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Predictors for 5-year survival in a prospective cohort of elderly stroke patients

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Objectives – To examine predictors for 5-year survival in elderly stroke patients. *Materials and Methods* – Prospective cohort study of 186 consecutive acute stroke patients aged ≥65 years admitted to Bankstown-Lidcombe Hospital, Australia 03/2002 to 03/2003. All subjects were followed up in 2007/8, at 5 years post-stroke, for outcome measures. Logistic regression analysis was performed to predict 5-year survival using covariables, including functional status, age, stroke type and severity and vascular risk factors. Patients lost to follow-up ($n = 20$) were excluded from the analyses. *Results* – One hundred patients (60%) were dead at study end. Predictors for survival in final logistic regression model were as follows: Glasgow Coma Scale (GCS) on admission (OR 1.49, 95%CI 1.1–2.0, $P = 0.01$), preadmission functional independence measure (FIM) score (OR 1.04, 95%CI 1.0–1.1, $P = 0.01$), age (OR 0.93, 95%CI 0.87–0.98, $P = 0.01$) and atrial fibrillation (OR 0.43, 95% CI 0.19–0.95, $P = 0.04$). For 5-year survivors, mean Modified Rankin Scale was 3.1 ± 1.5, total FIM score 85 ± 32, mini-mental state examination (MMSE) 22 ± 8 and Hospital Anxiety and Depression (HAD) scores 5.4 ± 3.4 and 5.2 ± 3.9, respectively. FIM cognition score was significantly lower at 5 years when compared to baseline (24 ± 8 vs 29 ± 8, $P < 0.05$) (all scores expressed as mean ± SD). In contrast, MMSE, HAD and total FIM scores were not significantly different at 5 years when compared to baseline. *Conclusions* – The study identified lower GCS on admission, lower preadmission FIM score, age and atrial fibrillation as negative predictors for 5-year survival following stroke.

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Introduction

Stroke is the second commonest cause of death worldwide after ischaemic heart disease (1). In westernized countries, it accounts for 12% of deaths; over 80% of these occur in people over 65 years of age (2), who themselves represent the fastest-growing age group of the population (3). Stroke is also the 4th leading cause of disease burden as measured by disability-adjusted life years (4). Although stroke incidence in high-income countries has reduced by 42% (5), with a decline in early case fatality, stroke incidence has increased by 100% in low- to middle-income countries (5). With the changing demographics, it has been projected that by 2030 there will be 7.8 million death worldwide each year because of stroke (6).

Gathering accurate information about both short- and long-term prognosis after stroke is important for a number of reasons. It can help the stroke physician to balance the risks and benefits of therapeutic options and make rational decisions where health care resources are limited. It also aids the multidisciplinary team in setting appropriate goals and determining likely discharge options. Furthermore, it can enable the stroke physician to provide both the patient and their family with realistic ideas about the future.

There are still relatively few prospective observational studies that have examined long-term outcome after stroke or analysed factors associated with long-term risk of survival after stroke (7–17). Most of these studies assessed outcomes in all stroke patients, with only a few focusing on

outcomes in subjects over 65 years of age as an independent group (16, 17).

In observational studies, 5-year mortality rates have varied from 45% (18) to 72% (14). This variation may be explained by the heterogeneity of the inception cohorts, where there are differences in mean age and also differences in types of stroke events examined (i.e. whereas some studies include all strokes, others have included only ischaemic strokes, whilst others include only first-ever stroke). A population-based study in Italy reported 5-year mortality of 24.4% in patients under 80 years of age vs 60.0% in those over age 80 years (16).

Baseline predictors of death at 5 years include increasing age (17, 19, 20), intracerebral haemorrhage (19), ischaemic heart disease (20, 21), atrial fibrillation or flutter (AF) (16, 20, 21), congestive heart failure (21), recurrent stroke (21), intermittent claudication (10), smoking (15), diabetes mellitus (DM) (15, 16), urinary incontinence (10) and prestroke Barthel $< 20/20$ (10).

The impact of ethnicity on stroke risk factors and long-term outcome after stroke has not been previously examined in Australia. A previous study compared differences in baseline characteristics, risk factors profiles and short-term (in-hospital) mortality between English-speaking (ESB) and non-English-speaking background (NESB) patients and found a higher prevalence of DM and underutilisation of anticoagulant therapy for AF in NESB patients (22).

The aims of this study were to examine the 5-year mortality of a cohort of elderly (aged ≥65 years) patients with acute stroke, determine factors predicting 5-year survival post-stroke and determine whether there are any significant differences in functional, cognitive, anxiety and depression measures amongst 5-year survivors, at study end when compared to discharge from hospital.

Materials and methods

Study design

Bankstown-Lidcombe Hospital is a 450-bed teaching hospital of the University of New South Wales and is part of the South West Sydney Area Health Service in Sydney, Australia. It serves an ethnically diverse population of 165,000. Of them, 14.3% of the population is aged 65 years and over, compared to 11.9% for the whole of the Sydney metropolitan area (23); 37.4% of the population are of NESB, which is a higher percentage than that for the whole of the Sydney metropolitan area where 29.4% are from NESB (22).

This is a prospective study of 186 consecutive inpatients, aged > 65 years, who were admitted to Bankstown-Lidcombe Hospital because of acute ischaemic or haemorrhagic stroke or who developed an acute stroke during their inpatient stay. The study period was between March 2002 and March 2003. Patients with transient ischaemic attack (TIA) (symptoms resolving within 24 h of onset and no CT or MRI evidence of acute infarction) or sub-arachnoid haemorrhage were excluded from the study. Baseline data was collected at the time of the index stroke, and patients were assessed for various outcome measures at 1 month, 6 months, 1 year and 5 years.

Data collection

Baseline data collection – At the time of the index stroke, baseline demographic and clinical patient data were collected by a standard questionnaire administered by an investigator to patients, or their relative or carer if the patient was unable to communicate. These data included patient characteristics, history of stroke risk factors and their management. An interpreter was used if the investigator was unable to communicate effectively with the patient and/or their surrogate. In addition, stroke type, clinical investigations and management data were collected prospectively during the patient's hospital stay from the patient's clinical notes and pathology results. Functional status was assessed for patients using the Functional Independence Measure (FIM) scale (24) before admission (by questioning patients, relatives or carers) and at discharge. FIM is an outcome measure of the severity of disability for an inpatient rehabilitation setting. It has a total of 18 items, including 13 items for motor function (evaluating individual's ability in self-care) and five items for measuring cognitive function. For each item, a score range from one to seven is given. The total maximum score for FIM is 126 indicating total independence; the minimum score is 18 indicating requirement for full assistance (24). Baseline demographic and clinical patient characteristics are included in Tables 1–3.

Follow-up data collection – Patients were followed up at 1, 6 and 12 months, and 5 years post-stroke. An analysis of the 1-month, 6-month and 1-year post-stroke outcomes has been previously published (22, 25). Outcome measurements included: mortality rate, Modified Rankin Scale (mRS) (26), FIM, Folstein mini-mental state examination (MMSE) (27), Hospital Anxiety and Depression

Table 1 Comparison of (a) patient characteristics and stroke risk factors (b) stroke subtypes and post-acute stroke characteristics amongst those who were alive or died at 5-year post-stroke

	Overall *n* = 166	Alive *n* = 66	Died *n* = 100	*P* value
(a)				
Age, mean ± SD	80.6 ± 7.3	78.1 ± 6.2	82.3 ± 7.5	<0.001
Age ≥85 years, number	44 (27)	7 (11)	37 (37)	<0.001
Gender, Male (%)	77 (46)	33 (50)	44 (44)	0.53
Ethnicity, NESB (%)	48 (29)	20 (30)	28 (28)	0.75
Living at home prestroke, number (%)	137 (83)	63 (96)	74 (74)	<0.001
Prestroke FIM score, mean ± SD	*n* = 155		*n* = 89	
	113 ± 25.8	122 ± 12.1	106.3 ± 30.8	<0.001
Medical history, number (%)				
TIA				0.26
>12 months	15 (9)	5 (8)	10 (10)	
<12 months	11 (7)	2 (3)	9 (9)	
Stroke				0.19
>12 months	10 (6)	3 (5)	7 (7)	
<12 months	38 (23)	11 (17)	27 (27)	
Ischaemic heart disease	50 (30)	17 (26)	33 (33)	0.39
Hypertension	114 (69)	44 (67)	70 (70)	0.65
Diabetes mellitus	33 (20)	13 (20)	20 (20)	0.96
Left ventricular failure	15 (9.0)	3 (5)	12 (12)	0.10
Peripheral vascular disease	25 (15)	9 (14)	16 (16)	0.68
Valvular heart disease	13 (8)	5 (8)	8 (8)	0.92
Atrial fibrillation	56 (34)	14 (21)	42 (42)	0.006
Family history of cerebrovascular disease	*n* = 152	*n* = 64	*n* = 88	1.0
	30 (20)	13 (20)	17 (19)	
Lipid-lowering therapy, number (%)				
No treatment	124 (75)	46 (70)	78 (78)	0.28
Smoking, number (%)	*n* = 162	*n* = 65	*n* = 7	0.85
Never	90 (55)	32 (49)	58 (60)	
Ex-smoker	50 (31)	20 (31)	30 (31)	
Current smoker	22 (14)	13 (20)	9 (9)	
Alcohol, number (%)	*n* = 161	*n* = 65	*n* = 96	0.85
Never/ex-light to medium	76 (47)	28 (43)	48 (50)	
Ex-moderate to heavy	2 (1)	1 (2)	1 (1)	
Current light/medium	78 (48)	34 (52)	44 (46)	
Current moderate/heavy	5 (3)	2 (3)	3 (3)	
(b)				
Stroke type, number (%)				0.15
Infarct	137 (83)	58 (88)	79 (79)	
Haemorrhage	29 (17)	8 (12)	21 (21)	
Clinical symptoms and investigations				
Glasgow Coma Scale score, mean ± SD	13.6 ± 2.6	14.7 ± 1.0	12.9 ± 3.0	<0.001
Able to walk without help, number (%)	80 (48)	42 (64)	38 (38)	0.001
Able to lift both arms, number (%)	95 (57)	46 (70)	49 (49)	0.008
Dysphasia, yes or unable to assess, number (%)	63 (38)	16 (24)	47 (47)	0.003
Dysphagia, yes or unable to assess, number (%)	84 (51)	21 (32)	63 (63)	<0.001
Vision field loss, yes or unable to assess, number (%)	60 (36)	16 (24)	44 (44)	0.01
Delirium within 3 days post-stroke, number (%)				<0.001
Yes or unable to assess	65 (39)	13 (20)	52 (52)	
No	28 (17)	2 (3)	26 (26)	
Admission blood pressure (mmHg), mean ± SD				
Systolic	159 ± 29	164 ± 30	155 ± 20	0.06
Diastolic	83 ± 17	84 ± 15	83 ± 18	0.74
Complications, number (%)				
Post-stroke pneumonia	15 (9)	3 (5)	12 (12)	0.17
Urinary tract infection	15 (9)	2 (3)	13 (13)	0.03
Day 1 temperature >37.5 degrees	7 (4)	2 (3)	5 (5)	0.54
Urinary and/or faecal incontinence	35 (21)	7 (11)	28 (28)	0.007
Discharge FIM scores, mean ± SD				
Motor	57.2 ± 30.6	69.9 ± 25.4	47.0 ± 30.7	<0.001
Cognition	24.2 ± 11.0	28.7 ± 8.0	20.5 ± 11.7	<0.001
Total	81.4 ± 40.1	98.6 ± 31.7	67.6 ± 41.0	<0.001

FIM, functional independence measure; NESB, non-English-speaking background; SD, standard deviation; TIA, transient ischaemic attack.

(HAD) scale (28), and living arrangements. Data about current medications and recurrent medical problems were also collected.

Data analysis – A patient either was alive or had died at 5 years (the patients' 5-year post-stroke date). Patients lost to follow-up were excluded. Logistic regression analysis was performed to develop a model to predict survival at 5 years by a list of covariables including: age, gender, ethnicity, preadmission living arrangement (lived at home or other than home), preadmission FIM score, history of stroke or TIA, history of hypertension, history of ischaemic heart disease, history of left ventricular failure or valvular heart disease, history of peripheral vascular disease, history of or newly diagnosed AF, DM, family history of cerebrovascular disease, lipid-lowering therapy, history of smoking or alcohol consumption, stroke type (haemorrhage vs infarction), admission systolic blood pressure, admission Glasgow Coma Scale (GCS), ability to walk on admission, ability to raise both arms on admission, visual field loss, dysphagia, dysphasia, post-stroke urinary or faecal incontinence, delirium within 3 days of admission and post-stroke pneumonia or urinary tract infection. PASW statistics 18.0.0 (copyright 1993–2007, Polar Engineering and Consulting, http://www.Winwrap.com/) was used to perform the analyses.

Table 2 Prediction model for 5-year survival (excluding subjects lost to follow-up)

		95% confidence interval		
	Odds ratio	Lower	Upper	*P* value
Preadmission functional independence measure score	1.04	1.01	1.07	0.009
Glasgow Coma Scale on admission	1.49	1.09	2.03	0.01
Age	0.93	0.87	0.98	0.01
Atrial fibrillation	0.43	0.19	0.95	0.04

Ethics approval

This study was approved by the South Western Sydney Area Health Service Human Research Ethics Committee and the University of New South Wales Research Ethics Committee. Informed consent was obtained from all participating patients or their relatives/carers.

Results

In total, 186 acute stroke patients aged ≥65 years were recruited during the initial 12-month study period. All eligible patients who met the inclusion criteria agreed to participate. Twenty patients were lost to follow-up and excluded from the 5-year logistic regression analysis.

Baseline patient characteristics

Patient characteristics are shown in Table 1a. Mean age was 80 years at stroke onset, and 48.4% were men. Thirty-one per cent of patients were of NESB (22). When comparing ESB and NESB patients, there were no significant differences in age, gender, stroke type or preadmission FIM.

Table 3 Comparison of stroke outcomes measurements at each follow-up for the 5-year stroke survivors ($n = 66$)

	Discharge/1 month	6 months	12 months	5 years
Living arrangement, number (%)				
Home	55 (83%)	NA	51 (77%)	40 (61%)
FIM score, mean ± SD (95%CI)				$n = 60$
Motor	69.6 ± 25.4 (63.6–76.1)	71.1 ± 26.0 (64.7–77.5)	71.2 ± 26.0 (64.8–77.6)	61.1 ± 25.5 (54.5–67.7)
Cognition	28.7 ± 8.0 (26.8–30.7)	29.0 ± 7.9 (27.0–30.9)	30.0 ± 7.2 (28.2–31.8)	24.4 ± 8.2 (22.3–26.5)*
Total	98.6 ± 31.7 (90.8–106.4)	100.1 ± 33.0 (92.0–108.2)	101.2 ± 32.6 (93.2–103.2)	85.2 ± 32.2 (76.9–93.5)
Mini-mental state examination score, mean ± SD (95%CI)	$n = 49$	$n = 18$	$n = 53$	$n = 51$
	24.1 ± 5.9 (22.4–25.8)	22.6 ± 5.9 (19.6–25.5)	25.1 ± 4.5 (23.8–26.4)	21.8 ± 7.9 (19.6–24.1)
Hospital anxiety and depression scores, mean ± SD (95%CI)	$n = 51$	$n = 50$	$n = 56$	$n = 51$
Anxiety	6.2 ± 5.4 (4.7–7.7)	5.2 ± 4.8 (3.9–6.6)	6.0 ± 4.8 (4.7–7.3)	5.4 ± 3.4 (4.4–6.3)
Depression	6.5 ± 4.1 (5.3–7.6)	4.9 ± 3.7 (3.9–6.0)	5.5 ± 3.7 (4.5–6.4)	5.2 ± 3.9 (4.1–6.3)

Data are expressed as number (% of total), 95% confidence interval (CI) for categorical variables, or mean ± SD, 95% confidence interval for continuous variables. Total number of subjects in the analysis was 66 unless stated otherwise because of missing information.

95% CIs are used for comparisons of outcome measurements between any two periods. No overlapping of 95% CI represents a significant difference between the two periods equivalents to a $P < 0.05$. * $P < 0.05$.

FIM, functional independence measure; CI, confidence interval; SD, standard deviation.

Baseline stroke risk factors and their management

The prevalence of stroke risk factors is shown in Table 1a. Within the cohort, 43% of patients had a history of smoking, although only 12% were current smokers. Seventy per cent of patients had a history of hypertension, of whom almost one-third were on treatment with more than one agent. Twenty per cent of patients had DM, the majority treated with oral hypoglycaemic agents. The prevalence of DM was significantly higher in patients of NESB when compared to ESB (41% vs 10%, $P = 0.001$) (22).

In our cohort, 32.3% of patients were found to have AF. Significantly fewer NESB patients were being anticoagulated for AF when compared to ESB [1/19 (5%) vs 19/41(46%), $P = 0.001$] (22).

Mortality

Figure 1 demonstrates the numbers of patients either alive, dead or lost to follow-up at 1 month, 6 months, 1 year and 5 years. The crude 1-month, 6-month, 12-month and 5-year survival rates were 88% (164/186), 76% (133/175), 69% (119/172) and 40% (66/166), respectively. There was no significant difference in survival rates between ESB and NESB patients (39% ESB vs 42% NESB, $P = 0.15$).

Patient and stroke characteristics at 5-year follow-up

Patients who had died at 5-year follow-up were significantly older than survivors and those lost to follow-up (82.3 years vs 78.1 and 75.1, respectively; $P < 0.01$). There was no significant difference in gender.

From our previous study, we found that haemorrhagic stroke was associated with a reduced likelihood for survival at 12 months when compared to cerebral infarction [13/29 (45%) haemorrhagic stroke survived compared to 106/143 (74%) infarction survived, $P = 0.003$] (25). In contrast, no significant difference on survival was found between the two stroke types at 5 years: 28% of patients with haemorrhagic stroke were still alive at 5 years when compared to 42% with cerebral infarction ($P = 0.15$). The initial GCS at the time of the stroke was significantly lower in patients who died within 5 years (12.9) when compared to survivors (14.7) or those lost to follow-up (14.5) ($P < 0.01$).

There were no significant differences in the prevalence of hypertension, smoking or alcohol consumption between patients who had survived or died at 5 years. The prevalence of atrial fibrillation was significantly higher in patients who had died at 5-year follow-up when compared to survivors (42% vs 21%, $P = 0.006$).

Logistic regression analysis was used to develop a model to predict survival by a list of covariables (see Methods). A prediction model for 5-year survival is shown in Table 2. Lower GCS on admission, lower preadmission FIM, age and AF were negative predictors for 5-year survival (all $P < 0.05$).

Significantly more survivors at 5 years post-stroke were living at home prestroke when compared to those who died within 5 years (95.5% vs 74%; $P < 0.01$). The mean mRS amongst 5-year survivors was 3.1 ± 1.5 [95% CI 2.7–3.4]. The hospital discharge or 1-month, 6-month, 12-month and 5-year FIM (motor and cognitive), MMSE, HAD anxiety and depression scores are shown in Table 3. FIM cognition score was significantly lower at 5 years when compared to baseline (24 ± 8 vs 29 ± 8, $P < 0.05$).

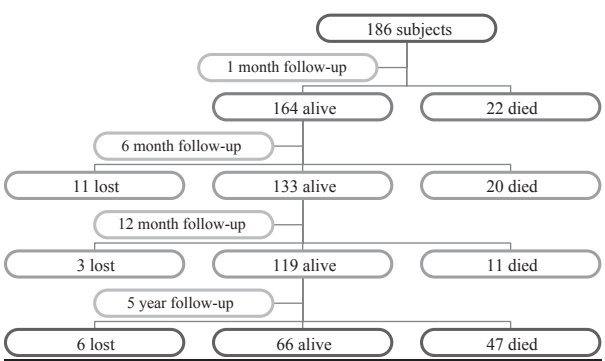

Figure 1. Patient flow – numbers of patients alive, dead or lost to follow-up at 1 month, 6 months, 1 year and 5 years.

Discussion

The present study has examined the mortality rate at 5 years after index stroke in an ethnically diverse cohort of elderly stroke patients. The 5-year survival rate was 40%. Despite advances in post-stroke care including implementation of stroke units and post-stroke pathways for acute complications and secondary stroke prevention management, the 5-year outcome is unchanged when compared to previous prospective studies of consecutive strokes (7, 10, 15). Higher (14, 16) and lower survival rates have been reported in other studies (8, 9, 11, 12, 14), but this is likely to be due to differences in study design such as the inception cohorts (first-ever vs all strokes, lower mean age) and setting (community vs hospital setting). Our study is one of only a few to examine long-term outcomes in elderly stroke patients. The mean age

is significantly higher than many other cohorts (mean age 80 years, compared with 73 years in Perth Stroke Study, and 73.7 years in Copenhagen Study). In spite of this, the 5-year crude survival rates are similar.

In this study, increasing age was inversely associated with 5-year survival after the index stroke which is in keeping with other studies (10, 16, 17, 19). Very old patients (age≥85 years) constituted a disproportionate number (37%) of the total who died at 5 years. Haemorrhagic stroke was associated with a significantly lower likelihood of survival at 12 months but not at 5 years. A similar finding was identified in the Perth Stroke Community Study where haemorrhagic stroke was associated with a substantially lower 30-day survival but a similar if not better prognosis at 5 and 10 years (10, 29). This most probably reflects the importance of cardiovascular disease in the long-term prognosis following ischaemic stroke. In contrast, several other studies have reported a decreased 5-year survival rate after haemorrhagic stroke (7, 19), which may be related to initial stroke severity. We have previously reported that delirium is associated with higher mortality at 12 months post-stroke, and haemorrhagic stroke is probably an independent risk factor for delirium (30). A higher incidence of delirium in patients with haemorrhagic stroke (48% haemorrhagic stroke patients with delirium compared to 21% cerebral infarction with delirium in our previous study) may have contributed to the significantly higher shorter term (12 months post-stroke) mortality rate associated with haemorrhagic stroke.

A recent meta-analysis has found that women are generally older and suffer more severe strokes when compared to men, which results in a less favourable outcome but there is no unequivocal proof of a gender difference in terms of survival (31). Overall, there were more women with stroke in our patient cohort but we did not identify a gender difference in survival at 5 years [33/77 (43%) males still alive compared to 33/89 (37%) females still alive, $P = 0.53$].

A higher GCS on admission was an independent predictor for survival at 5 years. This is most probably a marker of initial stroke severity and is consistent with previous studies (10, 13). Patients with a higher preadmission FIM score represent a group of patients with increased level of premorbid independence, and the finding of a higher 5-year survival is not unexpected (10).

In our cohort, atrial fibrillation was a negative predictor for 5-year survival. This is similar to findings in other studies (15, 16, 20). Interestingly, the prevalence of anticoagulation use for AF at baseline was low, (approximately 33%) and in our ethnically diverse cohort of patients, significantly fewer patients of NESB were anticoagulated than those of ESB (22). Postulated reasons for under-utilisation of Warfarin include communication difficulties in patients without a GP who spoke the same ethnic language and ethnic-specific differences in patient and doctor attitudes towards anticoagulation (22). In spite of this, there was no significant difference in the 5-year survival between ESB and NESB patients.

Neither hypertension nor current smoking was significantly associated with 5-year survival. There is clear evidence linking hypertension and short-term mortality from stroke (32) and even hypertension at discharge from hospital and stroke recurrence (13). One possible reason for the lack of a significant association is that in our study patients were classified according to a prior history of hypertension, although we also found no significant difference in admission blood pressures. Prospective studies have demonstrates a significant association between smoking and long-term mortality after stroke (12, 15). In our study, the lack of such an association may have been related to the low proportion of current smokers (12%), which may have reduced the power to detect a significant effect of smoking. A significantly lower prevalence of smoking in older stroke patients has also been described in other studies (16). A likely explanation for the low prevalence of smoking in an older cohort of patients is that of selective survival, in that smokers would have already died from vascular or other smoking-related diseases at a younger age. A number of the patients in our cohort were unable to communicate because of the effects of their stroke and required a carer or 'proxy' to provide information on their stroke risk factors. Capelle et al. (33) recently found a high level of agreement for exposure to chronic risk factors between stroke patients and proxies, suggesting it is unlikely that reliance on proxies in our study may have significantly underestimated the prevalence of smoking.

Patients in our study who were still alive at 5 years had a mean mRS of 3 and mean total FIM <90, both reflecting the presence of disability requiring assistance with some activities of daily living. The mean MMSE score (22 ± 8) amongst survivors was in the moderately impaired range, whereas mean HAD anxiety and depression scores both fell within the normal range. FIM cognition score was significantly lower at study end when compared to baseline (24 ± 8 vs 29 ± 8, $P < 0.05$). In contrast, MMSE, HAD and total FIM scores were not significantly different at 5

years when compared to baseline. These findings suggest that the functional performance status of 5-year survivors remained relatively stable.

Limitations of this study include its descriptive nature and sample size. Furthermore, the inception cohort included a series of consecutive stroke patients, rather than just those with first stroke. Another drawback is the potential for selection bias because of incomplete ascertainment of outcomes in patients lost to follow-up although this number was small (11%).

Conclusions

In summary, this study found a 5-year survival following stroke of 40%. We identified four independent predictors for survival in an ethnically diverse group of elderly stroke patients. Patient age and AF were significant negative predictors for 5-year survival. Whilst certain risk factors, such as smoking, may not be so prevalent in this older age group, a higher premorbid functional status (FIM score) and higher GCS on admission were significant predictors for survival. There was no difference in mortality between ESB and NESB patients but the low rates of anticoagulation use for AF described in this cohort, particularly in NESB patients, suggest a potential opportunity for future risk reduction.

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Conflict of interests

None.

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