Acute Stroke Teams
Results of a National Survey

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Background and Purpose—The sensitivity of the brain to brief periods of profound ischemia or prolonged periods of modest ischemia mandates an aggressive approach to acute stroke care. Past studies have shown that many stroke patients do not receive acute care in an urgent and timely fashion. The formation of acute stroke teams (AST) is one approach that can be used to accelerate the delivery of acute stroke care.

Methods—We conducted a survey of major stroke program directors and neurovascular experts throughout the United States. The survey focused on issues related to the presence of AST, their staffing, operational features, and utilization at the surveyed programs and hospitals.

Results—Surveys were returned from 45 of 60 centers. Ninety-one percent of the respondents indicated that they currently had an AST, with 66% formed between 1995 and 1997. Staffing of ASTs consisted of attending physicians (95%), nurses or study coordinators (73%), fellows (49%), and residents (46%). In almost all cases (98%), the AST was led by a neurologist or neurosurgeon, and 98% of the ASTs operated on a 24-hours-per-day, 7-days-per-week basis. The most common call frequency was 2 to 3 times per week (41%), followed by >5 calls per week (29%). In 59% of the cases, the teams cost $5000 per year to operate. The vast majority (78%) of ASTs responded within 10 minutes of receiving a call.

Conclusions—The formation of ASTs is quite common at the surveyed programs. Although staffing patterns vary, most teams are led by neurologists or neurosurgeons. The utilization of ASTs varies by facility, but they appear to be useful, with only a modest incremental financial cost. The use of ASTs may assist in providing more rapid medical care to stroke patients and increase the use of some acute therapies. Extension of the AST concept to nonacademic hospitals appears feasible. (Stroke. 1998;29:2318-2320.)

Key Words: cerebrovascular disorders ■ stroke management ■ stroke, acute

Stroke is a common and serious disease, with over a half million new cases per year and 150,000 deaths annually. The testing and approval of new therapies aimed at reversing or limiting the effects of an ischemic stroke mandate that such agents be administered within very few hours of stroke onset. This is supported by extensive in vitro and in vivo data that show the sensitivity of neurons to prolonged periods of ischemia. Patients with cerebral hemorrhage, either an intracerebral hemorrhage or a subarachnoid hemorrhage, also benefit from rapid therapy aimed at limiting the extent of the bleed and related complications, such as increased intracranial pressure.

Past studies have shown that the vast majority of stroke patients do not seek medical care in a timely fashion. Even patients who have a stroke while already hospitalized do not receive medical care in a timely fashion. A study of patients who had a stroke while they were inpatients found a median delay between stroke recognition and neurological evaluation of 2.5 hours. Data from this study showed that many of these delays were related to not calling a neurologist immediately or to a neurologist’s not responding in a timely fashion. These in-hospital delays, coupled with the delays seen in stroke recognition among the lay public, mandate changes in the medical system to improve the rapidity of stroke care. In addition, FDA approval of tissue plasminogen activator (tPA) for the treatment of acute ischemic stroke within 3 hours of symptom onset makes it more urgent for hospitals to develop rapid response mechanisms for acute stroke patients.

Acute Stroke Teams (ASTs), sometimes also referred to as Stroke Code Teams, are one approach for reducing the
in-hospital delays in obtaining medical care for stroke patients. The operation of these teams is similar to that of cardiac code teams, with special methods for rapid notification (typically a group paging system), redundant staffing, and very short response times. There have been isolated reports of the effectiveness of such teams in reducing in-hospital time delays. However, no large surveys have been conducted of the staffing, operations, and utilization of ASTs on a nationwide basis. This study was designed to collect preliminary data about acute stroke teams at academic medical centers in the United States and to determine the feasibility of expanding the AST concept to hospitals throughout the United States.

**Subjects and Methods**

A questionnaire survey was mailed to directors of major stroke programs as well as vascular neurologists throughout the United States who attended a stroke update meeting in New Orleans, La. These physicians represented 61 medical centers and hospitals, of which 39 were academic and 22 were nonacademic. For this study, academic included those facilities that were tertiary care hospitals with medical school teaching programs or had primary teaching affiliations with academic centers (ie, some Veterans Affairs hospitals). Nonacademic facilities were regional or community hospitals without the above affiliations.

The questionnaire contained 12 questions about the existence, staffing, utilization, costs, and operation of AST at the respondent’s primary hospital or medical center. (A copy of the actual questionnaire is available on request.) Respondents could return the questionnaire anonymously or could indicate their name and facility. The survey was completed in June and July 1997.

Statistical analyses were performed using either the Fisher exact test or Pearson χ² test.

**Results**

Of the 45 surveys returned, 41 (91%) indicated that an AST was already in operation at their hospital or medical center. Thirty of the 41 positive respondents (73%) were from academic facilities. The oldest team began operation in 1990, and 27 of the 41 teams (66%) began between 1995 and 1997. In almost all cases (98%) the teams were led by a neurologist or neurosurgeon. In at least 2 cases both a neurologist and a neurosurgeon led the AST. Team composition varied but typically included attending physicians, fellows, residents, and nurses (see Table 1). Staffing differed significantly between academic and nonacademic facilities. Residents or fellows staffed the AST in 93% of academic centers (28 of 30) compared with only 9% of nonacademic facilities (1 of 11) (P<0.001). Ninety-eight percent of the teams operated on a 24-hours-per-day, 7-days-per-week basis. In 2 cases the AST responded only to calls from the Emergency Department (ED), while all others (95%) responded to ED and inpatient stroke calls.

Team utilization varied widely by hospital. Some teams were called only 1 or 2 times per month, while others were called 10 to 20 times per week. The most common call rate was 2 to 3 times per week, indicated by 41% of respondents; however, 29% of teams indicated that they were called >5 times per week. A special beeper system was used in 83% of the programs to summon the AST. The typical response time varied by program, with 41% indicating a 5-minute response, 37% with a 6- to 10-minute response, and 20% with a response time of >10 minutes. We analyzed response times as a function of staffing patterns. For the 19 ASTs with residents as part of their staffs, all indicated response times of 1 to 5 or 6 to 10 minutes. However, of the 21 ASTs without residents, 7 of 21 (33%) had response times of >10 minutes. We also analyzed response times by academic/nonacademic status. In general, the academic centers had significantly shorter response times compared with nonacademic facilities (see Table 2).

The costs of operating an AST also varied. The majority of responses (24 of 41; 59%) indicated that the AST cost from $0 to $5000 per year to operate, and only 9 programs indicated a cost of more than $10 000 per year. There was no significant cost difference between academic and nonacademic centers, with 73% and 77% (respectively) indicating annual costs of ≤$10 000. Almost all respondents (98%) indicated that their AST was effective for utilizing therapies such as tPA, and 98% indicated that the AST would continue to operate in the future.

**Discussion**

Based on the survey results presented above, ASTs are commonly found at the facilities that participated in this study. A variety of staffing options are used for these teams, although almost all are led by a neurologist or neurosurgeon. ASTs at academic centers were more likely to use residents or fellows, and in general had shorter response times. The cost for the formation and operation of ASTs is quite modest, especially when compared with the average cost for hospitalization of an ischemic stroke patient ($9000) or a patient with a subarachnoid hemorrhage ($30 000). Many centers operate their AST for no or only minimal additional cost. ASTs are used quite often, in some cases receiving >5 calls per week. This study suggests that ASTs can operate at nonacademic facilities such as community hospitals. In such facilities,
stroke patients are cared for by a variety of physicians, including those trained in emergency medicine, internal medicine, and family practice. It is often stated that practicing physicians are reluctant to leave a busy office to see an acute stroke patient in the emergency department. By forming ASTs, a select group of physicians can be organized to receive special training and gain experience in caring for acute stroke patients. Physician coverage for these teams could be on a rotating basis, so that it does not interfere with other duties. Since most teams are staffed by attendings and nurses (as opposed to residents and fellows) the AST concept need not be limited to academic medical centers with house officers and fellows. We did find a trend for ASTs staffed by residents or in academic facilities to have an earlier response times, but many of the ASTs not staffed by residents still had response times of ≤10 minutes.

In most hospitals with ASTs, the team is activated for stroke patients seen initially in the ED and for patients who have a stroke during their hospitalization. Hospitalized stroke patients are an important population, since past studies have shown that approximately 35,000 patients each year have an in-hospital stroke. Since these patients are already hospitalized and under medical care, some may be ideal candidates for rapid interventions. In the future, care guidelines may be developed that encourage acute stroke patients to be taken preferentially to hospitals with ASTs. The presence of an AST may be one of several characteristics needed to designate a particular hospital as a comprehensive stroke center, although formal criteria have not been published.

The formation of ASTs must be accompanied by educational efforts aimed primarily at the hospital staff. These efforts should focus on the symptoms of stroke and procedures for calling the AST. As with the formation of cardiac code teams, such educational efforts will have to be repeated due to the turnover of the hospital staff as well as the need to keep the information current. As new acute stroke therapies become approved, revisions in the AST protocols will be needed.

Some potential limitations of this study should be noted. For the most part, we sent the questionnaires to leaders of stroke programs at academic medical centers or large regional/community hospitals. Therefore, our results may not mirror the practices of ASTs at smaller community or rural hospitals. A recent study of ED physicians found that only 52% of surveyed hospitals had ASTs. Clearly, the results of this type of study are highly dependent on the number and type of hospitals involved. A future project will be to determine the existence and utility of ASTs in a representative sample of nonacademic hospitals. However, since our study focused on centers with ASTs, it does provide a reasonable amount of data about the formation and operation of such teams.

The utility of ASTs in terms of reducing short-term and long-term costs associated with stroke care remains to be determined. Several past studies have shown that ASTs can reduce the time delays in patient evaluation and performance of CT scans at individual hospitals. The fact that most respondents found ASTs useful for treatment with tPA is encouraging, since it has been shown that tPA can reduce disability and improve functional outcome after stroke. Other studies have shown that delayed neurological attention was associated with worsened functional outcome after a stroke. Because the AST concept can increase the utilization of tPA as well as reduce delays in medical care, it is reasonable to assert that these teams will improve outcomes in stroke patients. If future studies prove the cost effectiveness of ASTs, it will be an added impetus for more hospitals to support their formation.

In summary, this study found that ASTs are very common at the surveyed hospitals, are used frequently, and have a modest cost. ASTs appear useful for enhancing the use of some acute stroke therapies. Further studies are needed to determine whether the formation of ASTs will be beneficial for hospitals that care for stroke patients yet lack neurologists, neurosurgeons, and house staff.

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References

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