

# Clinical Characteristics of Patients With Early Hospital Arrival After Stroke Symptom Onset

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*Background:* Identifying characteristics of early arrivers after stroke may be useful to improve delivery of acute stroke treatment. We sought to identify the clinical characteristics and outcomes of patients with ischemic stroke who present early after symptom onset using data collected from a representative sample of hospitals in the state of Georgia. *Methods:* Data were obtained retrospectively from a statewide observational stroke registry from December 1, 2001, to February 28, 2002, and from February 1 to March 31, 2003. Clinical characteristics of patients with stroke arriving to the hospital within 2 hours were compared with those arriving later. *Results:* Of the 409 patients with ischemic stroke identified with a specified time of onset, 172 (42%) presented within 2 hours. Univariate analysis showed hospital arrival within 2 hours was associated with history of coronary artery disease ( $P = .0400$ ), dyslipidemia ( $P = .0100$ ), ambulance transport ( $P = .0285$ ), stroke team consultation ( $P = .0070$ ), higher National Institutes of Health Stroke Scale score ( $P < .0001$ ), and lower Glasgow Coma Scale score ( $P = .0018$ ). Race, sex, age, smoking history, previous stroke, myocardial infarction, congestive heart failure, prosthetic heart valve, hypertension, diabetes, and family history of stroke were not associated with arrival within 2 hours. Multivariate analysis revealed National Institutes of Health Stroke Scale score (odds ratio = 1.20, confidence interval 1.08-1.34,  $P = .0013$ ) and Glasgow Coma Scale score (odds ratio = 0.84, confidence interval 0.75-0.94,  $P = .0027$ ) were associated with arrival within 2 hours. Patients with stroke arriving within 2 hours had higher in-hospital mortality (13% v 4%) ( $P = .0284$ ), but a higher rate of independent ambulation at discharge (55% v 37%) ( $P = .0419$ ). *Conclusions:* Early arrival after ischemic stroke symptom onset is associated with increased stroke severity, higher mortality, and better functional outcome. **Key Words:** Time factors—hospital emergency service—emergency medical service—stroke outcome—acute stroke.

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In acute ischemic stroke, the degree and duration of ischemia determines the extent of cell damage and potential for repair. Therefore, therapeutic interventions

focusing on more rapid reversal of cerebral ischemia are thought to more likely result in successful outcomes. A recent pooled analysis of the acute stroke treatment tis-

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sue-type plasminogen activator (tPA) demonstrated increased benefit with earlier administration of intravenous (IV) tPA, even within the established 3-hour time window, suggesting an even greater incentive for early hospital arrival and treatment.<sup>1</sup> In addition, patients with more severe strokes were found to present earlier and benefit more from tPA than other patients.<sup>1</sup>

Time-dependant therapies for acute stroke, such as tPA, require early recognition and response. Thus, identifying characteristics of patients who present early after symptom onset may be useful to improve delivery of acute stroke treatment. In this study, we sought to identify the clinical characteristics and outcomes of patients with ischemic stroke who present early after symptom onset using data collected from a representative sample of hospitals in the state of Georgia.

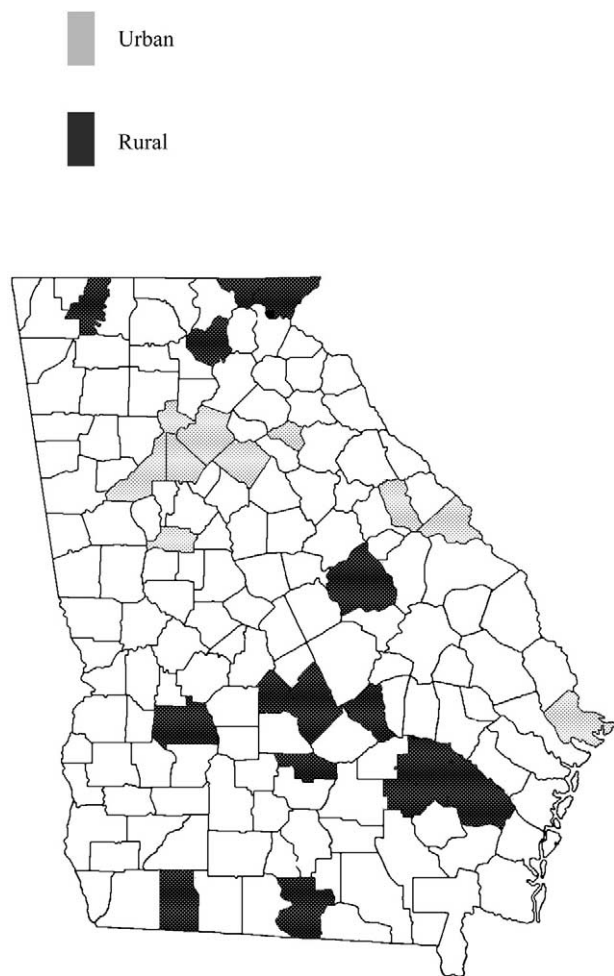
## Methods

### *Hospital Setting and Patients*

Data for this analysis were obtained from a statewide observational stroke registry. The Paul Coverdell Georgia Stroke Registry (PCGSR) was one of 4 state registries funded by the Centers for Disease Control and Prevention (CDC) in 2001 to design and implement a registry prototype. Hospital selection was intended to create a representative sample from the state. In Georgia, approximately one third of the hospitals were randomly selected. Sampling weights were used to adjust for nonresponse.<sup>2</sup> Of these, two thirds of the hospitals agreed to participate yielding 34 registry hospitals in Georgia (Fig 1). Hospitals participating in the PCGSR include both academic tertiary referral centers and rural community hospitals, with sizes ranging from 32 to 953 hospital beds.

### *Data Collection*

Data were collected retrospectively during two time periods (December 1, 2001-February 28, 2002, and February 1-March 31, 2003). Patient charts with primary or secondary discharge *International Classification of Diseases, Ninth Revision* codes (430, 431, 432.9, 433-436) were identified and abstracted centrally by trained nurse abstractors at the state's peer review organization—the Georgia Medical Care Foundation. Data collection included demographic and clinical variables suggested by an external expert panel<sup>3</sup> and further developed and defined by the 4 state registry prototype sites (Georgia, Massachusetts, Michigan, Ohio) and CDC representatives. Stroke type (ischemic, intracerebral hemorrhage, subarachnoid hemorrhage, or transient ischemic attack), initial Glasgow Coma Scale (GCS) score, and initial National Institutes of Health Stroke Scale (NIHSS) score were also ascertained. Charts from patients treated with tPA were independently reviewed by two neurologists (H. K. and



**Figure 1.** State of Georgia map shows counties with at least one randomly selected hospital participating in Paul Coverdell Georgia Stroke Registry.

M. R. F.) to determine the presence of symptomatic intracerebral hemorrhage as a complication of tPA.

Only patients with a diagnosis of ischemic stroke with a specified time of onset were included in this analysis. Specified time of onset was defined as the witnessed onset of stroke signs and symptoms by the patient or other observer. Patients with stroke symptoms recorded as present on awakening and patients with in-hospital stroke were excluded.

Readily identifiable factors thought to possibly influence arrival time in the hospital were examined in this analysis. These included patient characteristics of age, race, smoking status, family history of stroke, atrial fibrillation on admission, blood glucose on admission, and coexisting diseases. In addition, characteristics of the patient's hospital course were analyzed, including arrival method, emergency department diagnosis of stroke, stroke team consultation, in-hospital death, and independent ambulation at discharge. The definition of stroke team included a neurologist, neurosurgeon, interventional radiologist, registered nurse, or physician assistant

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