# "No Turn Back Approach" to Reduce Treatment Time for Endovascular Treatment of Acute Ischemic Stroke

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*Background:* A delay in endovascular treatment is less likely if acute ischemic stroke patients proceed from emergency department (ED) to computed tomographic (CT) scanner and directly to angiographic suite (no turn back approach). We determined the feasibility of the "no turn back approach" and its effect on treatment times and patient outcomes. *Methods:* The primary outcomes were procedures performed with a time interval: (1) between ED arrival and microcatheter placement of less than 120 minutes and (2) between CT scan acquisition and microcatheter placement of less than 90 minutes. We determined the effect of the no turn back approach on favorable outcome at discharge. *Results:* There was a significantly higher rate of CT scan acquisition and microcatheter placement time of less than 90 minutes in patients in whom no turn back approach was used (57.6% versus 31.6%, $P = .0007$). There was a significantly higher rate of ED arrival to microcatheter placement time of less than 120 minutes in patients in whom no turn back approach was used (31.8% versus 13.7%, $P = .004$). In the exploratory analysis, there was a trend toward higher rate of favorable outcomes (odds ratio 1.6, 95% confidence interval .9-2.8, $P = .07$) among those treated with no turn back approach after adjusting for age, admission National Institutes of Health Stroke Scale score strata, congestive heart failure, and diabetes mellitus. *Conclusions:* The no turn back approach appeared to be feasible and reduced the time interval between ED arrival and microcatheter placement in acute ischemic stroke patients undergoing endovascular treatment. **Key Words:** Ischemic stroke—endovascular treatment—treatment time—thrombectomy—microcatheter.


## Introduction

A pooled analysis of 6 studies of acute ischemic stroke patients treated with mechanical and/or pharmacologic endovascular treatment demonstrated that death or moderate-to-severe disability is seen in 49% of patients who achieve complete angiographic recanalization (futile recanalization).[1] The prolonged time interval between

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emergency department (ED) arrival and initiation of endovascular treatment has been implicated as the reason for high rates of futile recanalization and lack of comparative benefit over intravenous (IV) recombinant tissue plasminogen activator (rt-PA).[2,3] In the Interventional Management of Stroke III trial, there was a signal toward better outcomes in patients treated with endovascular treatment if the time interval between IV rt-PA initiation and femoral puncture was 90 minutes or less.[4] The wide variability of "time to microcatheter" defined as the time interval from computed tomographic (CT) scan to microcatheter placement among institutions regarding endovascular treatment[5] suggests that such time intervals are modifiable.

Therefore, a shift in effort is required to reduce the time interval between ED arrival and initiation of treatment to improve the outcomes associated with endovascular treatment in acute ischemic stroke. A delay in treatment is less likely if patients are not returned to the ED after CT scan acquisition and instead continue directly to the endovascular suite (no turn back approach). We reviewed our data to determine the feasibility of "no turn back approach" and its effect on treatment times and patient outcomes.

## Methods

### *Identification of Cases and Data Collection*

All consecutive acute ischemic stroke patients treated with endovascular treatment performed between April 2007 and May 2012 at 2 university-affiliated comprehensive stroke centers were identified. A prospective endovascular procedure database that recorded information regarding the procedural components, devices used, and intraprocedural medication with doses was maintained at both institutions. The database was supplemented by chart review using a protocol approved by the Institutional Review Board at each institution as part of a standardized database. The presence of cardiovascular risk factors (active cigarette smoking, hypertension, atrial fibrillation, coronary artery disease, hyperlipidemia, diabetes mellitus, prior transient ischemic attack, or ischemic stroke), and use of IV rt-PA are recorded. We also recorded admission, 24-hour post-treatment, and discharge National Institutes of Health Stroke Scale (NIHSS) scores. Outcome at time of discharge was assessed using modified Rankin Scale (mRS) determined by review of detailed descriptions provided by the vascular neurology team and occupational, speech, and physical therapists in the medical records. The details of this database have been published previously.[1,6,7]

The copy of written informed consent was reviewed to identify the consenting party and whether the consent was in person or via telephone. The endovascular treatment consisted of a combination of pharmacological agents and/or mechanical thrombus disruption and/or retrieval used in varying paradigms. The techniques for administration of thrombolytics and thrombectomy through the microcatheter are described in detail in previous publications.[1,6,7] Two investigators (A.E.H. and J.T.M.) reviewed the medical records and angiographic images to determine the time interval between symptom onset and CT scan acquisition and interval between CT scan acquisitions to initiation of procedure (time of femoral puncture) and placement of microcatheter (time to microcatheter) as described in a previous publication.[6] "Placement of microcatheter" was defined by positioning the microcatheter distal to the thrombus with angiographic confirmation by visualization of the arterial segment distal to the thrombus using contrast injection.[7]

One investigator (H.E.) reviewed the medical records and nursing transcripts from both ED and angiographic suites to determine whether the patient was transported back from CT scanner to ED and was transferred from CT scanner to angiographic suite directly. Patients in whom progression occurred from ED to CT scanner to angiographic suite were categorized under "no turn back approach." The documentation was also reviewed by a second investigator (H.S.) to provide independent confirmation of accuracy of categorization of patients. A third reviewer was used to adjudicate categorization if there was a difference in categorization between the 2 reviewers.

Angiographic occlusion and recanalization were classified by the treating physician using either the Thrombolysis in Myocardial Infarction grading scale or the Qureshi grading scale[8] as described in previous publications.[1,6] We also ascertained early neurologic improvement events defined by a reduction in NIHSS score of 4 points or greater at 24 hours compared with admission NIHSS score. Symptomatic intracerebral hemorrhages were defined as noncontrast CT scan–documented ICH resulting in neurologic deterioration (≥4 point worsening on a NIHSS score compared with previous clinical assessment). "Favorable outcome" was defined by an mRS score of 0-2 at discharge.

The primary outcomes were (1) procedure performed with a time interval between ED arrival and microcatheter placement of less than 120 minutes and (2) procedure performed with a time interval between CT scan acquisition and microcatheter placement of less than 90 minutes. A time interval of less than 90 minutes to define optimal performance was based on the time interval recommendations of American College of Cardiology/American Heart Association Task Force on Practice Guidelines in treatment of acute myocardial infarction.[9] The guidelines recommend a door to balloon time of less than 90 minutes for percutaneous coronary intervention in patients with acute MI. However, the patients with acute MI present with an electrocardiogram performed by emergency medical services confirming the diagnosis, but the