

Can Emergency Department Physicians Safely Discharge Patients Presenting with TIA? Assessing the TIA Rapid Assessment (TIARA) Protocol

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ABSTRACT

Objectives: Among discharged patients with TIA, we hypothesize that rates of recurrent stroke within 90 days will be similar to that of an admitted population reported in the current literature.

Methods: Beginning in 2011 a comprehensive stroke center's neurological emergency department (Neuro ED) implemented a protocol named TIA rapid assessment (TIARA). All patients presenting with an acute neurologic syndrome are triaged based on this system. This protocol enables Neuro ED physicians to admit high-risk patients and discharge low-risk patients based on ABCD² scores in conjunction with advanced neuroimaging. The discharged patients are provided with expedited work-up and neurology follow-up within 48 hours. Eligible participants were identified by physicians in the Neuro ED and consented at their 48-hour follow-up appointment. The TIARA protocol served as the intervention in our study. Rate of stroke recurrence at 90 days was the main outcome used to evaluate this new standard of care.

Results: At 90 days, 29 out of 37 patients discharge with TIA were successfully contacted by phone. One patient had a stroke in this time frame, yielding a recurrence rate of 3.4%. The overall risk of stroke reported in the literature currently is 11-17%.

Conclusions: While this study did not directly compare stroke recurrence rate to an admitted population, we were able to compare with rates in the literature. Our markedly low stroke recurrence rate at 90 days suggests that ED physicians can safely discharge patients with TIA provided they receive neurology follow-up in 48 hours.

KEYWORDS

Cerebrovascular Disease/Stroke; Transient Ischemic Attack; Magnetic Resonance Imaging; Emergency Care.

INTRODUCTION

Transient ischemic attack (TIA) heralds a potential medical emergency and warns of an impending stroke in roughly one-third of patients who experience it [1]. Between 200,000 and 500,000 TIAs are diagnosed annually in the United States.

Emergency Department (ED) visits for TIAs occur at an approximate rate of 1.1 per 1000 in the US population, and TIAs are diagnosed in 0.3% of ED visits [2]. Within two days after a TIA the risk is highest, with 1-8 percent of people having an actual ischemic stroke, depending on patient presentation and risk factors; within three months after a TIA, 11 to 17 percent of people will have an actual ischemic stroke [1, 3]. Influenced by this increased risk of stroke post TIA, ED physicians have been reluctant to discharge patients, therefore resulting in an increase in the percentage of TIA patients admitted. In fact, there was a statistically significant increase in the annual admission rates for TIA patients from 2000 to 2010, from 70% to 91%, respectively [4].

Over the past 11 years a trend to provide “urgent care” or “rapid access” to stroke and TIA patients in hospitals across the United States has emerged [5, 6]. While implementing “brain attack” programs to rapidly initiate thrombolytic therapy in patients suffering acute ischemic strokes has received much attention, little has been paid to identifying patients at high short-term risk of stroke, such as TIA patients. Our comprehensive stroke center attempted to remedy this discrepancy by implementing a specialized Neurologic Emergency Department (Neuro ED) to triage patients with neurological complaints who can benefit from immediate and focused attention [7]. The Neuro ED employs board certified physicians in emergency medicine who have additional specialized neurosciences training. The dual combination allows for quick recognition and treatment of various stroke presentations without neurology consultation [8]. The Neuro ED’s success led to the hypothesis that with specialized care, attention, and protocol, a majority of TIA patients can be discharged to home safely with timely neurology follow-up.

While evidence clearly supports quicker treatment for acute ischemic stroke patients yielding better prognoses, the role hospital admission versus possible ED discharge plays in these improved prognoses is unclear. Quantifying risk in five categories, ABCD² scores help physicians gauge risk of TIA leading to an acute ischemic stroke. Scores of 0-3 indicates a 1% risk for stroke in the next 48 hours, 4-5 a 4% risk, and 6-7 an 8% risk (Table 1) [9]. Despite the established use of ABCD² scores, the percentage of patients discharged safely with given ABCD² scores represents a gap in the literature.

Table 1: A: ABCD² score scoring table and point guidelines reproduced from The National Stroke Association’s published resource [9]. B: ABCD² score with corresponding predicted 2-day stroke risk reproduced from The National Stroke Association’s published resource [9].

A. Risk Factors	Points
Age ≥60 years	1
Blood Pressure Systolic BP ≥ 140 mm HG OR Diastolic BP ≥ 90 mm Hg	1
Clinical Features of TIA (choose one) Unilateral weakness with or without speech impairment OR Speech impairment without unilateral weakness	2 1
Duration TIA duration ≥ 60 minutes OR TIA duration 10-59 minutes	2 1
Diabetes	1
Total ABCD² Score	0-7

B. ABCD ² Score	2-Day Stroke Risk	Comment
0-3	1.0%	Hospital observation may be unnecessary without another indication (e.g., new atrial fibrillation)
4-5	4.1%	Hospital observation justified in most situations
6-7	8.1%	Hospital observation worthwhile

A big influence in the decision to admit versus possibly discharge TIA patients stems from limited immediate availability of specialized neurological care in an ED as well as access to immediate follow up. Although admitting patients with a TIA may provide them with closer medical attention during their acute recovery phase, longer lengths of hospitalization have been shown to be associated with significantly increased hospitalization charges and increased medical complication rates [10, 11]. Increased financial burdens and complication rates trigger the re-evaluation of admitting TIA patients as standard of care or best practice. Our institution attempted to reconcile these findings by designing a program that allows patients discharged with a TIA diagnosis to see a neurologist within 48 hours.

Our study is unique on two accounts. First, all patients received advanced neuroimaging with MRI of the brain within one hour of ED presentation. Second, patients were not admitted to the hospital or placed in an observation unit, the currently considered best practice for most hospitals across the country. Our study patients were discharged home with arranged neurology specialty follow-up within 24-48 hours.

We hypothesize that in our cohort of patients discharged following TIA diagnoses, the rate of recurrent stroke will be similar to those admitted to hospitals across the country.

METHOD

Our Transient Ischemic Attack Rapid Assessment (TIARA) is a well-defined protocol created by our neuroscience team to assess, diagnose, and disposition patients with transient neurologic symptoms. As endorsed by consensus statements from the American Heart Association (AHA) and American Stroke Association (ASA), TIA is now defined as a transient episode of neurologic dysfunction caused by focal brain, spinal cord, or retinal ischemia without acute infarction. Noting the new definition does not specify any time limitations, this was the criteria Neuro ED physicians used to enroll patients [12]. All patients received a complete set of vital signs, Complete Blood Count, Chem 7, PT/INR/PTT, troponin, Electrocardiogram and Chest X-Ray. The patient then received a rapid Magnetic Resonance Imaging (MRI) of the brain without contrast within one hour of arrival to the Neuro ED and our neuroradiology team read the Diffusion Weighted Images (DWI) in real time. Rapid access to MRI within one hour of patient arrival was easily attainable by a multidisciplinary approach between the Neuro ED staff, MRI technicians, and the neuroradiologist at our comprehensive stroke center. If the MRI was negative, patients continued to be monitored in the ED for a total of 4 hours, including close cardiac monitoring to rule out any arrhythmias. If the MRI was positive for infarct, Magnetic Resonance Angiography (MRA) of the head and neck was added and patients were admitted to our stroke unit. Patients that could not have an MRI due to pacemaker/defibrillator, claustrophobia, spinal/bladder stimulators, etc. were excluded from being enrolled. Any patients with a history of, or current atrial fibrillation, were also excluded from being enrolled due to their high risk of recurrent TIA or stroke. Each patient with a negative MRI, resolution of symptoms, and normal cardiac monitoring at the end of 4 hours was discharged on antiplatelet and statin therapy. If the patient was already on aspirin, clopidogrel was added. Neurology follow up appointments within the next 1-2 days were made by the Neuro ED physician personally, and the follow up information was given to the TIARA patients upon discharge. ABCD² scores were mandatory for each TIARA patient, however it was at the discretion of the Neuro ED physician whether to discharge with close follow up, or admit to the stroke unit depending on individual patient risk.

Institutional review board ethical standards and institutional guidelines were met by this prospective review. All subjects signed informed consent forms before enrollment at an outpatient follow-up appointment within 48 hours of TIA presentation to the Neuro ED. Following receipt of informed consent, patient charts were reviewed for hospital ED presentation, 48-hour follow-up, and 90-day follow-up.

Information gathered from the ED chart included patient demographic information, clinical symptoms, blood pressure, risk factors, ABCD² score, NIHSS score upon admission, and diagnostic imaging (Table 2). Treating physicians in an outpatient clinic conducted repeat physical and neurological examinations 24-48 hours later, consisting of cranial nerve examination, sensory and motor examination, and a Modified Rankin Scale. At 90 days, subjects were contacted by phone regarding their current state of health and whether they had experienced stroke following their initial TIA.

Table 2: Demographic information and risk factors for patients who were discharged following TIA (n = 37).

Demographic Information and Risk Factors	Number of Patients
Age > 60 years	7
Male	18
Female	19
White	6
African American	21
Hispanic	2
SBP > 140 or DBP > 90	22
Unilateral weakness only	9
Speech disturbance only	3
Both unilateral weakness and speech impairment	0
Duration of symptoms > 60	30
Duration of symptoms 10-59 min	7
Diabetes	6
NIHSS 0	28
NIHSS 1	6
NIHSS 2	3
ABCD ² score of 0-3	27
ABCD ² score of 4-5	10
ABCD ² score of 6-7	0
MRI brain without contrast	37

RESULTS

Between April 2014 through December 2015, thirty seven patients were consented at outpatient TIA follow-up visit within 48 hours of discharge from the Neuro ED. The 37 patients discharged included 18 males and 19 females. Ages ranged from 36 to 87 years with an average of 54 years. Blood Pressure measurements were ≤120/≤80 (Normal) in 5 patients, 121-139/81-89 (Prehypertensive) in 10 patients, 140-159/90-99 (Stage 1 Hypertension) in 12 patients, and ≥160/≥100 (Stage 2 Hypertension) in 10 patients. Clinical symptoms that earned patients points on their ABCD² score were lateralized weakness in 9 patients, and speech disturbance in 3 patients. Other clinical symptoms consisted of facial droop, altered mental status, paresthesias, headache, visual disturbance, dizziness/

vertigo, pain, and gait disturbance/balance issues (Table 3). The patients with other clinical symptoms listed that are atypical such as headache, altered mental status, and pain, were included as part of Table 3 as they coincided with a more typical TIA symptom complaint of weakness or speech disturbance. Duration of symptoms ranged from 10 minutes to 45 hours with a mean of 8 hours (one patient had a symptom duration of 168 hours and was removed from the mean calculation as an outlier). Recognizing that the majority of TIA patients have symptoms lasting less than one hour, patients were still included regardless of time of symptom duration based on the new AHA definition of TIA listed under Methods. Seven patients had a history of diabetes. NIHSS was performed in all 37 patients: 28 patients had a score of 0; 6 patients had a score of 1; and 3 patients had a score of 2 (Table 4). Patients with NIHSS of 1 or 2 were considered candidates for the study as their deficits were decreased sensation with no other objective neurologic findings. ABCD² scores were available in all patients and consisted of a score of 0-3 in 27 patients, and 4-5 in 10 patients (Table 5).

Table 3: Number of discharged TIA patients with various clinical symptoms (n = 37).

Symptoms	Number of Patients
Abnormal speech	3
Altered mental status	2
Dizziness/vertigo	8
Facial droop	4
Gait disturbance/balance issues	2
Headache	13
Pain	2
Paresthesias	24
Visual disturbances	2
Weakness	9

Table 4: Number of discharge TIA patients with each NIHSS score (n = 37).

NIHSS Score	Number of Patients
0	28
1	6
2	3
Total (n)	37

Table 5: Number of discharged TIA patients with ABCD² scores distributed by risk category (n = 37).

ABCD ² Score	Number of Patients
Low Risk	27
Moderate Risk	10
High Risk	0
Total (n)	37

Patients were contacted for follow up by phone and asked if they had a stroke within 90 days of initial TIA. Of 29 patients successfully contacted, 1 had acute ischemic stroke within 90 days, for a rate of 3.4 %.

DISCUSSION

The determination of which patients require inpatient services versus those who are for discharge is controversial, and significant practice variability exists. Reported admission rates of TIA patients in the United States range from 53% to 91%, with rates continuing to increase over the past decade. Local practice patterns, socioeconomic and demographic factors, as well as ED crowding all increase the likelihood of admission [1]. Our study tries to delineate if there is in fact population of TIA patients that can be safely discharged to home, and therefore decrease hospital admission rates.

Our specialized Neuro ED provides patients with the necessary timely, appropriate, and focused care for neurologic complaints. The Neuro ED physicians also collaborate efficiently with outpatient neurologists employed by the hospital. This environment allows for an examination of optimal practice, as best TIA practices have yet to be identified in such a specific setting [7, 13]. We found that 37 TIA patients were discharged after presentation to the Neuro ED. Physicians felt confident to discharge patients after TIA with the knowledge that these patients had a negative MRI and would have focused neurological care within 48 hours of the event, thereby preventing hospital admission.

Of the 37 discharged patients, 29 were successfully contacted for a 90 day follow-up. Only one out of 29 contacted patients had a stroke within 90 days, or 3.4 % which is markedly decreased compared to the rate currently reported in the literature for admitted patients. The overall risk of stroke reported in the literature at 90 days is 11-17% [1]. No patients that were enrolled in the study and discharged to home had a recurrent stroke within 2 days, 1 week, or even one month. In the one patient who was discharged with an ischemic event, the actual timeline for the recurrent stroke was at 60 days. The patient had a NIHSS score of 0 and the clinical symptoms consisted of a subjective feeling of weakness to the left arm and left leg with some mild confusion. In this particular patient, the blood sugar was low on initial presentation to the Neuro ED. Symptoms did not initially improve with correction of blood glucose, so the patient was included in the study. Although the patient's ABCD² score was 5 predicting a 4% two day stroke risk, the patient's actual ischemic event did not happen until 60 days. Therefore, it is very plausible that ad-

mission to the hospital would not have altered the patient's ultimate outcome. The proportion of actual stroke rate with our TIARA protocol (1/29) more than suggests that Neuro ED doctors can safely discharge TIA patients in conjunction with close specialty follow up within 48 hours.

Based on ABCD² scores, most patients in our study were at a low risk for TIA recurrence (Table 5). In looking at the group of patients successfully contacted at 90 days, ABCD² scores indicated low risk in 76% of patients, moderate risk in 24%, and high risk in 0% (22, 7, and 0 patients respectively). Because of the low percentage of TIA recurrence even when discharged, low risk ABCD² scores coupled with close neurologic follow up can influence a decision to discharge patients. However, clinical judgment remains imperative and individual patient ABCD² scores should still be considered in conjunction with other factors, such as NIHSS score, neurological history, and cardiovascular risk factors [14]. An ability to safely discharge TIA patients following the TIARA protocol supports the continued practice of our Neuro ED system for optimizing care for TIA patients.

One cause for our small patient enrollment was the number of patients that presented to the Neuro ED with resolved neurologic symptoms and NIHSS of zero, but DWI-positive MRI of the brain, and therefore were admitted rather than discharged. About 34% of TIA patients will have a DWI lesion and that percentage is consistent with our study as well [15]. These DWI-positive TIA patients are best classified as stroke with rapidly resolving symptoms and require a more aggressive antithrombotic strategy. This high percentage of DWI-positive TIA patients also can be used to justify the cost of rapid MRI.

Another limitation to our study was 8 patients were unable to be contacted by phone for 90 day follow up outcome. If able to be contacted, our population study would have been slightly larger. Ethical considerations limit this prospective study from randomizing patients to either hospital admission or ED discharge. For this reason, we were restricted to comparing our findings to admission data reported in the literature. Future studies should examine larger admitted and discharged TIA populations to provide a more comprehensive comparison between these two groups. Preliminary findings through our Neuro ED in conjunction with the TIARA protocol, that can be easily reproduced across other institutions, prompt further investigation of when and how to safely discharge TIA patients.

CONCLUSION

DWI-negative TIA patients perceived to have a low risk of recurrent stroke, and no other indication for hospitalization,

who are evaluated by neuro ED specialists and cared for with both immediate access to MRI and rapid outpatient neurology evaluation, turned out to indeed have a fairly low, albeit non-zero risk, of patient-reported stroke symptoms at 90 days. Our stroke recurrence rates following Neuro ED discharge are better than those reported in the literature, 3.4% vs. 11-17% respectively. Further evaluation is worthwhile prior to changing the standards of care for TIA patients as our combination of a specialized Neuro ED that implements a specific TIARA protocol shows initial promising results.

AUTHOR CONTRIBUTIONS

EV, MB, CS, GG, MD, KG, and CM conceived the study and designed the trial. MB, CM, and AL supervised the conduct of the trial. KG, MD, MB, CM, and AL supervised data collection. KG, MD, CS, and GG undertook recruitment and enrollment of consented patients. AL, DE, and CM managed the data entry, including quality control. CM provided statistical advice on study design and analyzed the data. DE and AL drafted the manuscript, and all authors contributed substantially to its revision. KG takes responsibility for the paper as a whole. All authors in the acknowledgements helped with the study design, logistics, or patient consent.

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DISCLOSURES

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