Outcomes of patients with transient ischaemic attack after hospital admission or discharge from the emergency department

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Abstract

Objective:

To compare outcomes at 28 days and 1 year between patients admitted to hospital and those discharged after presenting to the emergency department (ED) with transient ischaemic attack (TIA).

Design and setting:

All TIA presentations to EDs in a large metropolitan and rural region of Sydney and its surroundings, New South Wales, between 2001 and 2005 were extracted from state health department databases and followed up over 1 year. Admission and discharge data and subsequent TIA or stroke presentations were identified.

Main outcome measures:

TIA recurrence or stroke.

Results:

Of 2535 presentations to an ED with TIA during the 5-year period, 1816 patients were admitted to hospital (71.6%) and 719 were discharged from the ED (28.4%). At 28 days, the discharged group had significantly higher rates of recurrence than the admitted group for all events (TIA or stroke) (5.3% v 2.3%, $P < 0.001$), stroke (2.1% v 0.7%, $P = 0.002$), and recurrent TIA (3.2% v 1.6%, $P = 0.01$). During the 29–365-day follow-up period, there was no significant difference between the discharged and admitted groups for all events (4.2% v 5.1%; $P = 0.37$), stroke (1.3% v 2.5%; $P = 0.06$) or recurrent TIA (2.9% v 2.6%; $P = 0.65$).

Conclusion:

Patients with an ED diagnosis of TIA may benefit from admission to hospital through a reduced risk of early stroke.

Patients with symptoms of a transient ischaemic attack (TIA) have an annual stroke risk of 1%–15%.[1] Almost half the subsequent strokes occur in the first month after the TIA.[2-4] The Northern California cohort study found a 10.5% risk of stroke after 90 days, with 50% of patients suffering a stroke within 2 days of the initial symptoms.[2]

When patients with TIA present to an emergency department (ED), the decision whether to admit them for assessment and treatment is based on the clinician's perception of both the stroke risk and the benefits of admission. The choice may depend on the quality and availability of outpatient TIA services. Best care of TIA has been uncertain, although recent studies suggest early comprehensive assessment and treatment effectively reduce subsequent stroke and stroke unit admissions.[5,6] Highly resourced and rapidly accessible acute TIA clinics are rare: only 10% of Australian hospitals currently offer outpatient TIA services.[7] At most locations, rapid and comprehensive assessment of TIA is available only through hospitalisation.

Risk scoring systems, including the Californian and ABCD2 scores, were developed to identify TIA patients most likely to benefit from rapid assessment and treatment.[8-10] Initial studies in the United States and United Kingdom suggest that high, moderate or low risk of subsequent stroke can be determined by age, blood pressure, and duration and type of TIA symptoms, particularly limb weakness.[8-10] The benefit of scales such as ABCD2 to aid admission or discharge decisions in Australia remains uncertain.

We aimed to determine the proportion of patients with an ED diagnosis of TIA admitted to hospital, and their 1-month and 12-month risk of recurrent TIA or stroke. Outcomes were compared between TIA patients who were hospitalised and those who were discharged from the ED.

Methods

The study was conducted in a large defined metropolitan and rural region of Sydney and its surroundings, the South Western Sydney Area Health Service (SWSAHS), which has since been amalgamated into the Sydney South West Area Health Service. In 2001, the region had a population of 796 95011 served by six public hospitals: a principal referral hospital (Liverpool Hospital), and three metropolitan and two rural hospitals. Two of the six offered acute specialised neurological inpatient care during the study period. There were 825 541 ED attendances in the region between January 2001 and December 2005.

Case ascertainment and classification

Presentations to EDs in SWSAHS hospitals were extracted from the New South Wales Health Department Health Information Exchange database. This provides a census of all attendances to public hospital EDs within NSW. TIA presentation was identified by the ICD-9-CM (International classification of diseases, ninth revision, clinical modification) code 435, and stroke presentation by the codes 431, 432.9, 433, 434, 436, and 437. Code 437.3 (cerebral aneurysm, non-ruptured) was excluded. The primary ED diagnosis of TIA was made by the ED clinician at the time of patient separation from the ED, to home or hospital ward. Presentations from 2001 to 2006 (inclusive) were extracted. Presentations up to 2006 were included to provide 1 year of follow-up of the 2005 presentations.

The mode of separation (MOS) from the ED was categorised as: (1) admitted to ward; (2) admitted to critical care; (3) admitted and transferred to another hospital; (4) departed from the ED, treatment completed; (5) departed, did not wait/left at own

risk; or (6) admitted and discharged as an inpatient within the ED. Categories 1–3 formed the "admitted group", while Categories 4 and 5 formed the "discharged group". Category 6 patients were excluded from the comparison.

Presentations were identified by a unique "person identifier" and arrival date and time. If the same person presented with a TIA more than once in a year, the first visit was deemed the initial event. All TIA presentations were matched by the unique person identifier for the same and subsequent year, capturing all subsequent regional presentations to any SWSAHS ED within 12 months. Subsequent TIA or stroke presentations within 28 days and between 29 and 365 days were extracted using ICD-9-CM codes. Hospital separation data (ICD-10-AM) (tenth revision, Australian modification) identified all patients in the cohort who died in hospital within 12 months of follow-up.

Statistical analysis

SPSS statistical software, version 14.0 (SPSS, Chicago, Ill, USA) was used for data analysis. Odds ratios were calculated, comparing admitted patients with those discharged from the ED. Multivariate logistic regression analysis was performed to control for potential confounding effects of age, sex, marital status and language spoken at home. Bivariate logistic regression analysis was also performed for selected characteristics: MOS, hospital, age, sex, marital status, language spoken at home, triage category and year of arrival.

Liverpool Hospital subgroup analysis

Patients at Liverpool Hospital were further investigated to determine the in-hospital stroke rate and to investigate any association between ABCD2 score and the decision to admit or discharge the patient. All ED TIA presentations were matched with the hospital's separation records, using the person identifier and arrival date. Medical records of all admitted patients who had an ICD-10-AM separation diagnosis of stroke were reviewed to confirm that stroke occurred during the hospital admission. In addition, all available electronic ED files were obtained from the ED Information System for ED TIA patients and reviewed for stroke risk factors as a basis for calculating an ABCD2 score.[8]

Results

Between 2001 and 2005, 2672 patients were diagnosed with TIA: 137 were MOS Category 6 and were excluded from the comparison, 1816 were admitted (71.6% of those included in the comparison), and 719 were discharged (28.4%). Admission rates varied from 66% to 78% across the six hospitals.

Mean age of patients was 70.0 years (SD, 14.1; median, 73 years) for the admitted group and 67.9 years (SD, 15.8; median, 71 years) for the discharged group; the groups included 49.3% and 49.4% men, respectively. (Category 6 patients had mean age, 69.8 years [SD, 15.6; median, 73 years] and 50.4% were men.) For the admitted group, mean length of stay was 6.6 days (SD, 6.43; median, 5 days). In the 12 months after TIA presentation, both the admitted and the discharged group had an in-hospital mortality from stroke of 0.3%.

Box 1 shows the adjusted logistic regression analysis for the two groups in the two follow-up periods. The discharged group had higher occurrence of stroke, recurrent TIA and all events (stroke and TIA) combined in the first 28 days after TIA than the admitted group. However, there was no significant difference in occurrence of stroke, recurrent TIA or all events combined between the two groups over the 29-day to 1-year follow-up period. Overall, the cumulative 1-year event rate (stroke or TIA) was 7.33% for the admitted group and 9.46% for the discharged group (odds ratio [OR], 1.3; 95% CI, 0.98–1.7; P = 0.10).

Further analysis by selected patient and hospital characteristics is shown in Box 2. Patients in MOS Categories 4 and 5 (discharged group) had a significantly higher event recurrence at 28 days compared with those in MOS Category 1 (admitted to ward). No significant differences were found in event recurrence for the other selected characteristics, except age 55–64 years for recurrence within 28 days (P = 0.02) and widowed marital status for recurrence at Day 29 to 1 year (P = 0.03). Nor did the presence of a neurology department in the hospital significantly affect event recurrence.

The time to recurrence after initial presentation was compared between groups. In the admitted group, 41 of the 133 recurrences (31%) occurred within 28 days of initial TIA presentation. In the discharged group, 38 of the 68 recurrences (56%) occurred within 28 days, and 26 of the 68 (38%) occurred within 4 days. Among re-presentations in the first 28 days, median time to re-presentation was 9 days in the admitted group and 2 days in the discharged group.

The principal hospital separation diagnosis was obtained for all 536 ED TIA patients admitted to Liverpool Hospital. One case of acute in-hospital stroke was identified (0.2%).

ABCD2 scores were calculated for 383 (71%) of the patients admitted to Liverpool Hospital and 102 (68%) of those discharged from the ED. No difference was found between the admitted and discharged groups in the proportions with low, moderate or high stroke risk (Box 3). Among those with moderate–high risk (ABCD2 ≥ 4), 28-day all event (TIA or stroke) recurrence was 8/64 (13%) in those who were discharged compared with 5/240 (2%) in those who were admitted (OR, 6.7; 95% CI, 2.0–17.7; P < 0.001). As there were no recurrences in the discharged group after 28 days, no difference between groups was evident at 12 months. In patients with low risk (ABCD2 score ≤ 3), the 28-day all event recurrence rate did not differ between groups: 3/143 (2%) in the admitted group compared with 1/38 (3%) in the discharged group.

Discussion

This is the first study, to our knowledge, to compare the effect of hospital admission or ED discharge in patients with TIA symptoms. In this study, hospital admission for TIA brought significant early benefits. After TIA, the overall event recurrence rate (TIA and stroke) was 3% at 1 month and 8% at 1 year. At 1 month, the recurrence rate was significantly higher in discharged patients (5.3% v 2.3%), the risk of recurrent TIA was doubled (3.2% v 1.6%), and the risk of stroke was tripled (2.1% v 0.7%). In

the first week after TIA, significantly more TIAs or strokes occurred in discharged patients.

Further investigation of patients at Liverpool Hospital identified only one admitted patient who had an in-hospital stroke, suggesting a very low risk of early stroke with hospital admission. The higher recurrence of early stroke or TIA in discharged patients was not explained by higher ABCD2 scores in this group, as the distribution of low, moderate and high risk scores was similar in the admitted and discharged groups. Among patients with a moderate–high risk ABCD2 score (≥ 4), those discharged had a significantly higher 28-day rate of stroke or TIA recurrence than those admitted.

A likely reason for the poor early outcomes of the discharged group is delay or omission of appropriate investigation and treatment. Admitted patients are more likely to receive early comprehensive investigation and early initiation of stroke prevention measures, including investigation-guided antithrombotic choices, treatment of vascular risk factors, and intensive lifestyle modification. Early comprehensive investigation and treatment appears to account for improved TIA outcomes in two recent, single-centre studies of outpatient TIA services in the UK and France.[5,6]

The risk of event recurrence between 29 days and 12 months did not differ significantly between the discharged and admitted groups (4% and 5%, respectively). Possible reasons include insufficient numbers to detect a difference, suboptimal management in some of the admitted group, failure to maintain secondary prevention strategies after 1 month for admitted patients, a catching up in care of the discharged group, a higher proportion of TIA mimics among discharged patients, or the likelihood that post-TIA stroke mostly occurs in the first 28 days, and hence event rates after 29 days may be truly comparable.

US and UK guidelines recommend TIA patients be assessed and investigated within 7 days.[12,13] Many of our discharged group had TIA recurrence or stroke within 2 days (as has been previously reported[2]), and thus a 7-day window before intervention may be too long for optimal benefit. Our study suggests that direct hospital admission delivers favourable early outcomes for TIA. Referral to a rapidly accessible and comprehensive TIA service or clinic,[5,6] possibly guided by risk stratification, may be an alternative to hospital admission. However, the type of quickly accessible and heavily resourced TIA services assessed in these two studies[5,6] are rare in Australia. Further studies, preferably multicentre and randomised, are needed to address the relative benefit of comprehensive emergency TIA clinics versus urgent hospital admission. Until then, the perception that TIA patients can be safely discharged from the ED may be inappropriate.

The usual caveats for a non-randomised, observational and retrospective study apply to our results, including a risk of bias. In any TIA study, the proportion of TIA mimics is likely to be significant,[14-16] and the subsequent proportion of stroke events is dictated by the proportion of mimics. Accuracy of medical record coding of TIA as a diagnosis is a potential confounder. There is no highly sensitive or specific diagnostic test to determine whether TIA symptoms represent a thromboembolic warning of stroke. An over-diagnosis of TIA can result in a lowered apparent risk of subsequent events, but our analysis of a large subgroup in the study suggests that the

characteristics of admitted and discharged groups are very similar. A small proportion of patients may have been "lost" through presentations to EDs outside the region. Nonetheless, the risk of a subsequent cerebral ischaemic event within 28 days in the discharged group is only slightly lower than that reported in previous studies, including the recently published FASTER (Fast Assessment of Stroke and Transient Ischaemic Attack to Prevent Early Recurrence) trial (about 7%–10% stroke risk at 3 months).[2,17] The event risk in the admitted group is similar to the reduced risk seen after rapid assessment in the EXPRESS and SOS-TIA studies (about 1%–2% stroke risk at 3 months).[5,6]

Our study was not designed to investigate the rationale for the decision to admit or discharge individual patients. Confounding factors influencing decision making include the level of neurological expertise of the ED doctor and perceived general health status of the patient. However, as EDs are staffed by numerous doctors with varying experience, some of the bias may have been averaged out.

In conclusion, patients with a TIA diagnosis discharged from EDs in a large region of Sydney had a significantly higher risk of TIA recurrence and stroke within 28 days compared with those admitted to hospital. This may reflect more rapid and comprehensive investigation and management of admitted patients. These findings suggest that patients with TIA symptoms benefit from hospital admission, rather than discharge to existing outpatient services. The similarity in outcome between the two groups at 1 year suggests a need for better long-term intervention to further reduce event recurrence.

Box 1: Multivariable analysis for event recurrence (stroke or TIA) within 28 days and at 29 days to 1 year, by whether admitted to hospital or discharged home

Type of recurrence, group	Recurrence within 28 days		Recurrence at Day 29 to 1 year	
	Rate	Odds ratio (95% CI)*	Rate	Odds ratio (95% CI)*
All recurrences	3.1%		4.8%	
Admitted (n = 1816)	2.3%	1.00†	5.1%	1.00†
Discharged (n = 719)	5.3%	2.54 (1.60–4.01)‡	4.2%	0.84 (0.55–1.29)§
Stroke	1.1%		2.1%	
Admitted (n = 1816)	0.7%	1.00†	2.5%	1.00†
Discharged (n = 719)	2.1%	3.46 (1.59–7.51)¶	1.3%	0.52 (0.25–1.07)§
Recurrent TIA	2.0%		2.7%	
Admitted (n = 1816)	1.6%	1.00†	2.6%	1.00†
Discharged (n = 719)	3.2%	2.16 (1.23-3.81)**	2.9%	1.16 (0.69–1.96)§

Box 2: Bivariate analysis for event recurrence (stroke or TIA) within 28 days and at 29 days to 1 year, by selected characteristics

Characteristic	No. of patients	Recurrence within 28 days		Recurrence, Day 29 to 1 year	
		Rate	Odds ratio (95% CI)*	Rate	Odds ratio (95% CI)*
Mode of separation from ED					
1. Admitted to ward	1640	2.0%	1.00†	5.1%	1.00†
2. Admitted to critical care	49	0		8.2%	1.67 (0.59–4.75)
3. Transferred	127	6.3%	3.27 (1.48–7.25)‡	3.9%	0.77 (0.31–1.93)
4. Departed from ED	686	5.0%	2.54 (1.56–4.14)§	4.4%	0.86 (0.56–1.32)
5. Departed, own risk	33	12.1%	6.72 (2.23–20.19)§	0	
Hospital					
Neurology department	1371	2.6%	1.00†	5.2%	1.00†
No neurology department	1164	3.8%	1.50 (0.96–2.35)	4.4%	0.84 (0.58–1.21)
Triage category					
Emergency (within 10 min)	111	0.9%	1.00†	5.4%	1.00†
Urgent (within 30 min)	1893	3.4%	3.85 (0.53–28.06)	4.8%	0.88 (0.38–2.07)
Semi-urgent (within 60 min)	511	2.7%	3.10 (0.40–23.81)	4.9%	0.90 (0.36–2.25)

|					
Year of presentation					
2001	576	3.1%	1.09 (0.53–2.24)	6.3%	1.52 (0.86–2.68)
2002	549	2.7%	0.95 (0.45–2.01)	4.9%	1.22 (0.67–2.22)
2003	511	3.7%	1.30 (0.64–2.67)	3.7%	0.88 (0.46–1.68)
2004	448	3.1%	1.09 (0.51–2.34)	4.5%	1.06 (0.56–2.02)
2005	451	2.9%	1.00†	4.2%	1.00†
Sex					
Male	1250	3.3%	1.11 (0.71–1.74)	4.4%	0.84 (0.58–1.21)
Female	1285	3.0%	1.00†	5.2%	1.00†
Age (years)					
≤ 54	433	3.2%	1.30 (0.58–2.50)	3.2%	0.57 (0.32–1.03)
55–64	412	4.9%	1.99 (1.10–3.57)¶	3.6%	0.64 (0.36–1.15)
65–74	571	3.0%	1.20 (0.65–2.20)	5.4%	0.98 (0.63–1.52)
≥ 75	1119	2.5%	1.00†	5.5%	1.00†
Language spoken at home					
English	1999	3.1%	1.00†	5.0%	1.00†
Non-English	524	2.9%	0.94 (0.53–1.66)	4.0%	0.79 (0.49–1.28)
Marital status					
Married (including de facto)	1372	3.4%	1.00†	4.1%	1.00†
Never married (single)	155	0.7%	0.18 (0.03–1.34)	3.9%	0.95 (0.40–2.23)
Widowed	692	2.9%	0.84 (0.49–1.43)	6.4%	1.60 (1.06–2.40)**
Divorced	113	3.5%	1.04 (0.37–2.93)	4.4%	1.09 (0.43–2.77)
Permanently separated††	99	4.0%	1.19 (0.42–3.36)	5.1%	1.25 (0.49–3.20)
Not known	104	2.9%	0.84 (0.26–2.74)	5.8%	1.44 (0.61–3.42)

ED = emergency department. TIA = transient ischaemic attack. * For multiple logistic regression analysis. † Reference category. ‡ P = 0.003. §

P < 0.001. ¶ P = 0.02. ** P = 0.03. †† Legally or otherwise.

Box 3: Distribution of ABCD2 scores* for TIA patients admitted to hospital and those discharged from the ED at Liverpool Hospital, 2001–2005
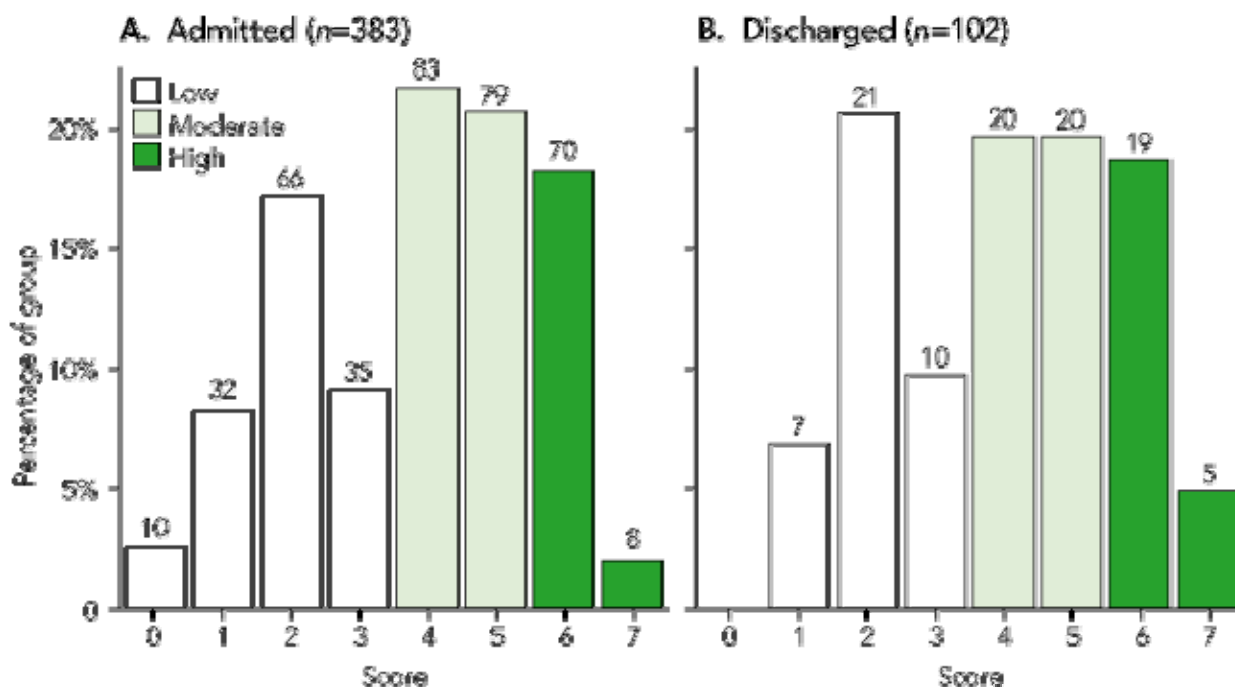
TIA = transient ischaemic attack. ED = emergency department. * ABCD2 scores were calculated by adding 1 point each for age ≥ 60 years; blood pressure ≥ 140/90 mmHg; clinical features, speech impairment alone (2 points if unilateral weakness); duration, 10–59 minutes (2 points if ≥ 60 minutes); and diabetes. Values above bars are number of patients.

Competing interests

None identified.

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