). Of the responding sites, 47 (64%) reported access to a specialist inpatient stroke unit at their hospital; 35 of these sites (74%) were defined as category A using the updated criteria of the NSF Acute Stroke Services Framework (access to on-site computed tomography [CT] within 24 hours and >200 stroke patients seen per year).⁷ Nineteen sites (26%) reported access to a specialist outpatient neurological clinic for TIA management. Patients with TIA presented directly to the emergency department at almost all sites (96%). The initial presentation and assessment of patients with suspected TIA is summarised in Box 1.

Most sites (92%–94%) undertook full blood examinations (including full blood count, and cholesterol and glucose levels), CT of the brain, and electrocardiogram (ECG). Some form of carotid artery imaging was conducted during the initial assessment at 65% of sites. About 20% of patients had follow-up cardiac investigations. Magnetic resonance imaging (MRI) was rarely performed as the initial form of brain imaging, but was ordered later if appropriate at 13 sites (18%). Results of basic assessment were generally available within 2 hours (78% of blood tests; 90% of ECGs; and 66% of brain CT scans), but delays of more than 12 hours were commonly reported (6% of blood tests; 10% of brain CT scans; and 52% of carotid artery investigations).

Half the sites surveyed currently used tools to stratify patients according to the risk of subsequent stroke, and this was more common in hospitals with a stroke unit than in those without such a unit (64% v 30%; $P=0.005$). Many sites admitted patients based on clinical assessment by the receiving physician, without using a risk stratification tool, whereas at 42% of sites the decision to admit or not was made using a

1 Initial presentation and assessment of patients with transient ischaemic attack at responding hospitals

	Overall (n = 74)*	No. of sites with	
		Stroke unit (n = 47)	No stroke unit (n = 27)
Initial assessment undertaken by			
ED registrar or medical officer	38	28	10
ED physician	11	6	5
General medical registrar	6	4	2
Neurology or stroke registrar	4	4	0
General practitioner	7	1	6
Other	8	4	4
Tests routinely undertaken during initial assessment			
Full blood examination (including cholesterol and glucose levels) (n = 73)	67	44	23
Computed tomography of brain	67	46	21
Magnetic resonance imaging of brain (n = 63)	2	2	0
Carotid artery investigations (n = 69)	45	28	17
Electrocardiogram (n = 71)	67	43	24
TTE or TOE (n = 66)	14	8	6
Transcranial Doppler (n = 64)	3	3	0
Risk stratification and admission policy			
Risk stratified at initial contact [†]	38	30	8
All admitted	11	4	7
Admission based on ABCD/ABCD ² risk score	16	13	3
Admission based on risk screen and test results	15	11	4
Other (eg, discretion of doctor based on clinical signs)	32	19	13

ED = emergency department. TTE = transthoracic echocardiography. TOE = transoesophageal echocardiography.

*Unless otherwise stated. †Significant difference between stroke unit sites and non-stroke unit sites ($P < 0.05$). ◆

risk tool (at 75% of these sites, it was the ABCD² tool).

More than half the sites (42; 57%) reported initiating treatment at the initial assessment. This proportion was higher at sites with a stroke unit than at non-stroke unit sites (68% v 37%; $P = 0.007$). A delay of more than 48 hours to initiate treatment was reported by 12 sites (17%). Twenty-four sites (35%) reported specialist follow-up (in a specialist's rooms, a neurology outpatient clinic or a TIA clinic) for patients not admitted to hospital, and delays of several weeks were common (61% > 1 week) (Box 2).

Thirty-eight sites (54%) reported having formalised policies for the management of TIA patients, with clear differences between sites that had a stroke unit and those that did not (70% v 25%, $P < 0.001$). Both the models of care used and the preferred models for TIA services varied greatly (Box 3). Formal links between hospital and community services for TIA management were reported at 21% of sites. Although 22% of

sites reported no plans to change their TIA service, almost a third of sites (32%) planned to review their service with a view to change. Sites with a stroke unit were more likely to be reviewing their services than those without such a unit (40% v 19%). Future plans commonly reported included creating a TIA clinic (22%) and developing a "TIA pathway" (16%). The main obstacles to providing the preferred model of TIA care were (in order of frequency): lack of hospital funding and support; workforce limitations (lack of stroke specialists); lack of availability or delays to tests; and limited liaison with the emergency department staff and general practitioners.

DISCUSSION

We report the results of a cross-sectional survey of TIA management in Australian hospitals in 2008. Although international and Australian guidelines recommend rapid assessment and management for TIA,^{2,8-10}

access to these services varied considerably. Most sites conducted blood tests, ECG and brain CT quickly, but there was marked variability in other aspects of assessment and management across sites, particularly between sites with a stroke unit and non-stroke unit sites.

The convenience sample was derived from sites involved in the National Stroke Audit. Responses were received from 74 hospitals (55% response rate) around the country, mostly urban centres that treat relatively large numbers of stroke patients each year. It is plausible that the response was biased toward sites with an active interest in stroke and TIA, and therefore overestimated the degree of organisation of TIA services across Australia. Nonetheless, it provides valuable evidence of the variability in services for TIA across the country. Because of the limited scope of the study, the survey did not include primary care providers, and the pattern of TIA service provision by GPs is unclear. A clearer picture of services within this sector would be particularly valuable to complement the current study.

Available evidence suggests that patients with TIA and associated high-grade carotid stenosis have the highest risk of stroke (20% by 90 days).^{11,12} In these patients, early carotid surgery (within 2 weeks of presentation) has been associated with greater benefits for stroke prevention than later surgery,¹³ but timely investigation is required to identify appropriate candidates. Although 45 of 69 sites (65%) in our study reported routine carotid investigation on initial assessment, 27 sites (39%) reported delays of over 24 hours.

There is now evidence that brain MRI improves the utility of stroke risk stratification tools.^{14,15} This is partly because it allows early identification of a subset of patients presenting with transient symptoms who are likely to progress to stroke.¹⁶ Our study found that early MRI was seldom used.

This survey also found variability in who assesses TIA patients, and delayed input by stroke specialists in some settings. Recent evidence indicates that the greatest risk of stroke is within the first few days after the event, and rapid expert assessment and initiation of preventive treatment may significantly reduce subsequent stroke rates.^{3,4} In this survey, only 5% of sites involved stroke specialists in the initial assessments of patients with suspected TIA. Furthermore, only 60% of sites commence treatment, or modify existing treatment, during this initial

2 Initial management and referral for TIA patients who were not admitted

	Overall (n = 69)*	No. of sites with	
		Stroke unit (n = 44)	No stroke unit (n = 25)
When is treatment initiated or altered for those not admitted? (n = 74)			
Immediately after assessment [†]	42	32	10
Within 48 hours of assessment	4	1	3
More than 48 hours after assessment, at general practice or clinic appointment	12	8	4
Not applicable or don't know	16	6	10
Where are most patients referred to?			
Specialist's rooms attached to hospital	5	5	0
General medicine clinic	8	1	7
Neurology outpatient department	13	8	5
Neurovascular or TIA clinic	17	16	1
Private physician	6	3	3
General practitioner	17	10	7
Geriatric clinic	3	1	2
What is the normal delay for follow-up appointment?			
Within 24 hours	1	0	1
Within 48 hours	6	3	3
Within 1 week	20	15	5
Up to 2 weeks	22	15	7
1 month or more	20	11	9

TIA = transient ischaemic attack. * Unless otherwise stated. † Significant difference between stroke unit sites and non-stroke unit sites ($P < 0.05$). ◆

3 Model of services for patients with transient ischaemic attack (TIA)

	Overall (n = 70)*	No of sites with	
		Stroke unit (n = 46)	No stroke unit (n = 24)
Protocol use for TIA			
Written protocols used [†]	38	32	6
Informal arrangements, not documented	18	13	5
No formal arrangements [†]	14	1	13
Facility's current model is best described as (n = 69)			
No specific model or policy [†]	23	9	14
Admit all	11	8	3
Admit high risk only and refer others for follow-up [†]	34	27	7
Refer all patients to other services	1	1	0
Preferred TIA model for local service			
Acute 24 h assessment unit (admit all)	12	6	6
Neurovascular clinic for rapid referral and treatment (< 48 h)	21	20	1
Admit high risk, refer low risk to GP or neurologist rooms etc [†]	26	11	15
Other model (eg, combination)	11	11	0

* Unless otherwise stated. † Significant difference between stroke unit sites and non-stroke unit sites ($P < 0.05$). ◆

consultation. Reasons for the apparent delay in early treatment were not explored in the survey.

Many sites reported long waiting times for follow-up specialist services for patients who were not admitted (Box 2). Over 60% of sites reported a wait of more than a week, and 30% more than a month. Given the benefits of early specialist assessment and intervention after TIA, these delays are concerning.

Risk stratification tools for TIA provide a simple and useful process to guide decision making.¹⁷ Australian, United Kingdom and North American guidelines all recommend the use of such tools to guide management. Only 51% of sites reported routine use of a risk stratification tool. However, they were used by more of the sites with a stroke unit compared with sites without a stroke unit (64% v 30%). Increasing the use of these tools across Australia would allow scarce resources to be prioritised for those with the highest risk and greatest potential to benefit from treatment.

The Australian guidelines describe three of the main models of TIA services (hospital admission, rapid-access TIA clinics, and primary care-centred models).² Almost 50% of sites in this survey reported admitting only high-risk patients and referring other patients to other services (GP or clinic). Hospital admission for rapid investigations and early commencement of treatment has been found to reduce the number of strokes compared with regular outpatient follow-up.^{4,5} Rapid-access TIA clinics (which admit patients within 2 days of a TIA) are potentially more cost-effective,¹⁸ and have been associated with substantial reductions in recurrent stroke events in a UK study.³ This model is currently uncommon in Australia; 19 sites (26%) in this survey reported offering TIA clinics. However, many sites reported long delays to follow-up in these clinics.

Organised stroke unit care remains the cornerstone of evidence-based care for people with stroke.² Our survey demonstrated that the presence of a stroke unit is also associated with improved processes of care for patients with TIA who present to the hospital. Reasons for the differences in care were not explored in our survey, but might reflect the availability of more resources for TIA care at these sites. The findings appear to strengthen the need for greater access to hospitals that provide stroke unit care.

Finally, the findings from this survey indicate that TIA assessment and management is

rapidly evolving, with 32% of sites reviewing their practice with a view to changing the current model. It is currently uncertain which models should be adopted in Australia for the rapid assessment and management of TIA to best prevent stroke. This issue urgently requires further investigation.

TIA is an emergency because the early risk of subsequent stroke is high, and rapid assessment and initiation of treatment leads to better outcomes. This survey of hospital-based TIA services provides evidence for gaps between current evidence and practice in the care of patients with TIA. A major finding was that the presence of a stroke unit in a hospital was associated with improved processes of care for patients with TIA presenting to that hospital. This highlights the need to improve access to stroke unit care and the associated clinical expertise. In the absence of a preferred model for TIA management, sites should adopt a model that provides rapid assessment and initiation of treatment, in the context of local resources and expertise. The results of this survey support the need to "Take Immediate Action" for TIA services.

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COMPETING INTERESTS

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REFERENCES

- Albers GW, Caplan LR, Easton JD, et al. Transient ischemic attack — proposal for a new definition. *N Engl J Med* 2002; 347: 1713-1716.
- National Stroke Foundation. Clinical guidelines for acute stroke management. Melbourne: NSF, 2007.
- Rothwell PM, Chandratheva A, Marquardt L, et al. Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison. *Lancet* 2007; 370: 1432-1442.
- Lavallée PC, Meseguer E, Abboud H, et al. A transient ischaemic attack clinic with round-the-clock access (SOS-TIA): feasibility and effects. *Lancet Neurol* 2007; 6: 953-960.
- Kehdi EE, Cordato DJ, Thomas PR, et al. Outcomes of patients with transient ischaemic attack after hospital admission or discharge from the emergency department. *Med J Aust* 2008; 189: 9-12.
- National Stroke Foundation. National stroke audit — organisational report acute services. Melbourne: NSF, 2007.
- National Stroke Foundation. Acute Stroke Services Framework. Melbourne: NSF, 2008.
- European Stroke Organisation Executive Committee; ESO Writing Committee. Guidelines for management of ischaemic stroke and transient

ischaemic attack 2008. *Cerebrovasc Dis* 2008; 25: 457-507.

9 Johnston SC, Nguyen-Huynh MN, Schwarz ME, et al. National Stroke Association guidelines for the management of transient ischemic attacks. *Ann Neurol* 2006; 60: 301-313.

10 National Institute for Health and Clinical Excellence. Stroke: national clinical guideline for diagnosis and initial management of acute stroke and transient ischaemic attack (TIA). London: NICE, 2008.

11 Lovett JK, Coull AJ, Rothwell PM. Early risk of recurrence by subtype of ischemic stroke in population-based incidence studies. *Neurology* 2004; 62: 569-573.

12 Purroy F, Montaner J, Molina CA, et al. Patterns and predictors of early risk of recurrence after transient ischemic attack with respect to etiologic subtypes. *Stroke* 2007; 38: 3225-3229.

13 Rothwell PM, Eliasziw M, Gutnikov SA, et al. Endarterectomy for symptomatic carotid stenosis in relation to clinical subgroups and timing of surgery. *Lancet* 2004; 363: 915-924.

14 Ay H, Arsava EM, Johnston SC, et al. Clinical- and imaging-based prediction of stroke risk after transient ischemic attack. The CIP Model. *Stroke* 2009; 40: 181-186.

15 Coutts SB, Eliasziw M, Hill MD, et al. An improved scoring system for identifying patients at high early risk of stroke and functional impairment after an acute transient ischemic attack or minor stroke. *Int J Stroke* 2008; 3: 3-10.

16 Coutts SB, Hill MD, Campos CR, et al. Recurrent events in transient ischemic attack and minor stroke: what events are happening and to which patients? *Stroke* 2008; 39: 2461-2466.

17 Johnston SC, Rothwell PM, Nguyen-Huynh MN, et al. Validation and refinement of scores to predict very early stroke risk after transient ischaemic attack. *Lancet* 2007; 369: 283-292.

18 Mant J, Barton P, Ryan R, et al. What is the optimum model of service delivery for transient ischaemic attack? Report for the National Coordinating Centre for NHS Service Delivery and Organisation R&D (NCCSDO), April 2008. <http://www.sdo.nhr.ac.uk/files/project/112-final-report.pdf> (accessed Oct 2008).

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