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Inpatient versus Outpatient Management of TIA or Minor Stroke: Clinical Outcome

Shahram Majidi, MD, **Christopher R. Leon Guerrero, MD**, **Kathleen M. Burger, DO**, and **John F. Rothrock, MD**

Department of Neurology, George Washington University School of Medicine, Washington, DC, USA

Abstract

Background—The management of patients with acute transient ischemic attack (TIA) or minor stroke is highly variable. Whether hospitalization of such patients significantly improves short-term clinical outcome is unknown. We assessed the short-term clinical outcome associated with inpatient versus outpatient management of patients with TIA or minor stroke.

Methods—We evaluated a consecutive series of patients with acute TIA or minor ischemic stroke (NIH Stroke Scale score ≤ 3) presenting to a single emergency department (ED). We randomized patients to either hospital-based or outpatient-based management. All patients underwent interview and examination 7–10 days following the index event.

Results—This study included 100 patients, 41 with TIA and 59 with minor stroke. Nineteen (46%) of the TIA patients and 29 (49%) of the minor stroke patients randomized to hospital management, and the remaining 22 TIA patients and 30 minor stroke patients randomized to outpatient-based management. In the patients with a minor stroke, neurologic worsening occurred in 6 out of 29 (21%) in the inpatient arm compared with 3 out of 30 (10%) in the outpatient arm ($p = 0.3$). In none of these cases was acute interventional therapy or need for urgent admission considered medically appropriate. In the patients with a TIA, recurrence of a TIA occurred in 2 out of 19 (11%) in the inpatient arm compared with 2 out of 22 (9%) in the outpatient arm ($p = 1$). None of the patients with a TIA randomized to the inpatient arm experienced a stroke compared with 1 out of 22 in the outpatient arm ($p = 1$). There were no deaths in either group.

Conclusion—Routine hospitalization of all patients with TIA or minor ischemic stroke may not positively affect short-term clinical outcome.

Keywords

Transient ischemic attack (TIA); minor stroke; stroke bridge clinic

Introduction

Each year in the United States, hundreds of thousands of individuals present to medical attention for evaluation of acute transient ischemic attack (TIA) or minor stroke [1]. Despite this frequent occurrence, the early management of TIA and minor stroke varies greatly across centers and controversy exists regarding the need for hospitalization for patients presenting after a TIA [2–5]. Prior studies have found the risk of early stroke within 7 days following TIA to be as high as 12% [6]. Conversely, one study reported that nearly a quarter of patients experience a TIA within 7 days prior to presentation with a stroke [7].

Given this temporal relationship, rapid evaluation of patients experiencing TIA clearly is indicated, and in the TIA population and for patients with clinically minor ischemic stroke, expeditious diagnostic evaluation and initiation of effective stroke prevention measures should reduce the risk of potentially disabling imminent stroke [8]. What remains less clear is what level and type of healthcare resource utilization represents the optimal

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Corresponding Author: Shahram Majidi MD, Department of Neurology, George Washington University School of Medicine, 2150 Pennsylvania Ave, NW 9th Floor, Washington, DC 20037, USA. Tel.: (202) 741-2700; fax: (202) 741-2721. majidis@gwu.edu.

means for managing patients who present with acute TIA or clinically minor ischemic stroke.

Although TIA is a risk factor for imminent stroke, the majority of TIAs are not followed by stroke, and only a small fraction of TIAs herald clinically severe stroke [9]. The same can be said for patients presenting with acute ischemic stroke and minor associated neurologic deficit. Predictive models and scales intended to stratify the early risk of stroke in patients presenting with TIA have been developed, but all possess limitations that variously include ease of use, reproducibility, and accuracy [10]. The age, blood pressure, clinical symptoms, duration of the symptoms, and presence of diabetes (ABCD2) score is widely used to assess early stroke risk following TIA, but in a meta-analysis of published studies, evaluating the utility of this instrument. Wardlaw *et al*. [11] found that the ABCD2 score did not reliably discriminate those at low and high risk of early recurrent stroke nor identify patients requiring urgent intervention. As demonstrated by Ferrari *et al*. [12], around 5% of patients presenting with a TIA or minor stroke experienced clinical deterioration even despite hospitalization and urgent subspecialized care. A few studies have looked at urgent outpatient follow-up after TIA, and, overall, this approach seems to be a safe alternative with relatively low 90-day stroke risk [13–15]. A “stroke bridge clinic” intended to provide an expeditious outpatient evaluation and work-up after a TIA or acute minor stroke may be an efficient and cost-effective approach.

Methods

We prospectively evaluated a consecutive series of patients presenting to the Renown Regional Medical Center (Reno, NV) emergency department (ED) between September 1, 2013 to June 30, 2014 with a TIA (classic definition [9]) or minor ischemic stroke (NIH Stroke Scale Score ≤ 3) and presenting within 6-h symptom onset. This study was conducted under the auspices of the relevant institutional review board.

All evaluations were performed by a neurologist with subspecialty board certification in vascular neurology. All patients underwent non-contrasted brain computed tomography (CT), and all patients with a TIA or stroke symptoms/signs referable to the anterior circulation underwent a vascular imaging study [carotid duplex exam, magnetic resonance angiography (MRA), or CT angiography (CTA)] to evaluate anatomically significant stenosis, involving the presumably symptomatic extracranial internal carotid artery. Laboratory studies included a complete blood count, chemistry panel, and lipid profile. All patients received a standard electrocardiogram, and were monitored via cardiac telemetry while in the ED.

An ABCD2 score was determined for each patient with a TIA. The etiology for patients with minor stroke was classified using TOAST criteria [16].

Patients with symptoms/signs referable to the anterior circulation and with evidence of anatomically significant stenosis within the symptomatic extracranial internal carotid artery on vascular imaging were excluded. Patients with a history of atrial fibrillation or active atrial fibrillation present at the time of ED evaluation were excluded. In addition, patients with a coexisting acute medical condition requiring hospitalization (e.g., acute myocardial ischemia, uncontrolled hypertension, or diabetes) were excluded. Patients with symptoms/signs referable to the posterior circulation were considered eligible for participation independent of any findings present on vascular imaging studies.

Eligible patients were offered the opportunity to participate in this study. Written informed consent was obtained, and subjects were randomized in a 1:1 fashion to either hospitalization or to “stroke bridge clinic" for management of their TIA or minor stroke. Antiplatelet therapy was started within 12-h initial presentation in all patients. A statin was prescribed for all patients. Patients randomized to management in the stroke bridge clinic were scheduled to be seen within 72-h discharge from the ED (Figure 1).

All patients underwent interview and examination 7–10 days following the index event. Primary clinical outcomes defined as clinically detectable new stroke, new TIA, death, and clinical deterioration in the minor stroke subset (defined as any increase in baseline NIHSS score) within 7 days after the index event was assessed among both groups.

Results

A total of 163 consecutive patients with either a TIA (67) or minor ischemic stroke (96) were screened for enrollment of which 122 patients were eligible for participation. Forty-one patients were excluded from participation due to one of the criteria described in the preceding section, and in 22 cases, the patient or next of kin declined participation. This study cohort, thus, consisted of 100 patients with a TIA (41) or minor stroke (59). The demographic and clinical characteristics of this cohort are listed in Table 1.

Table 1. Basic Characteristics of Patients Enrolled in the Study (*n* = 100)

	Study Population (*n* = 100)
Age (range)	61.7 (36–81)
Gender (Male %)	55 (55%)
Hypertension [*n* (%)]	71 (71%)
Diabetes [*n* (%)]	22 (22%)
Dyslipidemia [*n* (%)]	73 (73%)
Coronary Artery Disease [*n* (%)]	28 (28%)
Active Smoking [*n* (%)]	34 (34%)
Prior TIA [*n* (%)]	9 (9%)
Prior Stroke [*n* (%)]	8 (8%)
NIHSS Score [mean (±SD)]*	1.6 (±0.49)

Abbreviations used: TIA: transient ischemic attack, NIHSS: National Institute of Health Stroke Scale, SD: standard deviation.

*For the 59 patients with minor stroke.

Nineteen (46%) of the patients with a TIA and 29 (49%) with a minor stroke were randomized to hospital management, and the remaining 22 patients with a TIA and 30 with a minor stroke were randomized to outpatient-based management. Randomization did not yield any significant imbalance in the demographic or clinical characteristics of the patients involved.

Primary Clinical Outcomes

In the patients with a minor stroke, neurologic worsening occurred in 6 out of 29 (21%) in the inpatient arm compared with 3 out of 30 (10%) in the outpatient arm (p =0.3). In none of these cases was acute interventional therapy or need for urgent admission considered medically appropriate, and the worsening of deficits was minor in all cases. In the patients with a TIA, recurrence of a TIA occurred in 2 out of 19 (11%) in the inpatient arm compared with 2 out of 22 (9%) in the outpatient arm (p = 1). None of the patients with a TIA randomized to the inpatient arm experienced a stroke compared with 1 out of 22 in the outpatient arm (p = 1). One patient in the outpatient group who had a stroke occurred 2 days after the index TIA and resulted in an isolated sensory deficit. There were no deaths in either group.

Of the 22 eligible patients who were evaluated but declined to participate (14 with a minor stroke; 8 with a TIA), 20 were hospitalized. Two of the patients with minor stroke experienced neurologic worsening, but both were discharged to their homes following brief hospitalizations. None of the eight patients with a TIA suffered a stroke during the period of hospitalization. There were no deaths.

Other Findings

The mean (±SD) of ABCD2 scores for the 19 patients with a TIA randomized to inpatient management was 4.1 (±1.8), and 68% of these patients had an ABCD2 score of ≥4. The mean (±SD) of the 22 patients with a TIA randomized to outpatient management was 4.2 (±1.6), and 63% had an ABCD2 score of ≥4.

Diagnostic testing

At least one non-contrasted brain CT scan was performed on all subjects. Of the 100 CT scans performed in the ED and within 24-h event onset, in only one (1%) case did the scan demonstrate evidence of a lesion responsible for the patient's presenting symptoms.

Brain magnetic resonance imaging (MRI) was performed at least once in 81 (81%) cases. In 7 (32%) of the 22 TIA patients who underwent MRI, diffusion-weighted imaging (DWI) demonstrated evidence of ischemic injury in a neuroanatomical location referable to the patient's symptoms. In 56 (95%) of the 59 patients with minor stroke who underwent MRI, the DWI and T2-weighted sequences demonstrated ischemic injury in a neuroanatomical location referable to the patient's neurologic deficits.

A carotid duplex was performed in all patients with symptoms referable to the anterior circulation. After initial carotid duplex testing, a second non-invasive vascular imaging study was performed in 33 patients (CTA: 21; MRA:11). Eight (24%) of these patients (two with TIA; six with minor stroke) were found to have evidence of anatomically significant disease involving the presumably symptomatic intracranial carotid, middle cerebral, vertebral, basilar, or posterior cerebral artery. No patient underwent selective catheter arteriography.

In 91 (91%) patients who underwent transthoracic echocardiography (TTE), a range of abnormalities were identified (patent foramen ovale: n = 17; varying degrees of left ventricular dysfunction: n = 17; mitral valve prolapse: n = 7; other: n = 12). In no case did the results of the TTE alter patient management in terms of stroke prevention therapy. Three patients also underwent transesophageal echocardiography (TEE), and in no case did the results of the TEE alter the patient's stroke-related therapy.

In the hospitalized subgroup, the average length of stay was 2.2 days, and the cardiac telemetry was performed during the entire hospitalization. In the subgroup randomized to outpatient management, extended cardiac monitoring was performed for 24 h in 11 patients (21%) and for 21 days in 3 (6%). In no case did the results of cardiac monitoring alter patient management; in particular, no "occult" paroxysmal atrial fibrillation was identified.

Discussion

In this study, we observed little differences in both early clinical outcomes and management decisions in patients randomized to either inpatient or outpatient care following a TIA or minor stroke. A small percentage of cases went on to have recurrent TIAs/strokes; however, this did not result in any major changes in clinical management. Our study offers no new information to assist in determining which TIAs or minor ischemic strokes may have a greater or lesser likelihood of subsequently leading to major stroke; however, our results do suggest that this patient population is at a low risk for imminent major stroke and that acute hospitalization may offer no clear advantage over careful ED evaluation followed by early follow-up in a subspecialty clinic.

Analyses involving the cost/utility of various strategies employed for stroke prevention or acute intervention have acquired increasing relevance [11]. As the resources available for healthcare become increasingly limited, any reflexive application of resources requires critical appraisal and, potentially, replacement by systems that may lower costs without compromising patient welfare. The implementation of a stroke bridge clinic for patients with TIA/minor stroke may allow for more effective allocation of acute healthcare resources.

For decades, authors have acknowledged the difficulty even a stroke subspecialist may have in distinguishing between "brain spells" (i.e., TIAs that convey no increased risk of stroke) and transient attacks that warn of disasters (TATWODs) [12,13]. In terms of technologic advancement in the diagnosis and treatment of cerebrovascular disease, much has changed since the original papers on this topic appeared, and yet much remains the same. Still the question persists: how does one distinguish the "brain spell" from the "TATWOD?" From this extends, the question most relevant to this study described here: can one justify routine hospitalization of patients with acute TIA or minor stroke?

Although TIA is a risk factor for imminent stroke, the majority of TIAs are not followed by stroke, and only a small fraction of TIAs herald clinically severe stroke [9]. The same can be said for patients presenting with acute ischemic stroke and minor associated neurologic deficit. Predictive models and scales intended to stratify the early risk of stroke in patients presenting with TIA have been developed, but all possess limitations that variously include ease of use, reproducibility, and accuracy [10,17]. For example, the ABCD2 score is widely used to assess early stroke risk following TIA, but in their meta-analysis of published studies, evaluating the utility of this instrument, Wardlaw *et al*. [11] found that the ABCD2 score did not reliably discriminate those at low and high risk of early recurrent stroke nor identify patients requiring urgent intervention [11].

Furthermore, hospitalization does not guarantee a favorable clinical outcome. As reported by Ferrari *et al.* [12], around 5% of patients presenting with TIA or minor stroke experienced clinical deterioration despite hospitalization and subspecialized care.

As an alternative to hospitalization, other investigators have evaluated early outpatient follow-up after TIA and have reported such management to be associated with a relatively low 90-day stroke risk [13–15,18]. In a study of 1293 patients with TIA and stroke, 250 patients with minor stroke (NIHSS $\leq$ 3) and 337 patients with TIA were referred to outpatient management rather than hospitalization [19]. The 30-day rate of recurrent stroke was similar to that observed in the hospitalized group, and only 4% of the 587 required hospitalization after their outpatient evaluations.

Although the ABCD2 score has been used to stratify early stroke risk in routine clinical care and in clinical research, the system's relevance for assessing the value of hospitalizing patients with acute TIA may be limited. According to the instrument, only about 8% of TIA patients with even the highest ABCD2 score will suffer a stroke within the ensuing 2 days [19]. While that risk increases by a few percentage points if the period of assessment is extended to a full week, the cost associated with one week of hospitalization is obviously not insubstantial [19,20]. Furthermore, deflating enthusiasm for routine hospitalization of TIA patients is the reality that many of the early strokes, these patients may experience, will impose little or no permanent neurologic deficit. Even when these strokes are clinically significant, there is no assurance of benefit from application of currently available interventional therapies.

While our study offers the advantage of being prospective and randomized in design, it should be emphasized that the number of patients involved was relatively small. In addition, although the diagnostic evaluations undertaken in our two randomized subgroups appeared quite similar, we did not employ a uniform approach to diagnostic testing and, therefore, cannot exclude the possibility that a component of investigator bias potentially may have influenced our results. Correction of these flaws and generalized implementation of our results and conclusions would require a multicenter study, involving a much larger number of patients drawn from a variety

of regional populations, along with the use of uniform diagnostic and therapeutic pathways.

Conclusion

We observed no significant differences in both early clinical outcomes and management decisions in patients randomized to either inpatient or outpatient care, following a TIA or minor stroke. Routine hospitalization of all patients with a TIA or minor ischemic stroke may not positively affect short-term clinical outcome.

Disclosure: None.

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