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Outcomes of Medicare beneficiaries hospitalised with transient ischaemic attack and stratification using the ABCD^2 score

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ABSTRACT

Background Long-term outcomes for Medicare beneficiaries hospitalised with transient ischaemic attack (TIA) and role of ABCD^2 score in identifying high-risk individuals are not studied.

Methods We identified 40 825 Medicare beneficiaries hospitalised from 2011 to 2014 for a TIA to a Get With The Guidelines (GWTG)-Stroke hospital and classified them using ABCD^2 score. Proportional hazards models were used to assess 1-year event rates of mortality and rehospitalisation (all-cause, ischaemic stroke, haemorrhagic stroke, myocardial infarction, and gastrointestinal and intracranial haemorrhage) for high-risk versus low-risk groups adjusted for patient and hospital characteristics.

Results Of the 40 825 patients, 35 118 (86%) were high risk (ABCD^2 ≥4) and 5707 (14%) were low risk (ABCD^2=0–3). Overall rate of mortality during 1-year follow-up after hospital discharge for the index TIA was 11.7%, 44.3% were rehospitalised for any reason and 3.6% were readmitted due to stroke. Patients with ABCD^2 score ≥4 had higher mortality at 1 year than not (adjusted HR 1.18, 95% CI 1.07 to 1.30). Adjusted risks for ischaemic stroke, all-cause readmission and mortality/all-cause readmission at 1 year were also significantly higher for patients with ABCD^2 score ≥4 vs 0–3. In contrast, haemorrhagic stroke, myocardial infarction, gastrointestinal bleeding and intracranial haemorrhage risk were not significantly different by ABCD^2 score.

Conclusions This study validates the use of ABCD^2 score for long-term risk assessment after TIA in patients aged 65 years and older. Attentive efforts for community-based follow-up care after TIA are needed for ongoing prevention in Medicare beneficiaries who were hospitalised for TIA.

INTRODUCTION

High prevalence of cardiovascular comorbidities predisposes transient ischaemic attack (TIA) survivors to recurrent adverse events.[1] We aim to describe rates of major adverse events 1 year after hospital discharge among Medicare beneficiaries who experienced a TIA and to examine outcome differences among patients stratified by the ABCD^2 score. The ABCD^2 score has been widely used to identify patients at higher risk of acute recurrent stroke after a TIA.[2] However, it has not been used for evaluating long-term risk of other adverse vascular events or mortality after a TIA in Medicare beneficiaries.

MATERIALS AND METHODS AND RESULTS

Data for patients with an index TIA admission at a participating Get With The Guidelines (GWTG)-Stroke hospitals from 2011 to 2014 were linked with Medicare inpatient claims. Details of the GWTG-Stroke design, linkage with Centres for Medicare and Medicaid Services (CMS) claims data and ascertainment of TIA cases have been previously published.[3] Participating hospitals receive either human research approval to enrol cases without individual patient consent under the common rule or a waiver of authorisation by their institutional review board (IRB). The Duke Clinical Research Institute serves as the data analysis centre for the aggregate deidentified data and the IRB at XXXX University has approved this study. Calculation of the ABCD^2 score is described in detail in the online supplemental file. ABCD^2 ≥4 vs 0–3 threshold was used to risk stratify, as this has been shown to be predictive of higher risk of stroke in previous TIA studies.[4 5] Baseline patient and hospital characteristics were obtained from GWTG-Stroke and summarised using standard descriptive statistical techniques. All patients discharged in 2011–2013 were followed up for at least 1 year and Medicare inpatient claim data were used to determine the 1-year clinical endpoints. Patients discharged in 2014 were censored at the earlier date of death or the end of study date of 31 December 2014. The median follow-up time for all 2014 discharges was 184 days. Event rates for 1-year mortality and composite of readmission or mortality outcomes were provided using Kaplan-Meier

Table 1 Patient and hospital characteristics for Medicare beneficiaries with TIA

Variable	Overall (N=40 825)	ABCD^2 score 0–3 (N=5707)	ABCD^2 score ≥4 (N=35 118)	P value
Demographics				
Age in years, median (IQR)	80.00 (73–86)	80.00 (73–86)	80.00 (73–86)	0.0247
Sex, %				
Male	39.50	41.25	39.22	0.0036
Race, %				
Other	2.32	2.14	2.33	<0.0001
White	81.87	86.68	81.09	
Asian	1.18	1.12	1.19	
Black	10.34	6.80	10.92	
Hispanic	4.29	3.26	4.46	
Medical history, %				
Atrial fibrillation	19.21	20.61	18.99	0.0040
Prosthetic heart valve	1.85	2.56	1.73	<0.0001
Previous stroke/TIA	32.07	27.21	32.86	<0.0001
CAD/prior MI	31.98	28.40	32.56	<0.0001
Carotid stenosis	4.59	5.03	4.51	0.0844
Diabetes mellitus	35.34	11.90	39.15	<0.0001
PVD	5.16	4.99	5.19	0.5315
Hypertension	80.41	75.75	81.16	<0.0001
Smoker	6.45	5.87	6.55	0.0535
Dyslipidaemia	51.93	52.50	51.84	0.3577
Heart failure	9.28	7.59	9.55	<0.0001
No of prior hospitalisations, median (IQR)	0.00 (0.00–1.00)	0.00 (0.00–1.00)	0.00 (0.00–1.00)	0.3529
Discharge status, %				
Discharge home	81.55	89.15	80.32	<0.0001
Ambulating independently (vs unable or with assistance)	74.24	82.69	72.87	<0.0001
Discharge treatment, %				
Antihypertensive	83.10	79.25	83.73	<0.0001
Cholesterol-lowering medications	77.20	76.87	77.25	0.5080
Antithrombotics	95.51	95.92	95.44	0.2728
Defect-free care*	90.55	91.00	90.48	0.2193
Hospital characteristics				
No of hospital beds, median (IQR)	319 (223–443)	325 (231–484)	318 (222–439)	<0.0001
No of ischaemic stroke discharges/year, median (IQR)	198.25 (135.09–295.18)	206.82 (143.82–317.19)	196.00 (132.71–293.67)	<0.0001
Region				
West	11.85	9.64	12.21	<0.0001
South	30.61	23.80	31.72	
Midwest	19.15	18.50	19.25	
Northeast	38.39	48.06	36.82	
Teaching hospital, %	51.58	53.69	51.24	0.0023
Primary stroke centre certification, %	44.79	42.63	45.14	0.0004

Continued

Table 1 Continued

Variable	Overall (N=40 825)	ABCD^2 score 0–3 (N=5707)	ABCD^2 score ≥4 (N=35 118)	P value
Rural location, %	6.10	4.71	6.33	<0.0001

*Defect-free care is a global quality of care metric. Details provided in the online supplemental material.
CAD, coronary artery disease; HF, heart failure; MI, myocardial infarction; PVD, peripheral vascular disease; TIA, transient ischaemic attack.

estimates. For readmission outcomes, estimates were reported from the cumulative incidence functions. The cumulative instance was reported to describe the observed rates of outcomes. For mortality outcomes, the log-rank test was used to compare the difference between ABCD^2 ≥4 and 0–3, and for readmission outcomes, the Fine-Gray model was used to account for the competing risk of mortality to readmission. Multivariable proportional hazard (Cox) models were constructed to examine the association of outcomes with ABCD^2 score and adjusted for patient and hospital characteristics. Robust SE estimates were used to account for within-hospital clustering. Statistical analyses were performed using SAS software V.9.4 (SAS Institute). P values are based on two-sided tests, with p<0.05 considered statistically significant.

RESULTS

Of 40 825 patients with an index TIA admission, 35 118 (86%) were high risk and 5707 (14%) were low risk. Characteristics for patients with a TIA overall and by ABCD^2 score categories are described in table 1. Median age of Medicare beneficiaries with a TIA was 80 years, 81.9% were white and 60.5% were women. Discharge home from the hospital occurred for 81.6% of patients (table 1).

During 1-year follow-up after hospital discharge for the index TIA, 11.7% died and 44.3% were rehospitalised for any reason (table 2, online supplemental figure S1). After risk adjustment, patients with an ABCD^2 score ≥4 had a higher risk of 1-year ischaemic stroke (3.7% vs 2.7%; HR 1.25 (95% CI 1.04 to 1.50), all-cause), readmissions (45.1% vs 39.8%; HR 1.08 (1.03 to 1.14)) and mortality (12.0% vs 9.5%; HR 1.18 (1.07 to 1.30)) than patients with an ABCD^2 score of 0–3. Additionally, patients with an ABCD^2 score >=4 have a higher hazard of each composite endpoint (mortality/ischaemic stroke, mortality/all-cause rehospitalisation and mortality/major vascular event) at 1 year. When stratified by ABCD^2 score, there was no difference in the observed rates of 1-year myocardial infarction, haemorrhagic stroke, gastrointestinal bleed or major vascular events.

DISCUSSION

The contemporary data presented here on occurrence of adverse events within 1 year after hospitalisation for TIA in Medicare beneficiaries will be instructive for targeting preventive efforts. We also demonstrated that the ABCD^2 score can be used to identify patients at higher risk for ischaemic stroke, all-cause rehospitalisation and mortality even at 1 year following index TIA.

Major changes in the management of TIA have occurred in recent years, including urgent management in specialised units and implementation of rapid investigation and algorithms for routine use of preventive

Table 2 Event rates, unadjusted and adjusted 1-year outcomes comparing TIA patients with ABCD^2 ≥4 and 0–3

Outcomes 1 year after TIA	Overall	ABCD^2 0–3	ABCD^2 ≥4	Unadjusted HR (95% CI)	Adjusted* HR (95% CI)
Ischaemic stroke	3.6%	2.7%	3.7%	1.37 (1.15 to 1.64)	1.25 (1.04 to 1.50)
Haemorrhagic stroke	0.5%	0.5%	0.5%	0.94 (0.63 to 1.42)	0.97 (0.63 to 1.47)
Myocardial infarction	1.6%	1.5%	1.6%	1.04 (0.82 to 1.32)	0.88 (0.68 to 1.13)
Gastrointestinal bleed	2.2%	2.0%	2.2%	1.12 (0.90 to 1.38)	1.05 (0.84 to 1.31)
Major vascular events†	5.6%	4.7%	5.7%	1.21 (1.06 to 1.39)	1.10 (0.96 to 1.27)
All-cause readmission	44.3%	39.8%	45.1%	1.18 (1.12 to 1.24)	1.08 (1.03 to 1.14)
All-cause mortality	11.7%	9.5%	12.0%	1.28 (1.16 to 1.41)	1.18 (1.07 to 1.30)
Composite mortality or ischaemic stroke	14.6%	12.1%	15.0%	1.26 (1.16 to 1.38)	1.16 (1.07 to 1.27)
Composite mortality or major vascular event†	15.9%	13.4%	16.3%	1.24 (1.14 to 1.35)	1.14 (1.05 to 1.24)
Composite mortality or all-cause rehospitalisation	47.2%	42.2%	48.1%	1.20 (1.14 to 1.26)	1.10 (1.05 to 1.16)

*Covariates used in adjusted models listed in the online supplemental file.
†Major vascular event includes rehospitalisations for ischaemic stroke, haemorrhagic stroke or myocardial infarction.
TIA, transient ischaemic attack.

treatments.[6–9] However, patients with a higher burden of cardiovascular comorbidities continue to suffer from high mortality or rehospitalisation following TIA.[1 3 10–12] A previous study of Medicare beneficiaries admitted with TIA at GWTG-Stroke–participating hospitals from 2003 to 2008 showed that patients with TIA at higher risk of adverse outcomes were actually less likely to receive guideline-recommended care.[3]

Previous studies have shown the association between higher ABCD^2 score and increased short-term risk of stroke after TIA.[5] Validation studies have shown conflicting results, and the ABCD^2 scoring system has not been evaluated for predicting long-term risk.[2 13] Our study validates use of the ABCD^2 score for long-term risk assessment in a large, US national patient population of patients aged 65 years and older after TIA.

This study has several limitations. We analysed data for Medicare fee-for-service beneficiaries who presented to the hospitals participating voluntarily in a quality improvement initiative, which will influence generalisability of the results. It is worth noting that the observed rate of 1-year mortality in our cohort is significantly higher than what was reported in some of the previous studies, likely due to the older population in our cohort. In a study by Olson *et al*, 3.8% of subjects died within 1 year of hospital discharge after TIA, but the median age was 69 years for patients with TIA in that study compared with 80 years in our study.[11] Another study by Amarenco *et al* estimated 1-year risk of death from any cause in patients with a TIA at 1.8%.[10] Again, the average age of patients in this study was 66.1 years compared with 80 years in our study. Diagnosis of TIA was based on standard clinical criteria, and misclassification is possible. Outcomes were identified using only Medicare administrative claims data, although overall accuracy of such approach is high.[14] We were also unable to assess potential effects of differential postdischarge care on adverse outcomes.

SUMMARY AND CONCLUSION

Enhanced planning of postdischarge care and community-based follow-up may be warranted to ensure continued efforts to prevent adverse events after a hospitalisation for TIA in Medicare beneficiaries. ABCD^2 score on admission for Medicare beneficiaries with TIA can be used to identify a vulnerable group of patients at risk for ischaemic stroke, rehospitalisation and death.

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