GET WITH THE GUIDELINES—STROKE: A QUALITY IMPROVEMENT PROJECT

by

Lori Schenkel

A Scholarly Paper Submitted to the Faculty of the COLLEGE OF NURSING

In Partial Fulfillment of the Requirements For the Degree of

MASTER IN NURSING; FAMILY NURSE PRACTITIONER FOCUS

In the Graduate College

THE UNIVERSITY OF ARIZONA

2005
STATEMENT BY AUTHOR

This thesis has been submitted in partial fulfillment of requirement for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: _______________________

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

Leslie Sue Ritter                             Date
Associate Professor of Nursing
ACKNOWLEDGEMENTS

I offer my greatest thanks and praise to the chair of my committee Dr. Leslie Ritter who has stood beside me through thick and thin, undergrad and graduate school, often holding me up and spurring me on when I thought I could go no more. I admire the determination and the brilliance of Dr. Ritter and her unfailing dedication to myself, and all others she works with in her research endeavors. I also offer extreme thanks to Dr. Gerri Lamb the other member of my committee who also encouraged me and helped me with my project, offering her dedication even to the point of reading my paper over spring break on an airplane.

I cannot begin to thank and praise my family enough for their unfailing love and support in my darkest hours when I thought I would give up. My husband, Roger, and my children, Raymond, Christian, Amy and Anthony, and my parents, Joe and Claire, were constantly there for me, often sacrificing their time and needs for me. Words cannot express the gratitude I feel for each one of them. To them I will ever be grateful as they stood beside me, NEVER letting me give up in reaching my goals of family nurse practitioner. I love you and thank you.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title Page.................................1</td>
</tr>
<tr>
<td>Statement by Author..........................2</td>
</tr>
<tr>
<td>Acknowledgements................................3</td>
</tr>
<tr>
<td>Table of Contents..................................4</td>
</tr>
<tr>
<td>List of Figures....................................7</td>
</tr>
<tr>
<td>Abstract...........................................8</td>
</tr>
<tr>
<td>Chapter 1........................................10</td>
</tr>
<tr>
<td>Introduction........................................10</td>
</tr>
<tr>
<td>Stroke................................................10</td>
</tr>
<tr>
<td>Statement of the Problem........................11</td>
</tr>
<tr>
<td>Stroke Guidelines..................................14</td>
</tr>
<tr>
<td>Get With the Guidelines-Stroke..................15</td>
</tr>
<tr>
<td>Purpose of this Study.............................16</td>
</tr>
<tr>
<td>Significance to Advance Practice Nursing........17</td>
</tr>
<tr>
<td>Chapter 2........................................21</td>
</tr>
<tr>
<td>Background..........................................21</td>
</tr>
<tr>
<td>Definition and Types of Stroke..................21</td>
</tr>
<tr>
<td>Burden of Stroke...................................23</td>
</tr>
<tr>
<td>Strategies for Treating Ischemic Stroke..........25</td>
</tr>
<tr>
<td>Thrombolysis/treatment of acute ischemic stroke.25</td>
</tr>
<tr>
<td>Stroke treatment centers..........................30</td>
</tr>
<tr>
<td>Prevention of Stroke................................35</td>
</tr>
<tr>
<td>Summary.............................................38</td>
</tr>
</tbody>
</table>
Measuring and Improving Quality of Care.............38
QI Concepts ........................................39

TABLE OF CONTENTS (Continued)

Donabedian........................................39
Deming............................................43
QI Challenges......................................43
Successful QI Projects..............................44
Get With the Guidelines-Stroke......................47
  Description of the project.....................47
  Program Components.............................49
  Results of GWTG-National Pilot Study..........52
  Summary.........................................55

Chapter 3...........................................57
  QI Study Protocol................................57
  Purpose of Study ................................57
  GWTG Program .................................57
  Current Project Protocol.......................58

Subjects ..........................................62
  Patient Selection ...............................62
QI Elements.......................................63
  Description of Tool ............................63
  Questionnaires on the Tool ....................65

Results...........................................66
  Question 1.....................................66
  Question 2 ....................................67
Question 3......................................................68
Question 4 ....................................................71

TABLE OF CONTENTS (Continued)

Question 5 ....................................................74
Question 6.....................................................76
Question 7.....................................................77
Discussion....................................................81

The Current State of Stroke.........................81
QI Project Benefits........................................82
GWTG Tool Results.........................................83
Strengths and Limitations.........................91
Summary of Findings....................................93
Future Implications.................................99

APPENDIX A, NIHS Stroke Scale.....................102
APPENDIX B, GWTG Patient Management Tool......103
APPENDIX C, GWTG Patient Management Tool-continued.....104
References..................................................105
LIST OF FIGURES

Figure 1, Number of patients arriving with stroke & etiology of stroke in the three comparison groups........67
Figure 2, Percentage of patients of prenotification by EMS.................................................................68
Figure 3, Time from onset of Symptoms to ED arrival in 3 comparison groups........................................71
Figure 4, Time from ED arrival to CT imaging in 3 comparison groups.................................................74
Figure 5, Percent of patients who did not receive tPA for specified reasons............................................76
Figure 6, Percent of eligible patients not treated with tPA who had reasons..............................................77
Figure 7, Reasons eligible patients did not receive tPA............................................................................79
Figure 8, Documentation of reasons why eligible AIS patients were not treated with IV tPA....................80
ABSTRACT

Evidence suggests that acute ischemic stroke (AIS) care is fragmented and requires the development of systems of care to ensure that patients are consistently treated and discharged according to standard guidelines. The purpose of this project was to examine the participation of one Tucson, Arizona hospital (TH) in the Get with The Guidelines-Stroke (GWTG-Stroke) initiative. GWTG-Stroke uses a QI process to evaluate performance measures related to treatment and prevention of ischemic stroke in 99 hospitals, nationwide. In this project, a Deming PDCA (plan, do, check, and act) process was used to implement the GWTG program. Seven performance measures examined the time targets in the emergency department, the administration of tPA to eligible patients, and whether patients not receiving tPA had documented reasons for not receiving it. Data was entered into the GWTG Patient Management Tool, an online database that tracks and compares individual hospital performance to state and national benchmarks. Data was collected from January 2003 to 2004. The results demonstrated that the TH received slightly more AIS patients compared to the state and national benchmarks. The time target of onset of stroke
symptoms to arrival to the ED was consistent among all. State and national benchmarks for the time target of arrival to the ED until imaging were slightly better (22.3% obtaining imaging within 26-50 minutes in Arizona; 28.5% within 26-50 minutes, nationally) than the TH performance (27.8% of imaging done at 51-75 minutes and 27.8% done greater than 125 minutes of arrival). Of all eligible patients who received IV tPA the TH used tPA 0% of the time, Arizona used tPA 31.9%, and nationally, tPA was used 35.8% of the time. TH had a slightly higher percentage of all patients, out of all eligible patients not receiving tPA with reasons, compared to benchmarks. Reasons why eligible patients did not receive tPA, and the reasons given, were similar to benchmarks. In conclusion, the use of the PDCA process with GWTG at a TH was successful. The information from this QI tool will assist in providing information and in implementing changes to increase adherence to acute stroke guidelines in the future.
Chapter 1

Get with the Guidelines-Stroke: A Quality Improvement Project

Introduction

Stroke

Stroke continues to be the second leading cause of death and the most frequent cause of permanent disability in the world, with more than 3 million cases of stroke reported every year (Stahl, Furie, Gleason, & Gazelle, 2003). Approximately 83% of all reported strokes are ischemic in nature, as opposed to hemorrhagic. In 1999, there were 498,000 patients with ischemic stroke seen in the emergency departments across the United States (Stahl et al., 2003). Stroke remains a costly problem worldwide, and substantial advances have been made in recent years in understanding the mechanisms of stroke, risk factors, therapies, and prevention of stroke. Studies with animals have shown that brain injury occurs within minutes of a stroke and can become irreversible within as little as an hour (American Stroke Association, 2005). In humans, brain
damage begins from the moment the stroke starts and often continues for days afterward (NINDS, 1995).

Standards of care for stroke were recommended by the American Stroke Association (ASA) and include rapid transport to the hospital or stroke center, and rapid diagnosis of ischemic or hemorrhagic stroke by timely computerized tomography (CT) scan of the brain. Time of onset of symptoms and rapid treatment with tissue plasminogen activator (tPA) if indicated, is included in the standards of quality stroke care, as well [American Stroke Association (ASA) 2005]. The ASA and the Brain Attack Coalition (BAC) have also recommended the implementation of Acute Stroke Treatment Programs (ASTP) in every hospital treating stroke patients, in order to improve the quality of stroke care across the nation (NINDS study group, 1997). Methods designed to prevent ischemic stroke, including discharge protocols for stroke patients, and smoking cessation materials, are included as well. The stroke center characteristics recommended by the BAC, associated with tPA use were focused largely on reducing delays in treatment, a barrier to the use of tPA (Douglas et al. 2005).

Statement of the Problem
The state of acute stroke care was found to be extremely fragmented and use of treatment and discharge guidelines were either non-existent or inconsistent among many acute stroke care centers across the nation (Graham, 2003). Many hospitals did not have a designated stroke center that could quickly recognize, diagnose and provide therapy to patients suffering strokes. As a result, many patients experiencing ischemic strokes, in particular, were not receiving appropriate care and the resulting disabilities were tragic; yet deemed preventable. Additionally, many patients did not recognize stroke as the emergency it is, and delay in calling 911. They found that on average, patients waited 22 hours to get help (ASA, 2003).

Studies suggest that less than 5 percent of stroke patients currently receive the only early acute treatment for stroke that needs to be administered within three hours of onset of symptoms (American Stroke Association, 2003). Graham states that: “although most neurologists support the use of tPA according to recognized guidelines, the emergency medicine community has yet to endorse tPA for AIS” (Graham, 2003, p. 2847). The risk of hemorrhage and the small percentage of suitable patients eligible to
receive IV tPA therapy for ischemic stroke continues to pose problems with the practicality and safety of tPA for stroke victims (Koennecke, Nohr, Leistner, & Marx, 2001). Recent studies have served to reduce the suspicion in this area; supporting the safety of IV tPA for acute ischemic stroke, provided the utilization of established treatment guidelines are followed (Graham, 2003).

A review of the literature in one recent study indicated that the average time for in-hospital evaluation to treatment is more than 1.5 hours, meaning that, on average, a patient in the community experiencing an acute ischemic stroke must be recognized and delivered to the hospital in less than 1.5 hours to receive tPA in time (Stahl et al., 2003). NINDS recommendations were published to help manage intrahospital care, as to how long the process between evaluation and treatment should take once the patient arrives at the hospital. NINDS recommendations are that from the moment of arrival at the emergency department (ED): 1) a patient with stroke symptoms should be evaluated by an emergency medicine physician within 10 minutes, 2) a neurologist should be contacted within 15 minutes, 3) a CT of the head should be performed within 25 minutes, 4) CT findings should be
interpreted within 45 minutes, 5) tPA should be administered within 1 hour, and 6) the patient should be admitted to a supervised room within 3 hours.

Stroke Guidelines

In April, 2003, the American Heart Association (AHA) with the ASA, updated the stroke care guidelines. The guidelines urged patients to contact EMS immediately with any symptoms of stroke, treating stroke as an emergency. The AHA/ASA recommended that Emergency Medical Systems (EMS) pre-notify hospitals of patients arriving with stroke symptoms. The guidelines recommended the use of a tPA protocol for ischemic strokes with specific criteria determining patient eligibility for the administration of tPA (Adams et al.). TPA must be administered within a 3-hour window from the time of onset of stroke symptoms. The AHA/ASA recommended a goal of door-to-CT-completion interval of less than 25 minutes (Suzuki, Imai, Honda, Kobayashi, & Ohtsuka, 2004). Additionally, determination of any contraindications to tPA, and administration of tPA must begin immediately following the eligibility of the patient based on the CT results, in order to be within the 3 hour mark.
The BAC in conjunction with the AHA/ASA urged the identification and development of Acute Stroke Treatment Programs (ASTP) to improve stroke quality care and patient outcomes (Adams et al., 2003). The ASTPs utilize acute care stroke teams that are available 24 hours a day, seven days a week, with specialized units dedicated to stroke care, appropriate laboratory services; and an experienced staff, that undergoes regular continuing medical education (McNeill et al., 2005). In order to implement both the ASTPs and the improved guidelines in hospitals, the AHA/ASA developed a hospital-based Quality Improvement (QI) program called Get With the Guidelines-Stroke (GWTG-Stroke). The initiative was designed to save up to 80,000 lives annually by closing the treatment gap in acute stroke treatment and stroke prevention.

Get With the Guidelines-Stroke

The GWTG-Stroke initiative consisted of an electronic checklist of evidence-based standards of stroke care, and was implemented in a pilot study period of one year from April 2003, through April 2004. Data on the patients’ care were collected from interhospital collaborative meetings, best-practice sharing, and an internet tool used for data collection, reporting and decision support; entitled the
Patient Management Tool (PMT). Hospitals used the tool to track key timelines against benchmarks from similar hospitals, to improve the appropriate use of thrombolytic and anti-thrombotic therapies, to implement the ASTP, and to integrate stroke secondary prevention into hospital discharge protocols. The investigators examined the hospitals’ use of IV tPA or documentation of why it was not used in patients who arrived in the ED less than 2 hours after the onset of symptoms, as well as those who arrived less than 3 hours after the onset of symptoms. The study emphasized the importance of initiating tPA within 60 minutes of admission, monitoring symptomatic systemic or intracranial hemorrhage, and the use of antithrombotic therapy within 48 hours after admission, when appropriate (Moyer, 2005). The study investigators reviewed care given to 21,563 stroke patients in 99 participating hospitals.

Purpose of this Study

The purpose of this project was to examine the participation of one Tucson, Arizona hospital (TH) in the GWTG-Stroke quality improvement program. The TH was one of the 99 participating hospitals in the GWTG-Stroke pilot in 2003-2004. This project examined the acute care portion of stroke treatment as opposed to the hospitalization course
of treatment or the prevention measures and discharge protocols. Specifically, the project evaluated: 1) The amount of stroke patients arriving at the TH and the etiology of their strokes; 2) the percent of patients that EMS pre-notified the hospital they were receiving that were experiencing strokes; 3) the time from onset of symptoms of stroke to arrival at the ED; 4) time from arrival to initial imaging; 5) percentage of patients arriving to the ED within 120 minutes of onset of symptoms and receiving tPA within 180 minutes of onset of symptoms; 6) percentage of patients who did not receive tPA who had reasons for not receiving tPA; 7) the reasons tPA was not given; 8) documentation of contraindications to tPA or documentation of inferred contraindications to tPA administration. All elements were compared to participating hospitals nationally and in the state of AZ.

Significance to Advance Practice Nursing

The results of the GWTG-Stroke pilot that just finished in 2004, will serve to continue to educate APNs in the utilization and implementation of the guidelines pertaining to stroke in each of their various practices. APNs working in the hospitals will be part of the implementation of the guidelines designed to improve the acute treatment of
stroke, the prevention of stroke, and the administration of medications that will prevent recurrent and new strokes. APNs working in the emergency rooms or Urgent Care Centers across America will be able to quickly evaluate a patient arriving to the ED with symptoms of stroke, utilize the NIHSS scale, obtain their CT in a timely manner within 25 minutes of arrival, and begin treatment with tPA should they be eligible. APNs play a crucial role in ascertaining that the guidelines pertaining to the timely treatment of acute stroke are followed, and implemented accordingly. APNs involved with case management will assist in obtaining timely evaluation and treatment in the Urgent Care (UC) setting and the ED. Those working in the UC setting would then be aware of the true emergency that stroke is and will arrange for immediate transport to a stroke center for treatment; as quickly as possible, educating the EMS personnel, and families as necessary.

Often the APN is the “glue” in a clinical setting that enables the teaching and implementation of programs designed to decrease risks for stroke, for example, weight; thereby reducing hypertension, and diabetes; precursors of stroke. Many APNs are involved in smoking cessation therapy and encouraging health promotion strategies
designed to reduce blood pressure. They educate their patients about stroke and the prevention of stroke through exercise, diet, smoking cessation, and medications if needed. In utilizing the current guidelines in their various healthcare and health promotion practices, APNs will be the professionals that will direct their fellow professionals, and patients into a specific course of action, i.e., implementing the guidelines. The ultimate intent of any research or study is to stimulate clinicians to apply recommendations in clinical practice, based on their scientific merit, the collective wisdom of their authors, or a combination of both (Hart & Bailey, 2002).

The establishment of primary stroke centers at community hospitals has been proven to substantially increase the proportion of patients receiving thrombolytic therapy for ischemic stroke; thereby improving stroke outcomes (Lattimore et al. 2003). Additionally, other studies have shown that it is feasible and safe to treat rural patients referred to a tertiary care center with tPA, thus extending the benefits of thrombolysis for acute stroke to a wider population (Merino et al. 2002). APNs are increasingly being employed in rural areas and tertiary centers and could implement primary stroke centers and
teams at these hospitals provided there are CT scanners, intensive care units, laboratory facilities, and stroke expertise (Merino, et al). Increasing public and professional awareness of “time is brain” is spurring a call to action and a call for change in the way stroke is treated, making the use of APNs in the stroke arena, extremely valuable to the medical community. Management of AIS is a multitiered, time-critical process that involves prehospital health care providers, emergency medicine providers, nurses, neurologists, interventional neuroradiologists, and neurosurgeons; providing streamlined, and timely patient care (Fulgham et al. 2004).
Chapter 2

Background

Definition and Types of Stroke

The World Health Organization (WHO) defines the clinical syndrome of stroke as rapidly developing clinical signs of focal (or global) disturbance of cerebral function with symptoms lasting 24 hours or longer, or leading to death, where no other explanation is apparent other than a vascular cause (WHO Task Force on stroke and other cerebrovascular disorders, 1989). If the symptoms persist longer than 24 hours, the syndrome is defined clinically as a stroke or brain attack. If the symptoms resolve in less than 24 hours, then it is classified as a transient ischemic attack (TIA) (WHO Task Force on stroke and other cerebrovascular disorders).

Strokes or brain attacks can be classified into two broad categories: ischemic stroke and hemorrhagic stroke. Ischemic stroke causes cerebral injury secondary to loss of blood flow, caused by a variety of mechanisms in the cerebral microcirculation. One mechanism is an embolism
from the heart to the brain arteries causing 25% of ischemic strokes (Warlow, 2003). The emboli usually originate in the right atrium (Warlow). Platelet aggregation and inflammation have also been identified as causes of ischemic strokes or brain attacks, signifying an inflammatory component in the subsequent neurologic damage (Ritter, Orozco, Coull, & McDonagh, 2000). Hemorrhagic strokes involve intracerebral hemorrhage and subarachnoid hemorrhage, and usually result in higher mortality and permanent disability than ischemic stroke.

The severity of a stroke is determined by how large an area of brain is rendered ischemic, and for how long, necessitating speed and urgency in the early evaluation of a person suffering a brain attack (Warlow, 2003). Even large lesions will not cause permanent damage if the ischemia is reversed right away; while a small area that is ischemic for an extended length of time in an important area of the brain may cause massive disability. Therefore, the early strategies that are proposed and supported and recommended are to 1) reperfuse the ischemic area quickly, before it dies, and 2) protect the ischemic brain so that it will survive reperfusion (Warlow).
The first few hours after stroke onset, are the most significant for the person suffering from a brain attack or ischemic stroke. Strokes are not just an all-or-nothing phenomenon, unlike textbook descriptions (Warlow, 2003). Usually, the neurological signs start suddenly, however, the patient may recover rapidly, and the signs may reappear a few minutes later. The patient may have neurological symptoms that come and go over several days, similar to TIAs. The signs may become permanent, worsen in the first hours, and spread to other unaffected body parts; representing an unstable situation indicative of spontaneous lysis of arterial clots, recurrent emboli from an active proximal source, thrombi extending from occlusive emboli, and so on. To complicate matters further, some ischemic strokes may go on to become hemorrhagic strokes within hours, and days of onset (Warlow). Therefore, in the early stages of a stroke, it is better to think in terms of brain attack in order to portray the urgency and emergent nature of the situation.

Burden of Stroke

More than 700,000 strokes occurred in the United States in the year 2002; approximately 500,000 were first-ever strokes and 200,000 were recurrent strokes (Broderick,
The incidence of stroke increases with age, with 75% of strokes or brain attacks affecting the elderly over the age of 65 years (Volpato et al., 2004). Patients recovering from an ischemic stroke or a recent transient ischemic attack (TIA), are at high risk for stroke recurrence. The risk for recurrent stroke is highest in the first few weeks; approximately 10% in the first year and 5% each year thereafter (Volpato et al.).

Eighty percent of strokes in Western populations and mostly white populations are occlusive in origin (ischemic) strokes (Warlow, 2003). The vast majority are due to arterial rather than venous occlusion (Warlow). The other twenty percent of strokes are hemorrhagic in nature, either intracerebral or subarachnoid in origin with the proportion of hemorrhagic strokes slightly higher in Blacks, Japanese and Chinese (Warlow). Black Americans experience nearly double the overall rate of stroke compared with white Americans; particularly marked in young and middle-aged persons (Broderick, 2003).

The increase in strokes in persons aged over 65 years is due to the effects of aging on the vascular system, and to the progressive nature of risk factors for stroke common among older people (International Society of Hypertension
Writing Group, 2003). Men have a slightly higher risk for stroke in most age groups; however the actual number of strokes is greater in women, reflecting their greater longevity (International Society of Hypertension Writing Group). Women account for approximately 55% of all strokes in the USA and for 60% of stroke-related deaths (International Society of Hypertension Writing Group).

Strategies for Treating Ischemic Stroke

*Thrombolysis/treatment of acute ischemic stroke.*

Atherosclerosis of the arteries, large and small, supplying the circulation of the brain, is the most common cause of ischemic stroke in North America and Europe (Albers, Easton, Sacco, & Teal, 1998). Thrombolytic therapy for stroke treatment has been the subject of intense investigation for years; with the use of tissue plasminogen activator (tPA) as the first line recommendation for acute ischemic stroke (NINDS, 1995). According to Vahedi & Bousser, (2002) in their study entitled: *Thrombolysis in stroke,* thrombolytic agents can achieve early recanalization of an occluded intracerebral artery, and the benefit of their use in ischemic stroke has been assessed in several randomized trials involving more than 5,000 patients. Their study examined seventeen trials
that were conducted to look at the beneficial effect of thrombolytic agents in ischemic stroke and the subsequent disability associated with neurologic deficits resulting from symptomatic ICH (Vahedi & Bousser, 2002). The hypothesis was based on the recovery of the still-reversible ischemic penumbra (a portion of the brain) by early recanalization of the occluded artery (Vahedi & Bousser).

The rationale for thrombolytic therapy is based on the recognition that the majority of ischemic strokes are caused by thrombotic or Thromboembolic arterial occlusions. Neuronal death and brain infarction evolve in a time-dependent fashion determined by both the duration and severity of the ischemic insult on the brain. Therapeutic strategies designed to restore cerebral perfusion in a timely manner have the potential to limit the cellular, biochemical, and metabolic consequences of cerebral ischemia that ultimately lead to irreversible brain injury (American Stroke Association, 2005). Two studies successfully evaluate the use of tPA using different doses, therapeutic windows, and treatment protocols: the NINDS rtPA study, and the European Cooperative Acute Stroke Study (ECASS).
The NINDS rtPA Acute Stroke Study Group conducted a randomized, double-blind, placebo-controlled study using 624 patients receiving treatment within 3 hours of symptom onset (Albers, Easton, Sacco, & Teal, 1998). A pretreatment CT scan was required to exclude the presence of intracerebral hemorrhage, along with a set of strict inclusion and exclusion criteria. Eligible patients received IV tPA 0.9 mg/kg (maximum of 90 mg), or placebo; with tPA given as a 10% bolus over 1 min, and the remainder of the total dose infused over 60 minutes (Albers et al., 1998). In order to reduce the risk of intracerebral hemorrhage associated with hypertension, strict treatment algorithms were developed to monitor and maintain BP less than 185 mm Hg systolic and 110 mm Hg diastolic (Albers et al.). Patients who required aggressive measures to attain pretreatment BP below these limits were disqualified from the study. Early treatment response was measured by the NIHSS scale 24 hours after enrollment in the study and an improvement of four or more points or a complete resolution of the neurologic deficit was considered a positive response (See Appendix A for stroke scale). Part 2 of the study measured minimal or no disability at 3 months post
stroke as measured by a global test statistic of four stroke scales (Albers et al.).

The ECASS trial was a multicenter, double-blind, placebo-controlled trial that randomized 620 patients within 6 hours of stroke onset to treatment with IV tPA at a dose of 1.1 mg/kg (maximum of 100 mg) or placebo (Albers et al., 1998). Primary end points included the Barthel Index (BI) and Rankin Scale (RS) at 90 days. The target population analysis included 511 patients. Besides an intention-to-treat analysis that included data from all randomly selected people, a target population analysis excluded results in 109 patients, with the most common reason for exclusion due to enrollment of a person with CT findings that contraindicated treatment. In this trial there was a significant difference of 1 point in the RS, favoring treatment with tPA (p=0.035). In the target population 41% of tPA-treated patients were asymptomatic or had minimal disability, compared with 29% in the placebo group (RS 0 or 1, p< 0.05). Other predefined secondary end points, including the combined BI and RS, speed of neurologic recovery, and lengths of hospital stay, favored tPA-treated patients. There were no statistically significant differences in the 30-day mortality rates or in
the overall incidence of intracerebral hemorrhages (Albers et al.).

Criticisms of the various trials utilizing thrombolysis as a treatment for ischemic stroke included fears that there was an increased incidence of ICH, with the use of tPA within three hours of the onset of symptoms (Barclay & Lie, 2004). In the NINDS trial, there was a concern that there were differences in baseline stroke severity in the patient subgroup receiving tPA, and increased incidence of symptomatic ICH (Barclay & Lie). The analysis of the NINDS tPA trial revealed no statistical evidence that the effect of tPA treatment differed among patient subgroups, however the study did not have sufficient power to detect such differences. After detailed analysis, the committee that was formed by the NINDS trial concluded that the imbalance in baseline stroke severity between the two treatment groups did not invalidate the trial results (Barclay & Lie).

A meta-analysis of safety in the use of tPA for the treatment of AIS was conducted by Graham (2003) to examine the overall safety data from the collective trials over the past decade. The meta-analysis was performed of all identified open-label reports of tPA use for acute ischemic
stroke published through April 2003 that purported to follow approved indications and guidelines (Graham). The results of 15 studies incorporated 2639 total patients in 10 prospective, and 5 retrospective studies. Data from this analysis of more than 2500 treated patients support the safety of tPA therapy for acute ischemic stroke (Graham). The incidence of early symptomatic ICH, perhaps the most feared complication of tPA use in stroke patients, was significantly less than in the placebo-controlled NINDS study (Graham). The tendency for series with more protocol violations to be associated with higher death rates emphasized the importance of adherence to established treatment guidelines (Graham). Additionally, he claimed that the safety results from community hospitals were comparable to those of large, tertiary medical centers, although many physicians, especially non-neurologists remain hesitant to use tPA in AIS patients; possibly endorsing the establishment of specific stroke centers.

Stroke treatment centers.

In 2002, the AHA & ASA implemented the Operation Stroke project in an effort to raise standards of care in communities by reducing disability caused by stroke (American Stroke Association, 2003). Four objectives were
identified: 1) To educate the general public about the warning signs of stroke; 2) To encourage the general public to call 9-1-1 when these warning signs are experienced by themselves or someone around them; 3) To advocate for EMS systems to upgrade the coding for transport of stroke patients, to train EMS personnel to assess for stroke, to advocate for medical dispatcher training, and to implement outcomes-tracking systems; and 4) To advocate for acute care medical facilities to implement stroke protocols, stroke teams and stroke units, and to implement outcomes tracking systems (American Stroke Association, 2003). The operation was a success in educating and motivating emergency medicine professionals and in raising public awareness of stroke symptoms, and stroke treatment. This success was shown in the improvement in the care of stroke patients when hospitals implemented the GWTG-Stroke QI program (McNeill, Bullock, & Del Barto, 2005) However, there still remained a significant problem in providing tPA for those persons suffering from ischemic stroke in keeping with the guidelines set forth by the ASA and the AHA, prompting an urgent call for hospitals and healthcare providers to “get with the guidelines” across the nation.
There is increasing concern over the fact that stroke care appears to be fragmented in this country with many different groups and institutions providing stroke care independently, whether for prevention, acute treatment or rehabilitation from stroke (Bullock et al., 2005). Stroke care providers must develop systems of care that improve each area of care in preventing and treating stroke; urges the AHA/ASA in their statement released on February 5, 2005 (Bullock et al.). The ASA issued a blueprint with a call for health professionals to identify the acute stroke treatment capabilities and limitations of all hospitals in a state or region and make the information available to primary care providers, emergency services and providers, and the public (Bullock et al.). The chairman of the AHA/ASA committee that drafted the statement, Lee H. Schwamm, M.D., a neurologist at Massachusetts General Hospital in Boston, stated:

This is a non-partisan document. It is not about making the teaching hospitals even more comprehensive in their stroke care. This is about equal access for all citizens to high quality stroke care. It is critical to leverage technology to make the stroke expertise available to all, regardless of their geography or economic circumstances. If you’re poor and live near a poor hospital, you shouldn’t be deprived of high-quality stroke care just because your hospital can’t afford or can’t attract a dedicated on-site stroke neurologist (Bullock et al., 2005, p.2).
The implementation of the recent recommendations and guidelines of the ASA will be significantly expedited with the use of stroke centers or stroke systems of care. According to Schwamm, creating these systems of care will be much easier if U.S. Congress passes the Stroke Treatment and Ongoing Prevention Act, know as the STOP Stroke act (Bullock et al., 2005). The legislation is expected to be reintroduced early in the 109th Congress and would assist in creating a grant program to help states ensure that patients have access to quality stroke prevention and treatment and rehabilitation services, as well as creating a national awareness campaign about stroke warning signs and stroke prevention. Education of medical professionals in the newly developed diagnostic approaches, technologies and therapies is included. Two studies presented at the American Stroke Association International Stroke Conference in 2005, showed that hospitals with certified, designated stroke centers administered clot-busting therapy and responded with needed tests and exams for acute stroke patients better than hospitals lacking certification (McNeill, Bullock, & Del Barto, 2005).
In 2000, the Brain Attack Coalition (BAC) published guidelines on establishing primary stroke centers to improve care of stroke patients and standardize some aspects of acute stroke care (McNeill et al., 2005). Fourteen hospitals were designated as BAC primary stroke centers and included acute stroke teams available to respond 24 hours a day, seven days a week; a specialized unit dedicated to stroke care; appropriate laboratory services; and an experienced staff, which undergoes regular continuing medical education on stroke (McNeill et al). From March to May 2002 researchers examined data from 763 ischemic stroke patients at the start of the study, before the hospitals received designation, and remeasured the data for 725 ischemic stroke patients after the hospitals were designated. All time-to-treatment improvements were greater at stroke centers between baseline and remeasurement; with the use of tPA increasing from 2.4 percent at baseline (18 out of 763 patients), to 5.2 percent overall in the hospitals (38 out of 725) and 7.7 percent (32 out of 416 patients) at stroke centers (McNeill et al).

Since the inception of the BAC study, many other studies have looked at the efficacy of stroke centers
specific for stroke treatment and have concluded that establishment of a stroke care system or unit; as well as a “brain attack” team will greatly improve patient outcomes. The ASA assembled a multidisciplinary group of experts to develop recommendations regarding establishment of stroke system programs and stroke centers; concluding that identification of stroke center/systems competencies is in the best interest of stroke patients in the U.S. (Adams et al., 2003). Vladimir Hachinski, M.D., D.Sc., professor of neurology at the University of Western Ontario, London, Ontario, Canada, is the recipient of the ASA’s highest honor – The Thomas Willis Award – for 2005 for his part in pioneering the development of acute stroke units providing specialized care for stroke patients (ASA, 2005). The Calgary Regional Stroke Program in Canada, spearheaded the development and organization of a “brain attack team” using thrombolytic therapy in patients with AIS, and after 3 years, showed huge success in improved patient outcomes, shorter times from symptom onset to treatment and acceptable adverse event rates (Hill et al., 2000). Additionally, other hospitals and neurologists have developed a Code Stroke Protocol (CSP) for identifying acute ischemic stroke patients and treating them with tPA
with excellent improvement in neurologic outcomes (Aismos, Norton, Price, & Cheek, 2003). The most common reasons for thrombolytic therapy exclusions were mild or rapidly improving symptoms, intracerebral hemorrhage and unconfirmed symptom onset time (Aismos et al.).

Prevention of Stroke

Prevention of stroke has certainly been in the forefront, as well, with the development of new stroke prevention therapies over the past 25 years. Antihypertensive therapy was implemented as a stroke prevention modality in 1975, as well as secondary prevention utilizing aspirin in the prevention of stroke. At present, there is scientific evidence promoting the effectiveness of antiplatelet drugs, warfarin, statins, and antihypertensives, for secondary stroke prevention (Broderick, 2003). Guidelines from the AHA and ASA included the initiation and maintenance of appropriate medication therapies while in hospital following an acute brain attack and the continuation of these therapies on discharge to home or other facility.

In 1998, the first published statewide assessment of stroke prevention and treatment services in the US was carried out in North Carolina. They assessed the hospital-
based stroke-related prevention and treatment services such as facilities providing emergency department services offering treatment of acute ischemic stroke with intravenous tPA, performing brain CT scan, carotid Ultrasonography, cerebral angiography, transthoracic echocardiography (TTE), and carotid endarterectomy. The study found that certain technologies have become more widely available, but hospital investments in stroke-related programs have not appreciably increased (Osvaldo & Goldstein, 2003).

The Stroke Center and Department of Neurology, University of California at Los Angeles, implemented a program utilizing the therapies given in the guidelines from the AHA and the ASA. These therapies included eight secondary prevention goals at the time of discharge: 1) antithrombotic therapy 2) statin agents 3) antihypertensive agents 4) Thiazide diuretic therapy 5) smoking cessation advice and referral to a formal cessation program 6) AHA diet 7) exercise counseling and 8) stroke education, including awareness of stroke warning signs as well as instructions to call 911 in the event of a possible cerebrovascular event. Overall, four medication and four lifestyle modification goals were compared in all patients
discharged from a hospital-based stroke service with a diagnosis of AIS or TIA during a one-year period in the PROTECT (Preventing Recurrence of Thromboembolic Events through Coordinated Treatment) Program (Ovbiagele et al., 2004). According to Ovbiagele et al., the program was associated with a substantial increase in treatment utilization at the time of discharge and was a huge success.

Summary

An overview of the literature pertaining to ischemic stroke points out a common thread of the need to reassess and examine current practices surrounding stroke and a need to improve outcomes for stroke patients (Holloway, Vickrey, Benesch, Hinchey, & Bieber, 2001). The establishment of stroke centers will improve the acute care of stroke and provide consistent, quality care in the treatment of AIS. The involvement of the U.S. Congress in the STOP Stroke act will assist in creating national awareness of stroke warning signs and prevention and will hopefully decrease the incidence of stroke while increasing the use of tPA to improve outcomes.

Measuring and Improving Quality of Care
Assessing quality of care requires the development and application of performance measures and explicit standards of care against which actual clinical care is judged (AHA/ACC Conference Proceedings, 2000). The availability of evidenced-based guidelines for the management of patients with cardiovascular and neurological disease provides both impetus and tools to use the consensus statements as a basis for developing performance measures for the evaluation of healthcare quality (AHA/ACC conference proceedings). However, guidelines are not performance measures; they are written to suggest diagnostic or therapeutic interventions for most patients in most circumstances (AHA/ACC conference proceedings). The use of guidelines in treating patients is left to the APN’s and the physician’s discretion; in contrast, performance measures are standards of care that imply error on the part of the provider if they do not care for patients according to those standards (AHA/ACC conference proceedings). In the AHA/ACC conference, participants identified a need to link performance measures or quality indicators to development of guidelines; creating a powerful addition to the quality improvement process. It was suggested that such a process would allow experts to
suggest measures for quality-assessment efforts that reflected the realities of clinical care, and would also allow the indicators to become a vehicle for more rapid translation of strong new evidence into clinical practice (AHA/ACC conference proceedings).

**QI Concepts**

*Donabedian.*

According to the working group in the AHA/ACC forum on Stroke (2000), there is a great need for a framework of organizing and presenting data, including the meaning and limitations to providers, the public and payers. The framework that was used by the AHA/ACC working group to organize their report was the Donabedian triad system of structure, process and outcomes (AHA/ACC Conference Proceedings). Donabedian defined quality assurance to mean “all actions taken to establish, protect, promote, and improve the quality of health care” (Donabedian, 2003, p. xxiii). According to Donabedian, one can not assure or guarantee quality; only increase the probability that care will be “good” or “better” Donabedian (2003, p. xxiii).

The targets that Donabedian refers to are the functions and activities that are subject to quality assurance, including health care itself as provided directly to
patients by legitimate health care practitioners. He also includes other services that directly affect the ability of the practitioner to perform well, i.e. radiological, pharmaceutical and laboratory services and personnel (Donabedian). Ultimately, he defines quality in healthcare thus: “that it is amenable to measurements accurate enough to be used as a basis for the effort to monitor and ‘assure’ it” Donabedian (2003, p. xxxii).

Health care quality can be measured utilizing Donabedian triad of structure. Structure refers to the components of the healthcare system that include: 1) material resources, such as facilities and equipment, 2) human resources, such as the number, variety and qualifications of professional and support personnel and 3) organizational characteristics, such as the organization of the medical and nursing staffs, the presence of teaching and research functions, kinds of supervision and performance review, and methods of paying for care (Donabedian, 2003). Process refers to the activities that constitute health care including diagnosis, treatment, rehabilitation, prevention, and patient education (Donabedian). The AHA/ACC working group states: “to facilitate the interpretability of process assessment,
'ideal' patient subsets—those without contraindications for therapy—are often used as the denominator, and those who received appropriate treatments are reported as the numerator” (AHA/ACC Conference Proceedings, 2000, p. 1485).

The term outcome refers to the changes (Desirable or undesirable) in individuals and populations that can be attributed to health care (Donabedian).

The current emphasis on quality improvement is based on the work of Donabedian and his ability to define the concept in clear operational terms. His research and publications have had an impact worldwide, particularly in the area of organization and delivery of health services. Hospitals, hospital administrators and healthcare providers began to look seriously at quality improvement in the 1980’s, with early efforts going into organizing teams (Carey & Lloyd, 2001). Deming, a quality expert, once stated that healthcare was a system in need of improvement (Carey & Lloyd). He developed a framework by which concepts of quality improvement could be looked at and implemented using a cycle of plan, do, check and act (PDCA). The PDCA cycle is one of the most common QI structures used today. This framework reflects the basic components of the scientific methods and represents a
process that proceeds along both inductive and deductive lines of thinking (Carey & Lloyd). Many hospitals and providers use the PDCA process to apply the concepts of quality improvement and improve quality of patient care and outcomes.

Deming.

Deming defined quality as the achievement, at low cost, of the level of uniformity and dependability demanded by the market. He viewed quality improvement as a continuous cycle of review and improvement, a journey rather than a destination (Tappan, 2001). Utilizing a systematic PDCA cycle allows providers to 1) establish a baseline for targeted indicators, 2) implement changes to improve targeted indicators, 3) determine if improvement has been achieved, and 4) identify additional opportunities for improvement.

QI Challenges

Limitations and challenges to data quality, as well as time frame considerations in tracking outcomes are all elements that must be addressed in any study. Retrospective data collection versus prospective data
collection must be determined at the start of the study to ascertain where the best data will be obtained. Retrospective chart abstraction can often further clarify patient characteristics and information, but the recording of such data by healthcare providers may be incomplete. Prospective data collection has the potential to provide the most useful information when the data are specifically defined and collected for quality-assessment purposes (AHA/ACC conference proceedings). Using prospective data collection allows acquisition of data directly from patients or physicians; enabling assessment of variables such as health status. With the use of electronic medical records, if they are being utilized in a particular facility, collection of prospective data is easier and more cost-effective as well.

Successful QI Projects

Experiences have shown that QI can have a lasting positive impact on the culture of an organization, in the engagement and stimulation of healthcare staff and providers, and, most importantly, on the quality of care provided. Successful QI projects serve as a model for others to follow, and invite others to build on their efforts. One such successful QI project was conducted using
9 hospitals in the Cleveland area. This study was implemented after a systematic audit of IV tPA use and stroke outcomes demonstrated higher rates of symptomatic ICH following the use of tPA (Katzan, Hammer, Furlan, Hixson, & Nadzam, 2003). A quality improvement program was initiated in the 9 hospitals using the Cleveland Clinic Health System (CCHS) and emergency medicine committees. Stroke QI teams met quarterly to review data and facilitate QI initiatives (Katzan et al., 2003). A standardized “dashboard” report was provided that listed the performance of CCHS hospitals individually and collectively for the system. Best practices were benchmarked within the system and compared with national evidence-based guidelines (Katzan et al.).

The committee reviewed hospital action plans periodically and all participating hospitals were expected to have an acute stroke protocol in the ED and a 24-hour CCHS stroke beeper in place daily. Additionally, continuing medical education programs related to acute stroke care and the use of intravenous tPA were utilized as well (Katzan et al.). Results of the study were positive in that the rate of ICH with IV tPA dropped from 13.4% to 6.4% in the 9 CCHS hospitals. The rate of specified
protocol deviations declined from 33% to 17% and the IV tPA usage rate increased from 1.8% to 2.7% among all patients with ischemic stroke; indicating a successful QI project (Katzan et al.).

A second successful study was done using a QI process to prevent recurrent thromboembolic events through achievement of eight secondary prevention goals at the time of discharge from the hospital. The program, entitled The Preventing Recurrence of Thromboembolic Events through Coordinated Treatment (PROTECT) was comprised of a set of tools designed to achieve four medication and four lifestyle modification goals during the acute hospitalization for AIS (Ovbiagele et al., 2004). The ultimate objective was to facilitate the early initiation and long-term maintenance of stroke prevention measures in a systematic, expedient, and widely applicable manner, resulting in improved long-term treatment rates and vascular outcomes in all hospital patients admitted with a diagnosis of ischemic stroke or TIA (Ovbiagele et al.). Development of the program goals was guided by treatment algorithms derived from national clinical guidelines, consensus reports and data from large clinical trials.
The program tools were created and disseminated to neurology attending staff, primary care attending staff, fellows, residents, nurses and additional health care professional involved in the care of stroke patients. The tools included pocket cards, reprinted admission order sheets, medication algorithms, information sheets for both patients and primary care physicians, and a downloadable power-point slide set. Tools were also made available on a PROTECT program-dedicated website (Ovbiagele et al.). The authors commented that the PROTECT tool kit was specifically designed to allow it to be readily adopted and implemented in busy community hospitals and a variety of healthcare systems that may not run a primary stroke service, making this program valuable in this area of research (Ovbiagele et al).

Get With the Guidelines-Stroke

Description of project.

Quality measurement systems for the structure and process of health care delivery in both the inpatient and outpatient settings were developed by the AHA/ASA in their program GWTG-Stroke. The program provided hospitals with a method for initiating quality improvement in cardiovascular and stroke care (LaBresh & Tyler, 2003). The internet-
based point of service data collection tool was used for both reminders in real time and for feedback to hospitals to track their own performance and to compare their data to aggregate data from the entire project or a large group of similar hospitals (LaBresh & Tyler).

The ASA’s GWTG-Stroke is an in-hospital acute stroke treatment and ischemic stroke prevention program that focused on providing an infrastructure for higher quality of care; ensuring patients were treated and discharged appropriately (McNeill, Bullock, & Del Barto, 2005). The GWTG-Stroke used inter-hospital collaborative meetings, best-practice sharing and an Internet tool for data collection, as well as reporting and decision support. According to Schwamm, (McNeill et al., 2005, p.1), “when people operate in isolation, they are not as effective as when they interact in groups.” The collaborative model, used in the GWTG-Stroke project, in combination with all the other aspects of the program, served to bring people together, colleagues and competitors alike, who were interested in improving stroke care quality across the United States. The model was patterned after the Donabedian seminal work on healthcare quality separated
into the three components of structure, process and outcomes.

GWTG-Stroke identifies people (champions) to lead, develop and mobilize teams designed to implement treatment and discharge guidelines for patients in hospitals (American Stroke Association, 2005). The program assesses each participating hospital’s current acute treatment and discharge protocols for stroke patients. The assessment provides a baseline against which future results and measurements of success will be compared (American Stroke Association). Using the program’s online tool, the hospital can achieve continuous quality improvements in their acute treatment and discharge procedures, and implement changes accordingly. The use of process, structure and outcome was used in the development of the tool and the hospitals participating in the use of the tool were able to measure performance measures and participate in quality improvement at each of their facilities by using the tool.

Program components.

Components of the program included 1) organizational stake holder meetings to build consensus and create a common approach in each state by developing buy-in from
organizations interested in promoting quality improvement in hospital based secondary prevention; 2) identification of key stroke opinion leaders in each community to advocate for the program; 3) recruitment of hospitals to participate with multidisciplinary teams; 4) Continuing Medical Education (CME) - based learning sessions, which include didactic, science-based sessions, best practice presentations, interactive, collaborative workshops, individual hospital team planning sessions, and poster sessions; 5) program follow-up via E-mail and telephone; 6) monthly conference calls for hospital teams, including guest speakers and interhospital collaboration; and 7) ongoing, real-time feedback of hospital performance to support rapid cycle improvement (LaBresh & Tyler, 2003).

The stake holder meetings consisted of a number of organizations working with hospitals to improve stroke care. The Quality Improvement Organization (QIO), state hospital association, state health department and various professional groups have run improvement programs in the past and been involved in quality improvement for hospitals. These programs are often more limited in the scope of improvements sought, and tend to compete with each other for hospital attention and resources; particularly
when multiple tools are in use (LaBresh & Tyler, 2003). Multiple local organizations and parent national organizations have demonstrated a willingness to join forces with the AHA to create a common goal and optimize resource utilization by hospitals interested in pursuing quality care (LaBresh & Tyler). The AHA utilized a top-down approach in the GWTG project, including such organizations as the CMS, the Centers for Disease Control and Prevention, the AHA, the ACC, and several large hospital networks.; promoting additional focus on consensus at the state level (LaBresh & Tyler).

Key elements of the GWTG project on the state level included a focus on perceived benefits to organizational collaboration, including the ability to recruit more hospitals, to be more comprehensive in Stroke secondary prevention and acute treatment, and to increase the willingness of hospitals to agree to share hospital-level data with appropriate collaborating organizations. During the GWTG project in Massachusetts, the Massachusetts Secondary Prevention Partnership, and in California, the California GWTG Consortium became influential groups to support the program and advocate for change (LaBresh & Tyler).
Opinion leader consensus meetings consisted of local AHA divisions, QIOs, and other individuals identified to be influential and well-respected in the community. During the meetings the basics of the program were presented including statewide or communitywide performance data. The evidence base and current performance enhancement opportunities were translated into lives saved and care improved at the local level (LaBresh & Tyler, 2003). The role of the opinion leaders was to disseminate the guidelines from the AHA/ACC to front-line practitioners and instigate the necessity for change (LaBresh & Tyler). A facilitated discussion obtained support for the program, and each individual was asked to personally commit themselves and their hospitals to the program and to influence others to participate. A specific implementation plan was developed in the meeting to facilitate ownership, and hospitals ready for change, and represented key opinion leaders were encouraged to be early adopters (LaBresh & Tyler). As these hospitals developed success, they became the best practice hospitals for others to emulate, creating a sense that, “If they can do it, I can do it” (LaBresh & Tyler, p. 22). The current study examined one of the
participating hospitals that committed to being part of the early adopters in the GWTG-Stroke study.

*Results of GWTG-National Pilot Study*

The study period of the GWTG-Stroke project was one year, from April 2003 to April 2004. The results of the study showed that overall, participating hospitals increased their use of intravenous tPA for the treatment of acute ischemic stroke, as well as their documentation of the reasons that such agents were not used (Moyer, 2005). According to Moyer, these findings show that a program like this one serves as a “gentle reminder” to providers and reduces their reliance on their own memories of stroke management guidelines (Moyer, p. 1). The study investigators reviewed 21,653 stroke patients in 99 participating hospitals, collecting data on patient care from inter-hospital collaborative meetings, best-practice sharing, and an internet tool designed for data collection, reporting and decision support (Moyer). The current study represents the data from one of the 99 participating hospitals in Tucson, Arizona.

The investigators compared the hospitals’ baseline practices with their practices for the four consecutive quarters that made up the study period. They measured the
hospitals’ use of intravenous tPA; or documentation of why it was not used in patients who arrived to the emergency department within 2 hours of onset, and were screened with a CT and determined to be having an acute ischemic stroke, as well as those arriving less than three hours after the onset of symptoms (Moyer, 2005). The importance of initiating tPA in the appropriate candidates within 60 minutes of arrival, monitoring for symptomatic or intracranial hemorrhage, and the use of antithrombotic therapy within 48 hours after admission; were emphasized during the entire duration of the project (Moyer). The compliance rates of each institution were monitored at each quarter of the study period and compared to their baseline rates, and analyzed as trends over time (Moyer).

The investigation found that at baseline, tPA was used in 32.3% of cases of the 804 patients admitted within two hours of onset (Moyer, 2005). That rate increased each quarter so that by the fourth quarter the rate of use was 61.1% (P<.0001). In the 1,033 patients admitted within three hours of onset, 26.9% received tPA at baseline compared with 44.5% of patients by the fourth quarter (P>.0001). In the 3,504 patients who did not receive tPA, the justification for not using it was documented in 62.9%
of cases at baseline compared with 85.2% by the study’s end (P<.0001); (Moyer). The investigators noted that increased use of tPA was not associated with a higher rate of complications; at any time (Moyer). In the present study, similar data was collected in the Tucson hospital and compared with the National data and the data from all participating hospitals in the state of Arizona.

In conclusion of the study, according to Dr. Schwamm, the participating physicians and providers were satisfied with the program; seeing the preprinted order sets and the documentation of reasons not to give evidence-based treatments as tools that help them do their job well with less effort (Moyer, 2005). He stated: “The system should be prompting you to do what the evidence base suggests, rather than relying on us to remember” (Moyer, 2005, p.2). He continued on to stress that physicians and providers should not be concerned with the program intruding onto their clinical judgment; rather that it is a “gentle reminder at their elbow” (Moyer, p. 2). Quality improvement strategies that assisted the provider and facility to implement changes in stroke would then be in place and could be utilized to implement changes in other targeted areas as well. Schwamm states: “This is the first
time that anyone has undertaken such a comprehensive analysis of the core components of this chain of prevention, survival and recovery...and this is just the beginning” (Bullock et al., 2005, p. 3).

Summary

The QI program, GWTG-Stroke was considered a success by the AHA and the ASA. The program was the first hospital-based program to receive the Innovation in Prevention Award, given by Health and Human Services Secretary Tommy Thompson. The award is part of the President Bush Healthier US initiative and Secretary Thompson’s emphasis on preventing chronic disease and improving the lives of Americans (Honore, 2004). The program is recognized in the Health Care Delivery System category and is noted as being the premier hospital-based healthcare improvement program for cardiac and stroke patients. “GWTG is a model for the nation in addressing a growing health issue,” Secretary Thompson said (Honore, p. 1). The program is reaching hospitals nationwide and enabling them to redesign systems of care that reduce health care costs and save lives by closing the gap between what we know in stroke care and the care that is delivered to patients.
Chapter 3

QI Study Protocol

Purpose of Study

The purpose of this study was to examine the participation of one Tucson, Arizona hospital (TH) in the GWTG-Stroke initiative. The project looked at the participation of this small community hospital in the QI process established by the AHA/ASA. This study evaluated seven questions related to the acute care of stroke at the TH and compared them with other participating hospitals nationwide and in the state of Arizona. Questions were as follows: 1) How many strokes patients were treated at the TH and what was their stroke etiology; 2) what percentage of cases were pre-notified by EMS of arrival with stroke
symptoms; 3) what is the time from symptom onset to arrival in the ED; 4) what is the time from ED arrival to initiation of imaging; 5) what is the percent of eligible AIS patients who received tPA at the TH; 6) what percent of eligible AIS patients not treated with tPA at the TH that had reasons for not receiving tPA; and 7) what are the reasons why eligible AIS patients were not treated with tPA at the TH, and how were those reasons documented.

**GWTG Program**

The program used to implement this project was the GWTG-Stroke program that was conducted by the ASA over the past several years, and described in the previous section. The ASA’s GWTG-Stroke is an in-hospital acute stroke treatment and ischemic stroke prevention program conducted from April 2003 through April 2004. The program began with an assessment of participating hospital’s current acute treatment and discharge protocols for stroke patients, providing a baseline against which the hospital compared results and measured their success, on a continual basis.

Hospital recruitment was implemented by invitations sent to local leaders (chief executive officer, chief operating officer), clinical leadership (director of nursing, vice president for medical affairs, and chiefs of neurology and neurosurgery), and the quality improvement staff. Hospitals that agreed to participate were then
asked to build teams that included physician champions, care managers, pharmacists, quality improvement directors, cardiac rehabilitation directors, and nurse managers in appropriate clinical areas (LaBresh & Tyler). The Tucson hospital (TH) that participated in this study was recruited in this manner.

Current Project Protocol

The Tucson hospital (TH) used in this study was recruited in the traditional manner. The Neurology Nurse Educator (NNE) was the designated champion or leader of the quality improvement team. The NNE met with the neurologists, neurosurgeons, radiology staff, ED staff and administrators as well as nurses and patient care techs (PCT) in the ED and on the Neurology floor. In keeping with the PDCA process, in the planning phase, the NNE formed a committee of all of the personnel involved in the treatment of stroke. Performance measures consistent with the GWTG-Stroke program were identified. The NNE discussed the performance measures with the committee members and the collection of baseline data was done by the NNE and entered into the Outcome Sciences Data Base (OSDB) in the Patient Management Tool (PMT).

The Plan “P” phase of the project included the discussion of the criteria used to collect the data by the NNE and this author. Logistics of the questionnaire and
the PMT were discussed, as well as the criteria determining stroke etiology, chart review techniques and elements to include in the study. The NNE met with the committee to determine root causes of poor performance, and design interventions for improvement. It was determined that the tool would be used to track key timelines against benchmarks from similar hospitals, to improve the appropriate use of thrombolytic therapies within a specified time-frame, to implement the ASTP, utilizing the “D” or Do portion of the PDCA cycle. For example, the NNE determined that the ED physicians and staff were not using the National Institutes of Health Stroke Scale (NIHSS) to score patient symptoms and degree of disability. The NIHSS was presented to the pertinent members of the staff and administration by the NNE, and was subsequently implemented for use in the ED and on the Neurology unit by the 3rd month of the project. The implementation of the NIHSS was an example of the D phase of the cycle where the tracking of information identified an area for improvement and the change was made. The “C” or Check phase would include an evaluation of the interventions implemented and changes made if indicated. The NNE was able to accomplish this phase with the help of the committee. The “A” or Act phase would involve the continued improvement of the performance measures, and ultimately improved patient outcomes. By
using the PDCA process, protocols can be implemented, information is shared with the team, and the team subsequently engages in further process improvement, and accurately links the data outcomes to the continuous improvement process.

This project was conducted using a non-experimental, descriptive design, using the charted information on patients arriving in the ED suffering from an acute stroke. Specific areas of data were obtained using the 3-page questionnaire from the ASA’s GWTG quality improvement program (See Appendix A). The data were then transferred from the questionnaire to the GWTG’s internet tool referred to as the Patient Management Tool (PMT) by the NNE and the author. The PMT, an interactive assessment and reporting system, was able to generate information representing adherence to guidelines individually and compared to national and Arizona hospitals, on a continuous basis. By accessing and reviewing this information throughout the data collection process, the NNE was able to implement various protocols and guidelines through each step of the process, improving the final outcome at the end of the program.

The current project looked at data pertaining to the acute-phase treatment of stroke, specifically the time from onset of symptoms to the treatment with tPA. Data was
collected from January 2003 through 2004. Baseline data was collected by the NNE and was not included in the analysis. The GWTG program enabled the tracking of the identified performance measures at the TH, and the comparison with the 2 other benchmarks, i.e. participating hospitals in the GWTG program nationally and in the state of Arizona (AZ). The tool was used as a point-of-care instrument to provide interactive guidelines, integrated into the discharge process as a final checklist and note generator, or used for QA chart review or to be part of a national stroke registry, enabling the implementation to be customized to fit existing work flow. Data pertaining to the prevention of stroke and discharge protocols were not included in this project. The data on prevention and discharge protocols were also used by the NNE as the project evolved and various protocols and guidelines pertaining to prevention of stroke and discharge guidelines controlling hypertension were able to be implemented hospital-wide.

Subjects

Patient Selection

The nonprobability, purposive, sampling method used in this study was based on inclusion or eligibility criteria consistent with the GWTG-Stroke program. The criteria was based on patients within a specified age group of 30+
years, male or female who were experiencing symptoms of ischemic or hemorrhagic stroke, or TIA. The patient health status, prior treatment with medications or current use of medications did not influence inclusion in this study. All patients were included in the study on arrival to the ED with symptoms of stroke and the continued inclusion for the purposes of CT/MRI scan and tPA injection depended on the time factor of 3 hours. All symptoms must have begun no longer than 3 hours prior to administration of tPA. If more than 3 hours had lapsed since the onset of symptoms, the patient’s inclusion in the study ended at that point, as far as the eligibility for tPA, and only the data pertaining to onset of symptoms and call to activate EMS and period of time for transport to the ED was used in the analysis. 86 patients were studied over a 10 month period.

QI Elements

Description of QI Tool

Data to fill in the tool was obtained from the patients charts within 1 to 5 days of admission. Data was entered on a paper copy of the tool and then transferred to the OSDB at a later date. The data were collected by 2 people initially, the NNE for the community hospital that was being used, and the author of this study. The NNE entered all data for baseline and the author entered the data that was included in this project. The baseline data was not
included in the analysis of the data for this project. As patients were admitted with a diagnosis of stroke, their name and diagnosis appeared on a unit list for the Neurology unit, and the list was pulled up on the computer, daily. Each person with a diagnosis of stroke or TIA had their chart pulled and either the NNE or this author went through the chart and obtained the information to put on the tool. All of the questions on the tool were filled in; however for the purposes of this study, the only data analyzed was pertaining to the acute care of stroke. The times were obtained using the nurses’ notes from the ED as to when the patients arrived in the ED from EMS or private vehicle, the time the patient was transported to CT for imaging, the time they returned to the ED from imaging and the time they were transported to the floor. Time from onset to arrival in the ED was obtained from the EMS notes, or from the ED triage nurse as reported in the patient’s chart.

Documentation of the administration of tPA to a patient was obtained from nurses notes. Nurses’ notes on the status of the patient’s condition, disability, neurological deficits, were used to calculate the score on the NIHSS stroke scale. The use of the stroke scale was not being done at the beginning of the study; however the ED nurses and physicians began to use the NIHSS by the 3rd
quarter of data collection due to the QI process. During the “Do” portion of the process, the NNE was able to get the implementation of the NIHSS in place in the ED as well as on the Neurology inpatient unit, and the staff was trained in the documentation on the scale. Prior to that, the patient was scored on the stroke scale by the NNE or the author, based on the description of the patient’s abilities in the nurses’ notes and the physicians’ charting of the exam on arrival to the ED.

Questionnaires on the Tool

The seven specific questions asked focused on the acute care of the patient. Questions were as follows: 1) How many strokes patients were treated at the TH and what was their stroke etiology; 2) what percentage of cases were pre-notified by EMS of arrival with stroke symptoms; 3) what is the time from symptom onset to arrival in the ED; 4) what is the time from ED arrival to initiation of imaging; 5) what is the percent of eligible AIS patients who received tPA at the TH; 6) what percent of eligible AIS patients not treated with tPA at the TH that had reasons for not receiving tPA; and 7) what are the reasons why eligible AIS patients were not treated with tPA at the TH, and how were those reasons documented.
Data was collected for these areas over a one year period and the data was looked at throughout the process by the NNE and the ED physicians, to improve the performance of the ED personnel in responding to patients suffering stroke. Baseline data was collected at the beginning of the study, with the use of 30 patients, however the baseline data was not included in the analysis and the charts associated with this study. The charts were compiled using the OSDB.

Results

The following section discusses the evaluation of the seven questions for the GWTG tool related to the acute care of stroke. Data was gathered over a one year period and includes all patients with diagnosis of stroke from January 2003 to 2004. Baseline patients are not included in the data reporting.

Question 1

How many patients were treated at my hospital for stroke (all types) during the period of time that this project represents? The data was collected from the use of the PMT and analyzed using the tool. Results were generated on the OSDB and exported to Microsoft Excel. A chart was printed
out for review. Results of the data showed that TH had a total of 111 strokes, 80 (72%) were AIS, 24 (21.6%) were TIA, 0 were SAH, 5 (4.5%) were ICH, 2 (1.8%) were SUT, and 0 had missing diagnoses. Nationally, of those hospitals participating in the pilot, there were 25,335 patients with strokes; 16,820 (66.4%) were AIS, 5457 were TIA, 476 (1.9%) were SAH, 1446 (5.7%) were ICH, 921 (3.6%) were SUT, and 215 (0.8%) were missing diagnoses. Of all participating hospitals in Arizona, they had a total of 632 patients with strokes; 429 (67.9%) were AIS, 146 (23.1%) were TIA, 2 (0.3%) were SAH, 12 (1.9%) were ICH, 38 (6%) were SUT, and 5 (0.8) were missing diagnoses.

![Diagram](image.png)

Figure 1- Number of patients arriving with stroke and etiology of stroke in the three comparison groups

- □ Tucson Hospital
- □ All Hospitals
- □ Arizona Hospitals

(1)Ischemic Stroke
(2)Transient ischemic attack (<24 hours)
(3)Subarachnoid Hemorrhage
(4)Intracerebral Hemorrhage
(5)Stroke of uncertain type
(6)Blank ("Missing diagnosis")
Question 2

What is the percentage of cases of pre-notification out of all patients transported by EMS from the scene? The results of this question were that out of 111 patients arriving to the TH with symptoms of stroke, 91.7% were pre-notified by EMS, compared to 41.7% nationwide and 66.5% in the state of Arizona (See Figure 2).

![Figure 2-Percentage of patients of prenotification by EMS.](image)

Question 3

What is the time from symptom onset to ED arrival at my hospital (ischemic stroke or TIA patients). Patients included are all patients with a primary stroke diagnosis of ischemic stroke or TIA. Those excluded were those patients transferred from another hospital, patients who
did not present via ED, patients for whom the arrival mode was not documented or blank. Patients whose date/time of onset of stroke symptoms was blank, not documented, or unknown were also excluded as well as those whose date/time of ED arrival was blank, not documented or N/A.

The OSDB had the time frames broken into 15-minute intervals where each patient could be recorded based on the amount of time from symptom onset to arrival. Time frames spanned from 1-30 minutes to greater than 360 minutes. The results were as follows: At the TH, out of 57 total patients arriving to the hospital with AIS or TIS, 6 patients (10.5%) arrived between 0 and 30 minutes of onset of symptoms; 11 patients (19.3%) arrived 31 to 60 minutes from onset of symptoms; 5 patients (8.8%) arrived between 61-90 minutes from onset; 6 patients (10.5%) from 91 to 120 minutes; 4 (7%) from 121-150 minutes; 5 (8.8%) from 151 to 180; 2 (3.5%) from 181 to 210; 2 (3.5%) from 211-240 minutes; 0 patients from 241-270 minutes; 1 (1.8%) patient from 271-300 minutes and 1 (1.8%) from 301-330 minutes; 0 (0%) from 331 - 360 minutes. 14 (24.6%) of patients arrived greater than 360 minutes from the onset of symptoms of stroke (Figure 3).
The national participating hospitals had 3,627 total patients arriving to their EDs with AIS and TIAs. Out of those patients, 691 (7%) arrived from 0-30 minutes from onset, 1520 (15.4%) arrived 31-60 minutes from onset, 5 (8.8%) from 61-90 minutes, 645 (6.5%) from 91-120 minutes, 496 (5%) from 121-150 minutes, 414 (4.2%) from 151-180 minutes, 310 (3.1%) from 181-210 minutes, 279 (2.8%) from 211-240 minutes, 260 (2.6%) from 241-270, 231 (2.3%) from 271-300, 183 (1.8%) from 301-330, and 166 (1.7%) from 331-360 minutes. 3627 (36.6%) of patients suffering AIS and TIA arrived greater than 360 minutes from the onset of symptoms (Figure 3).

Arizona Hospitals had 88 total patients arriving with strokes or TIAs, and out of those 22 (7.2%) patients arrived between 0-30 minutes of onset of symptoms, 55 (18%) arrived 31-60 minutes, 42 (13.8%) arrived 61-90 minutes, 18 (5.9%) arrived 91-120 minutes from onset, 24 (7.9%) arrived 121-150 minutes later, 15 (4.9%) arrived 151-180 minutes, 10 (3.3%) arrived 181-210 minutes from onset, 7 (2.3%) arrived 211-240 minutes, 5 (1.6%) from 241-270 minutes, 5 (1.6%) from 271-300 minutes, 10 (3.3%) patients from 301-330 minutes, 4 (1.3%) from 331-360 minutes and 88 (28.9%)
patients arrived greater than 360 minutes from onset of symptoms (Figure 3).

![Figure 3- Time from onset of symptoms to ED arrival in 3 comparison groups.](image)

**Question 4**

What is the time from triage (ED arrival) to initial imaging work-up for acute ischemic stroke or TIA? Patients included in this subset of data according to the GWTG stroke measure descriptions were those patients with a primary stroke diagnosis of ischemic stroke or TIA who arrived at the ED $\leq$ 180 minutes after onset of stroke
symptoms (American Stroke Association, 2005). Patients excluded were those patients with any of the date/time fields blank, not documented, unknown or N/A. Patients who received outside brain imaging prior to transfer and those with a negative calculated time difference were also excluded from the data subset.

Data from this subset of questions was entered as a time that was retrieved from the patient’s chart as the time the triage nurse wrote the patient arrived in the ED to the time that the nurse that was caring for the patient in the ED wrote that the patient was transported to CT via stretcher. Nurses would also write the time the patient returned from CT so that if the patient waited in the hall for the CT that would be evident by the amount of time that had lapsed since they were transported to CT. Percent of patients were divided into seven time frame groups from 0 to 12 minutes up to >125 minutes.

Results were as follows: At the TH, out of 36 patients experiencing ischemic strokes, 1 (2.8%) patient received CT 0-12 minutes after arrival to the ED; 1 (2.8%) patient was scanned 13-25 minutes after arrival; 2 (5.6%) patients from 26-50 minutes from arrival to the ED; 10 (27.8%) patients from 51-75 minutes; 3 (8.3%) patients from
76-100 minutes; 9 (25%) 101-125 minutes from arrival and 10 (27.8%) patients received a CT greater than 125 minutes from arrival (See Figure 4).

Comparisons were made with the national hospitals participating as well as the hospitals in Arizona. Nationally, out of 4,486 hospitals, 302 (6.7%) of patients received CT within 0-12 minutes of arrival; 731 (16.3%) within 13-25 minutes of arrival; 1277 (28.5%) within 26-50 minutes; 827 (18.4%) from arrival; 489 (10.9%) from 76-100 minutes of arrival; 301 (6.7%) received a CT within 101-125 minutes; and 559 (12.5%) received a CT greater than 125 minutes from arrival.

Arizona hospitals had 166 patients total arriving with AIS and TIAs and out of those patients, 8 (4.8%) received a CT within 0-12 minutes of arrival; 18 (10.8%) from 13-25 minutes of arrival; 37 (22.3%) from 26-50 minutes; 37 (22.3%) from 51-75 minutes; 22 (13.3%) from 76-100 minutes of arrival; 21 (12.7%) from 101-125 minutes; and 23 (13.9%) patients received a CT greater than 125 minutes from arrival (Figure 4).
Question 5

What is the percent of eligible acute ischemic stroke patients who arrived at the hospital within 120 minutes of onset of symptoms and received IV tPA at my hospital within 180 minutes of onset of stroke symptoms. Patients included in this subset of data were those patients with a primary stroke diagnosis of AIS and a known date/time of onset of stroke symptoms. Patients excluded were those who did not arrive via the ED, and patients who arrived at the ED greater than 180 minutes after onset of symptoms.
Additionally, patients who may have arrived at the ED too late to be eligible for IV tPA (time not known) and ineligible patients where treatment with tPA was not applicable or contraindicated. This included patients who received IV tPA at an outside hospital, or those that received “other” investigational IV thrombolytics (ASA, 2005). Those patients that had an acceptable reason why IV tPA was not started at my hospital were also excluded.

The TH did not administer tPA to any patients throughout the period of the study. In comparison to national hospitals, there were 382 patients out of 1068 (35.8%) that were treated with tPA within 120 minutes of onset of stroke symptoms that had a diagnosis of AIS and were eligible to receive tPA according to the protocol. The Arizona hospitals had 47 patients that were eligible with ischemic strokes and out of those, 15 (31.9%) were treated with IV tPA according to the protocol (Figure 5).
Figure 5- Percent of patients who did not receive tPA for specified reasons.

Question 6

What is the percent of eligible acute ischemic stroke patients not treated with IV tPA at my hospital who had reasons for not receiving tPA? The data for this subset included patients that had reasons for not receiving tPA. Those patients included were those with a primary stroke diagnosis of AIS who arrived at the ED $\leq 180$ minutes after the onset of stroke symptoms. Patients excluded were those who received IV tPA, and whose date/time of onset of stroke symptoms were blank, not documented or unknown. The TH had 82.8% of eligible patients not treated with IV tPA compared to 79.4% nationwide and 79.5% in Arizona.
Question 7

What are the reasons why eligible AIS patients were not treated with IV tPA at my hospital? This data subset included the reasons patients that were eligible to receive tPA did not receive tPA. The measure included those patients arriving with a primary stroke diagnosis of AIS who came less than or equal to 180 minutes after the onset of stroke symptoms, and had reasons why IV tPA was not started. Patients who received IV tPA or whose date/time of onset of stroke symptoms were blank, not documented or unknown, were excluded. The term “other reasons” included
reasons such as uncontrolled hypertension, rapid improvement in stroke symptoms, investigational protocol or any other reason for not treating with tPA. Other reasons also included any other reason, inferred or documented that implied a contraindication to the use of tPA.

The data from TH shows that out of all patients that were eligible to received tPA, 4 (16.7%) were not treated because of delay in patient arrival, 1 (4.2%) were not treated due to delay to CT done, 1 (4.2%) were not treated due to delay to CT read, 1 (4.2%) was not treated for “other delay” and 20 (83.3%) were not treated due to “other reasons.” (25%) were not treated because of delay in patient arrival; 1 patient because of delay of reading CT; and 13 patients (80%) for “other reasons.” Other reasons could include delay from CT ordered to CT done, Delay in reading of CT, uncontrolled hypertension, rapid improvement, investigational protocol, or reason was not documented (See Figure 7).
Figure 7- Reasons eligible patients did not receive tPA.

An analysis of the documentation of reasons why eligible acute ischemic stroke patients were not treated with IV tPA was done in the three comparison groups. The TH had reasons documented as contraindications 4 (16.7%) of the time, reasons inferred as apparent contraindications 19 (79.2%); reasons not documented or inferred as contraindications 1 (4.2%) and no data or question not answered 0(0%). Nationally, 814 (33.3%) were reasons documented as contraindications, 770 (31.5%) inferred as apparent contraindications; 101 (4.1%) as reasons not documented or inferred as contraindications, and (31.1%) no data or question not answered. In Arizona, 31 (34.8%)
were reasons documented as contraindications, 33 (37.1%) inferred as apparent contraindications; 9 (10.1%) as reasons not documented or inferred as contraindications, and 16 (18%) no data or question not answered. (Figure 8).
Discussion

The Current State of Stroke

Over the years since the NINDS tPA study approved the use of tPA for the treatment of AIS, only a small minority of acute stroke patients received appropriate approved stroke therapy. Studies prove that an aggressive multilevel stroke educational intervention program can increase delivery of acute stroke therapy; citing important public health implications for reducing disability on a National level (Morgenstern et al., 2002). It has been demonstrated that quality of care for stroke patients in small district hospitals is sometimes suboptimal indicating the need for standardized therapeutic protocols in stroke treatment centers (Handschu et al. 2001). The most common reasons cited for the low treatment rate are long delay times for hospital presentation, reluctance among physicians to treat patients, and fear of the safety and efficacy of the use of tPA (American Stroke Association, 2005).

The use of interventions to decrease protocol violations with the use of tPA to treat AIS, is definitely effective and increases stroke outcomes when implemented in communities; necessitating their use in the future
(Morgenstern et al). Furthermore, the implementation of protocols, and the use of performance measures to evaluate hospitals, is effective in improving stroke outcomes, as well (Holloway et al., 2001).

QI Project Benefits

The Institute of Medicine (IOM) defines clinical practice guidelines as systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances (Heinemann et al. 2002). The purpose of clinical practice guidelines are to 1) assist clinical decision-making by patients and practitioners; 2) educate individuals and groups; 3) assess and ensure quality of care; 4) guide allocation of resources for health care; and 5) reduce the risk of legal liability for negligent care (Heinemann et al). Essentially the implementation of guidelines is designed so that physicians and providers actively use them and conform to recommended practices, thereby promoting change (Heinemann et al). Recent studies have proven an association between adherence to guidelines and stroke outcomes, and many trials in this area, continue to prove beneficial (Micieli, Cavallini, & Quaglini, 2002).
The implementation of a quality improvement project has been proven to be successful in improving outcomes for hospitals, providers and patients, in many areas, as well as stroke. Quality of health care varies throughout the U.S. and does not always meet professional standards, or standards of practice. Patients having strokes do not always receive care based on the current evidence-based standards of practice; in acute treatment as well as preventive treatment (Holloway et al). Developing reliable performance measures and using them to implement change is an effective way to improve the delivery of care, especially stroke care. As described previously the use of the Deming PDCA process, with Plan, Do, Check and Act, can adequately assess clinical practice in any setting. Both short-term and long-term readjustments can be realized in any quality improvement project. The project must be implemented within a certain protocol, in order to be effective in providing change.

GWTG-Tool Results

The current project measured 7 QI indicators related to the acute care of stroke at a community hospital in Tucson, Arizona. The questions looked at: 1) the number of patients brought to this hospital with stroke symptoms, and
the etiology; 2) pre-notification of the ED of a person arriving with stroke symptoms; 3) the time of onset of symptoms to arrival in the ED; 4) the time from arrival in the ED to imaging of the brain; 5) the administration of tPA to eligible stroke patients; 6) and the identification of eligible patients not given tPA who had reasons for not receiving tPA; and 7) what those reasons were, as well as the documentation of the reasons. All of these areas were compared to other participating hospitals nationwide, as well as participating hospitals in the state of Arizona.

Related to the number of patients treated at the participating hospital comparison groups, there were 111 patients brought to TH with symptoms of stroke, compared to 25,335 patients nationwide and 632 patients in Arizona. Of those 111 patients, 80 patients or 72.1% of all patients arriving with symptoms of stroke at the TH were suffering from AIS, compared to 66.4% nationwide, and 67.9% in Arizona. The results indicate that TH has a comparable percent of patients arriving to their ED with symptoms of stroke, and a slightly higher number of AIS patients compared to the 2 groups.

Question 2 looked at the prenotification of the ED that a person was arriving suffering symptoms of stroke. The
results indicate that out of 111 patients, 91.7% were pre-notified by EMS of their arrival to the ED, compared to 41.7% nationwide, and 66.5% in the state of Arizona. The EMS system is able to prenotify hospitals in Tucson of a patient arriving with stroke to a greater extent than nationwide and in the state of Arizona. It is documented that Tucson, Arizona’s EMS system is particularly well-educated on rapid recognition and treatment of stroke.

Question 3 evaluated the time from symptom onset to the arrival to the ED for care. Out of 57 patients arriving to the TH with AIS, almost 1 in 4 (24.6% or 14/57) patients arrived in the ED greater than 360 minutes from onset of symptoms; compared to 36.6% or 3627/9897 patients, nationally, and 28.9% or 88/305 patients statewide. Similar to other participating hospitals in Arizona and nationally, the TH portrays that the majority of the patients suffering from stroke delay in calling 911 or getting to the hospital. It is well documented that lack of education on the part of the public is one main reason for the high morbidity and mortality associated with stroke. The data from this project supports the blueprint published by the ASA that seeks to disseminate credible knowledge to the public as well as establish stroke centers and mass media
promotions to increase the public’s awareness of the emergency nature of stroke (American Stroke Association, 2005).

Question 4 looked at the period of time from arrival to the ED to the initial imaging of the brain in order to determine the etiology of the stroke and the eligibility for tPA. The results indicated that TH did not perform as well as the other hospitals nationally and within the state of Arizona. TH provided CT scans, on the average, 51-75 minutes after arrival and greater than 125 minutes in 27.8% of the cases, and 101-125 minutes in 25% of the cases. Nationally, 28.5% of CT scanning was done in the 26-50 minute timeframe, with 12.5% being done at greater than 125 minutes from arrival, indicating a slightly better performance in this area than TH; and Arizona State performed 22.3% of CT scanning at 26-50 minutes and 22.3% at 51-75 minutes with 13.9% at the timeframe greater than 125 minutes. These results indicate that both comparison groups performed better than the TH in this timeframe of arrival to the ED to CT scan.

This data supports the findings of the AHA/ASA that stroke care is greatly fragmented and in need of guidelines to improve standards of care. One of the new guidelines
was to provide means to quickly evaluate a person arriving to the ED suffering from stroke with CT imaging of the brain, within 25 minutes of arrival. Studies documented that many centers either did not have radiology services available or did not have a radiologist to read the image once obtained, as well as lacking the neurology specialists to treat the AIS once it was identified. There has been improvement in these areas; however, the inability to provide imaging within the 25 minute time frame continues to be a hindrance to acute treatment of stroke with tPA. Looking at this data indicates there is beginning to be a decrease in the amount of time from arrival to imaging and this trend will hopefully continue as more and more hospitals implement ASTPs and protocols for tPA become more prevalent.

Question 5 related to the number of eligible AIS patients arriving to the hospital within 120 minutes of onset of symptoms and receiving tPA within 180 minutes of onset of symptoms. Results showed that the TH had 8 patients arriving to the ED within 120 minutes of the onset of their symptoms, making them eligible for tPA. Out of those 8 patients, 0 (0%) were treated with tPA. Data was compared to nationwide participating hospitals that
administered tPA to 382 patients out of 1,068 or 35.8% arriving to the ED within 120 minutes of onset of symptoms, and were found to be eligible, and to Arizona hospitals who treated 15 patients out of 47 eligible patients or 31.9%. These percentages indicate that the TH did not perform well compared to national and statewide hospitals in treating eligible patients with tPA.

As part of the pilot, the participating hospitals were looked at for their use of tPA, and reasons why it was not given if indeed, the patient was eligible to receive it. The results of this study support the findings that nationally, the use of tPA continues to be fragmented and not consistent, as pointed out by the GWTG working committee. The intent of the national GWTG-Stroke project was to raise the awareness of the treatment protocols for stroke, implement ASTPs and increase the use of tPA, across the nation (American Stroke Association, 2005). The PMT links performance measures with the guidelines recommended by the ASA and enables hospitals to evaluate their performance and initiate interventions to improve their stroke care. The TH was able to see that the results of this performance measure indicated that their standards of
care were not in keeping with the recommendations of the ASA, and needed improvement in the area of using tPA.

Question 6 related to the amount of patients treated with tPA that were eligible to receive tPA who had reasons for not receiving tPA. Data showed that at the TH out of 29 eligible patients, 24 or 82.8% of those patients had reasons for not being treated with tPA, compared to 2,444 eligible patients out of 3,079 (79.4%) patients nationally, and 89 out of 112 patients or 79.5% statewide. The TH was consistent with the hospitals nationwide and in Arizona, and in fact, had a slightly higher percentage of patients not treated who had reasons for not being treated.

Question 7 looked at the reasons given for not treating with tPA when the patient was found to be eligible. Reasons included: 1) delay in patient arrival to the hospital; 2) delay in obtaining the CT within a specified timeframe; 3) delay to the reading of the CT, or 4) “other time delay” which could include any reasons that tPA was not given. The percentages at TH indicated that overall, 16.7% patients were not treated due to delay in patient arrival, and 83.3% were listed as other reasons. Nationally, 14.4% were delay in patient arrival, and 85.8% were for other reasons, and the state of Arizona gave 12.4%
for delay in patient arrival and 85.4% for other reasons. In this area, TH seems to be performing consistently with the other participating hospitals, as far as the reasons for not administering tPA to eligible patients. Unfortunately, with the element of “other reasons” it is difficult to identify areas for improvement.

Question 7, part two, looked at the documentation of the reasons for not giving tPA and whether those reasons were: 1) actually documented in the chart as a contraindication to tPA or 2) if the reasons were inferred as contraindications, or 3) if the reasons were neither inferred or documented as contraindications, or 4) if the question was not answered, with no data available. Results showed that at the TH, reasons were documented as contraindications 4 (16.7%) of the time, reasons inferred as apparent contraindications 19 (79.2%); reasons neither documented nor inferred as contraindications 1 (4.2%) and no data or question not answered 0(0%). Nationally, 814 (33.3%) were reasons documented as contraindications, 770 (31.5%) inferred as apparent contraindications; 101 (4.1%) as reasons neither documented nor inferred as contraindications, and (31.1%) no data or question not answered. In Arizona, 31 (34.8%) were reasons documented
as contraindications, 33 (37/1%) inferred as apparent contraindications; 9 (10.1%) as reasons neither documented nor inferred as contraindications, nor 16 (18%) no data or question not answered. The TH had far greater reasons inferred as apparent contraindications compared to nationally and statewide.

With this subset of data is important to note that the accuracy of the data is dependent on the knowledge base of the person entering the data. The person reading the chart and entering the data on the PMT is the person that is responsible for making the decision on whether the reasons were actual contraindications or inferred, allowing for the possibility of bias in the data collection. Unless the reasons were actually documented in the chart as a contraindication, then they are inferred or neither inferred or documented, based on the information given.

**Strengths and Limitations**

The GWTG-Stroke program was an excellent tool to use to evaluate, identify areas of improvement, and implement interventions, at the TH. As the study progressed, the performance measures were used to implement changes in several areas of the hospital, almost immediately. One example was the implementation of the NIHS scale in the ED.
Until the study was underway the ED physicians and nursing staff were reluctant to use the NIHS scale. They felt that the current state of charting was sufficient, and they wanted to continue in their traditional manner. Once the physicians were able to see some of the data and were educated on the protocols for administering tPA, they agreed to use the scale. The scale was then implemented in all departments of the hospital that were caring for stroke patients.

Several other strengths of this study were that the same person entered the data into the database for the performance measures on acute care and the data was able to be compared to similar hospitals nationwide. Although the baseline data was submitted and entered by the NNE, the baseline data was not included in the current data analysis. The data collection was consistent as far as the various parameters entered into the PMT for this study, as the author was the only person entering the data into the OSDB during the study period.

Limitations of this particular data subset includes the inability to specifically monitor or ascertain the exact reasons the tPA was not given when it should have been given, in order to evaluate what can be done to improve in
this area. The reasons tPA was not given were specific in some areas, however the category of "other reasons" is very broad and vague. Additionally, the documentation of reasons why tPA was not given could be biased as indicated earlier, by the person entering the data.

Another limitation to this study was in the area of reasons why tPA was not given. Interestingly, it appeared that all 3 comparison groups used this category the majority of the time, which would limit the identification of a specific reason that tPA was not given and therefore prevent any improvement in this area. In the future, the addition of an element to specify the exact reason would be of great benefit, as it would afford an opportunity to resolve the reasons why tPA was not given, when it could have been given. Until the reason tPA was not given in those circumstances, the use of tPA will not increase, making the QI process ineffective.

Summary of Findings

The current project was considered a success by this author in the sense that the TH agreed to participate in the study and data was collected and reviewed and improvements were identified and implemented throughout. The measurements of the 7 indicators were met and current
standards of care at the TH compared to other hospitals were evaluated. Areas of improvement were identified, and interventions implemented. The PDCA cycle served to assist the ability of the NNE in disseminating the information to the ED physicians, the neurologists and neurosurgeons, the nursing staff and others included in the QI process of the GWTG program.

The data indicated that TH was similar to other hospitals in the amount of stroke patients seen at their hospital and the etiology of stroke. The majority of strokes in all comparison groups were, in fact, AIS, consistent with the national statistics. Each year 500,000 Americans suffer acute brain attacks and out of those attacks, 400,000 are ischemic strokes (NINDS study group, 1997).

In the area of prenotification of the ED, the EMS system in Arizona was superior compared to nationally and statewide. As stated previously the education of EMS technicians in Arizona is excellent, and the focus is on rapid identification of stroke and rapid transport and notification. Recommendations to increase the organization of delivery of care from the contact and arrival of emergency medical services to evaluation and treatment in
the ED continue to be implemented across the nation and will hopefully improve prenotification of hospitals. The ASA guidelines for the management of patients with AIS state that “EMS personnel should be instructed in the rapid recognition, evaluation, treatment, and transport of patients with stroke (ASA, 2003).

The percentage of ischemic stroke patients who arrive at the ED within 2 and 3 hours of onset is low (Broderick, 2004). Delay in patient arrival from symptom onset was consistent in all 3 comparison groups with the national statistics. According to the data, there remains a national trend of arrival to the hospital greater than 360 minutes of onset of symptoms. At a recent lecture, it was stated that: “Getting more patients to the hospital more rapidly represents the biggest opportunity to make a difference in acute stroke, whatever the method of recanalization” (Broderick, 2004, p. 209). Hopefully as the GWTG-Stroke program continues to incorporate hospitals and providers in the implementation of guidelines and protocols, the awareness among general practitioners and neurologists of stroke as a medical emergency will improve and they will disseminate their awareness to their patients and families.
The TH did not perform as well as the other hospitals nationally and statewide in the area relating to the amount of time from arrival to the ED to the first imaging of the brain. TH obtained the CT from one hour to greater than one hour the majority of the time, compared to 25 to 60 minutes for the other 2 comparison groups. The guidelines recommend that the CT be done within 25 minutes of arrival to the ED to ascertain the etiology of the stroke and determine eligibility for tPA.

The TH was similar or slightly better in all of the areas looked at pertaining to the acute treatment of stroke, except for the treatment of eligible patients where TH was a little less likely to treat with tPA compared to other participating hospitals. The ASA reports that the use of tPA had low baseline compliance at the beginning of the national GWTG program and the use of tPA improved substantially by the end of the study to 61.1% from 32.3% at baseline (McNeill et al., 2005).

Results of the national GWTG-Stroke implementation was associated with a dramatic 89% improvement in rates of IV tPA use in eligible patients who came in within two hours of symptoms, without an increase in bleeding complications (McNeill et al.). Another study demonstrated an association
between stroke outcome and compliance with guidelines with a reduction of mortality at the 6-month-follow-up, with risk of death found to be directly related to the level of noncompliance with guideline-based recommendations (Micieli, Cavallini, & Quaglini, 2002). In the current study, as the data continues to be analyzed by the NNE, it is hoped that the use of tPA in the TH will increase.

While the QI process was not ideal the current study due to the fact that the committee in the present study dissolved before the end of the project, the information is still relevant and of potential use by physicians, staff, and administration at the TH. Limitations of this project were the size of the committee, and the lack of consistent evaluation and meetings as the process continued. Additionally, a specific stroke program was not in existence at the beginning of the study, limiting the quality of care in place at the onset. However, as the study progressed and the ASTP was put in place, the increase in the use of the NIHSS, as well as new written standing orders for tPA protocol and antithrombotic prophylaxis, was a positive outcome. The standing orders that were developed and implemented increased the quality of care in the areas of acute treatment of stroke, as well
as prevention of stroke. Furthermore, the program continued to be useful for the NNE in that specific discharge protocols were developed and implemented increasing the treatment of hypertension, hyperlipidemia and smoking cessation counseling.

Use of a QI process to improve the quality of stroke care was successful both in the national GWTG-Stroke program and in the current study. The national GWTG-Stroke program showed that the quality care for stroke patients improves dramatically within a year when hospitals use the program (Moyer, 2005). The national study showed that participating hospitals increased their use of tPA in stroke patients, as well as their documentation of the reasons that such agents were not used, after the program was implemented (Moyer). Furthermore, the investigators noted that increased use of tPA was not associated with a higher rate of complications (Moyer). Participating physicians were satisfied with the program. They viewed the preprinted order sets and the documentation of reasons not to give evidence-based treatments as tools that help them to do their job well with less effort (Moyer).
Future Implications

Creating quality stroke systems of care will improve if the U.S. Congress passes the Stroke Treatment and Ongoing Prevention Act, known as the STOP stroke act. The legislation which is supposed to be reintroduced in the 109th Congress would create a grant program to educate medical professionals in newly developed diagnostic approaches, technologies and therapies. In addition the grant program will help states ensure that patients have access to quality stroke prevention, treatment and rehabilitation services. A national public awareness campaign about stroke warning signs and stroke prevention will be created as well. The legislation would also support the Coverdell Stroke Registry and Clearinghouse to collect data and share best practices.

There are ongoing studies into the goals for the fundamental approaches to the development of acute stroke therapy and reperfusion and neuroprotection. Several approaches to result in expanded use of thrombolysis in acute stroke and more rapid reperfusion are under investigation (Fisher & Brott, 2003). Spanish researchers report that the treatment window for tPA can be safely and effectively widened to six hours in selected stroke
patients by using multimodal magnetic resonance imaging (Kerr, 2005). One approach under investigation is the use of galactose-based microbubbles to ultrasound, which has already been shown to accelerate the effects of thrombolysis, speeding recanalization in stroke patients (Kerr).

Another approach being studied involves combining initial IV rtPA with intra-arterial rtPA given later to determine if delayed intra-arterial therapy after initial lower-dose IV rtPA can be used safely and effectively if the initial IV therapy does not induce successful reperfusion (Fisher & Brott). Other recanalization devices under experimentation include the Neurojet, which fragments and removes clot by generation of high velocity jets of saline, devices that fragment clot by laser energy and wire devices that remove clot by assuming a given shape (e.g., pig’s tail, basket) after exit from the angiographic microcatheter (Broderick, 2004).

New aspects of stroke care also include the use of telemedicine and stroke education using compact disk interactives (CDI) (Levine & Gorman, 1999). Internet-based interactives (CDI) can be developed to enhance the education of physicians in the area of treatment protocols
and CT interpretation in early ischemic stroke. These CDI may supplement the services of stroke teams, especially in rural areas where stroke teams may not be available. Telestroke use in the prehospital setting is already being piloted, linking patients in the ambulance to the ED, including performing an NIHSS analysis using Tele-BAT (Levine & Gorman). Additionally patient education via CDI and Telestroke classes can also enhance the number of high-risk patients exposed to stroke risk-factor reduction, warning sign awareness programs, and the importance of accessing acute stroke care (911 emergency) urgently (Levine & Gorman). Data collection, by linking a Telestroke system to a computerized database, could facilitate data analysis of all aspects of stroke care as well (Levine & Gorman).

Acute stroke therapy will be a major focus for the next 10 to 15 years. Brain recovery after stroke will be the area of scientific discovery with the largest potential for advances far into the next century (Broderick, 2003). The 21st century and beyond will be focused on understanding the neural code. “Until we know the language of brain cells and systems, our ability to restore function in the damaged or recovering brain will be limited” (Broderick, 2003).
# APPENDIX A-NIHS STROKE SCALE

## NIH Stroke Scale at Initial Evaluation

<table>
<thead>
<tr>
<th>1a. Level of consciousness:</th>
<th>0: Alert</th>
<th>1: Not alert, but arousable with minimal stimulation</th>
<th>2: Not alert, requires repeated stimulation to attend</th>
<th>3: Coma</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b. Ask patient the month and their age:</td>
<td>0: Answers both correctly</td>
<td>1: Answers one correctly</td>
<td>2: Both incorrect</td>
<td></td>
</tr>
<tr>
<td>1c. Ask patient to open and close eyes:</td>
<td>0: Obey both correctly</td>
<td>1: Obey one correctly</td>
<td>2: Both incorrect</td>
<td></td>
</tr>
<tr>
<td>2. Best gaze (horizontal eye movement):</td>
<td>0: Normal</td>
<td>1: Partial gaze palsy</td>
<td>2: Forced deviation</td>
<td></td>
</tr>
<tr>
<td>3. Visual field testing:</td>
<td>0: No visual field loss</td>
<td>1: Partial homonymous</td>
<td>2: Complete hemianopia</td>
<td>3: Bilateral hemianopia (blind including cortical blindness)</td>
</tr>
<tr>
<td>4. Facial paresis (Ask patient to show teeth or raise eyebrows and close eyes tightly):</td>
<td>0: Normal symmetrical movement</td>
<td>1: Milder paralysis (Focused nasolabial fold, asymmetry on smiling)</td>
<td>2: Partial paralysis (Total or near paralysis of lower face)</td>
<td>3: Complete paralysis of one or both sides (Absence of facial movement in the upper and lower face)</td>
</tr>
<tr>
<td>5. Motor function-right arm:</td>
<td>0: Normal (extend arm 90° or 45° degrees for 10 seconds without drift)</td>
<td>1: Drift</td>
<td>2: Some effort against gravity</td>
<td>3: No effort against gravity</td>
</tr>
<tr>
<td>5. Motor function-left arm:</td>
<td>0: Normal (extend arm 90° or 45° degrees for 10 seconds without drift)</td>
<td>1: Drift</td>
<td>2: Some effort against gravity</td>
<td>3: No effort against gravity</td>
</tr>
<tr>
<td>6. Motor function-right leg:</td>
<td>0: Normal (extend leg 30° degrees for 5 seconds without drift)</td>
<td>1: Drift</td>
<td>2: Some effort against gravity</td>
<td>3: No effort against gravity</td>
</tr>
<tr>
<td>6. Motor function-left leg:</td>
<td>0: Normal (extend leg 30° degrees for 5 seconds without drift)</td>
<td>1: Drift</td>
<td>2: Some effort against gravity</td>
<td>3: No effort against gravity</td>
</tr>
<tr>
<td>7. Limb ataxia:</td>
<td>0: No ataxia</td>
<td>1: Present in one limb</td>
<td>2: Present in two limbs</td>
<td>3: Present in three limbs</td>
</tr>
<tr>
<td>8. Sensory (Use pinprick to test arms, legs, trunk and face—compare side to side):</td>
<td>0: Normal</td>
<td>1: Mild to moderate decrease in sensation</td>
<td>2: Severe to total sensory loss</td>
<td></td>
</tr>
<tr>
<td>9. Verbal Language (describe picture, name items, read sentences):</td>
<td>0: Normal</td>
<td>1: Mild to moderate aphasia</td>
<td>2: Severe aphasia</td>
<td>3: Mutism</td>
</tr>
<tr>
<td>10. Dysarthria (read several words):</td>
<td>0: Normal articulation</td>
<td>1: Mild to moderate slurring of words</td>
<td>2: Near unintelligible or unable to speak</td>
<td>3: Incomprehensible or non-verbal</td>
</tr>
<tr>
<td>11. Extinction and inattention:</td>
<td>0: Normal</td>
<td>1: Inattention or extinction to bilateral simultaneous in one of the sensory modalities</td>
<td>2: Severe hemi-inattention or hemi-inattention to two or more sensory modalities</td>
<td></td>
</tr>
</tbody>
</table>

The "Quick & Easy" NIHSS Authored by: Judith Spilker, RN, BSN, Dept. of Emergency Medicine & Laura R. Sanebeck, RN, BSN, Dept. of Neurology, University of Cincinnati.
### APPENDIX B - PATIENT MANAGEMENT TOOL

**Patient ID:**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Status</td>
<td>[optional field]</td>
</tr>
<tr>
<td>Admit Date</td>
<td>/ / / / / / / / /</td>
</tr>
<tr>
<td>Discharge Date</td>
<td>/ / / / / / / /</td>
</tr>
</tbody>
</table>

**Location:**
- O Neurology - Stroke Unit
- O Other Location
- O Other Unit w/ Stroke Consult
- O Other Unit w/o Stroke Consult

**Demographics:**
- O Male
- O Female
- O White/Caucasian
- O African American or Black
- O Hispanic
- O Asian or Pacific Island
- O American Indian or Alaskan Native
- O Other

**Medication:**
- O None
- O Other

**Pre-admission Rankin Scale Score prior to stroke:**
- O 0
- O 1
- O 2
- O 3
- O 4
- O 5
- O Not documented

**Stroke Diagnoses:**
- O Ischemic stroke
- O Transient ischemic attack (< 24 hours)
- O Subarachnoid Hemorrhage
- O Intracerebral Hemorrhage
- O Stroke of uncertain type

**Primary Stroke ICD-9:**

**Discharge Status (Functional):**
- O Able to ambulate alone w/ or w/o device
- O Able to ambulate w/ assist from other person(s)
- O Not able to ambulate
- O Not documented

**Discharge Destination:**
- O Home
- O Skilled Nursing Facility
- O Home Health Agency
- O Other

**Discharge Destination Other Unable to Determine:**
- O Other

**Date/Time of Onset of Stroke:**
- O Date
- O Time
- O Documented as "Unknown Onset"
- O Witnessed
- O Self-reported onset
- O Not documented

**How determined?**
- O Time
- O Witnessed
- O Self-reported

**If time, estimated time of day of onset:**
- O Morning
- O Evening
- O A.m.
- O P.m.

**NIH Stroke Scale Initial:**
- O Normal
- O 1
- O 2
- O 3
- O 4

**Completed at your hospital:**
- O Yes
- O No

**Interpretation of first brain imaging after symptoms onset:**
- O Normal
- O Abnormal

**Was Thrombolytic Therapy for Stroke Administered? (check all that apply):**
- O Not administered at all
- O Intravenous t-PA started at outside hospital
- O Intravenous t-PA started at my hospital
- O Other

**If IV t-PA started at outside hospital, document date and time started:**
- O Date
- O Time

**Date/Time of Thrombolytic Administration started at your hospital:**
- O Date
- O Time

**Complications of Thrombolytic Therapy (check all that apply):**
- O Symptomatic intracranial hemorrhage
- O None
- O Life-threatening systemic hemorrhage
- O N/A
### APPENDIX C—PATIENT MANAGEMENT TOOL #2

<table>
<thead>
<tr>
<th>If No IV-t-PA started at your hospital, Possible Reasons(0) Why Not:</th>
<th>O Delay in patient arrival (&lt;3 hrs from onset of stroke symptoms)</th>
<th>O OICH, brain aneurysm, vascular malformation, or brain tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O Delay from CT ordered to CT done</td>
<td>O Age</td>
</tr>
<tr>
<td></td>
<td>O Delay from CT done to CT read</td>
<td>O Active internal bleeding (&lt;22 days)</td>
</tr>
<tr>
<td></td>
<td>O Other time delay</td>
<td>O Platelet count &lt;100,000</td>
</tr>
<tr>
<td></td>
<td>O Uncontrolled hypertension</td>
<td>O Abnormal PT or PT</td>
</tr>
<tr>
<td></td>
<td>O Rapid improvement</td>
<td>O Glucose &lt;50mg/dl or &gt;400 mg/dl</td>
</tr>
<tr>
<td></td>
<td>O CT findings:</td>
<td>O No IV access</td>
</tr>
<tr>
<td></td>
<td>O Stroke severity — Too Mild</td>
<td>O Life expectancy &lt;1 yr or severe co-morbid illness</td>
</tr>
<tr>
<td></td>
<td>O Stroke severity — Too Severe</td>
<td>O IV t-PA given at outside hospital prior to transfer</td>
</tr>
<tr>
<td></td>
<td>O Sacrum at onset</td>
<td>O Invasive protocol instead of IV t-PA</td>
</tr>
<tr>
<td></td>
<td>O Recent surgery/trauma (&lt;15 days)</td>
<td>O Other reason</td>
</tr>
<tr>
<td></td>
<td>O Recent IC surgery, head trauma or stroke (in past 3 months)</td>
<td>O Not documented</td>
</tr>
<tr>
<td></td>
<td>O Patient-family refused (e.g., DNR, CM/C)</td>
<td>O Consent not obtainable</td>
</tr>
<tr>
<td>Were any of the above reasons documented as contraindications to IV-t-PA?</td>
<td>O Yes</td>
<td>O No</td>
</tr>
<tr>
<td>Additional Comments:</td>
<td>O Not documented as contraindication, but inferred by anesthetist as apparent to physician</td>
<td></td>
</tr>
</tbody>
</table>

#### Medical History

<table>
<thead>
<tr>
<th>Condition</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial Fibrillation</td>
<td>Present/History</td>
</tr>
<tr>
<td>Atrial Fibrillation during current admission</td>
<td>Present/History</td>
</tr>
<tr>
<td>Prosthetic heart valve</td>
<td>Present/History</td>
</tr>
<tr>
<td>Previous Stroke/Thrombolysis</td>
<td>Present/History</td>
</tr>
<tr>
<td>CAD (previous MI)</td>
<td>Present/History</td>
</tr>
<tr>
<td>Carotid Stenosis (≥70%)</td>
<td>Present/History</td>
</tr>
<tr>
<td>Diabetes mellitus (DM)</td>
<td>Present/History</td>
</tr>
<tr>
<td>FVD*</td>
<td>Present/History</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Present/History</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Present/History</td>
</tr>
<tr>
<td>Smoker (current or within the past year)</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Lipids (all patients), AIC (if diabetic)

<table>
<thead>
<tr>
<th>Total Chol:</th>
<th>mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides:</td>
<td>mg/dl</td>
</tr>
<tr>
<td>HDL:</td>
<td>mg/dl</td>
</tr>
<tr>
<td>LDL:</td>
<td>mg/dl</td>
</tr>
<tr>
<td>A1C:</td>
<td>%</td>
</tr>
</tbody>
</table>

#### LDL Goal Documented:

| < 100mg/dl | O |
| < 130mg/dl | O |
| < 160mg/dl | O |

#### Height/Weight:

| Height (inches) | select one |
| Weight (lbs) | select one |
| BMI: | select one |

#### DVT Prophylaxis:

| Patient ambulating without assistance (no help from another person) on 2nd hospital day? | O Yes | O No | O Unable to determine |
| Did patient have DVT prophylaxis initiated by 2nd hospital day? | O Yes | O No | O N/A (patient ambulating) |

#### Testing Medications/Interventions

#### Antithrombotic Therapy

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin (or clopidogrel)</td>
<td>Present/History</td>
</tr>
<tr>
<td>Clopidogrel (Plavix)</td>
<td>Present/History</td>
</tr>
<tr>
<td>Ticlopidine (Ticlid)</td>
<td>Present/History</td>
</tr>
<tr>
<td>Heparin</td>
<td>Present/History</td>
</tr>
<tr>
<td>Low molecular weight heparin</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Atrial Fibrillation

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warfarin</td>
<td>Present/History</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>Present/History</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Present/History</td>
</tr>
<tr>
<td>Labetalol</td>
<td>Present/History</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Antihypertensive Therapy

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitors</td>
<td>Present/History</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>Present/History</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>Present/History</td>
</tr>
<tr>
<td>Diuretics</td>
<td>Present/History</td>
</tr>
<tr>
<td>Other antihypertensive agents</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Cholesterol Reducing Therapy

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statin therapy</td>
<td>Present/History</td>
</tr>
<tr>
<td>Low cholesterol diet (HDL diet or equal)</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Diabetic Therapy

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral agents</td>
<td>Present/History</td>
</tr>
<tr>
<td>Ajusted diet</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

#### Preventive Measures

<table>
<thead>
<tr>
<th>Treatment:</th>
<th>Present/History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiseizure medications</td>
<td>Present/History</td>
</tr>
<tr>
<td>Anti-smoking medications</td>
<td>Present/History</td>
</tr>
<tr>
<td>Other lifestyle interventions:</td>
<td>Present/History</td>
</tr>
</tbody>
</table>

---

ASA STROKE CONTINUUM
NOT FOR USE WITHOUT PERMISSION
? 855-526-0700
Ottawa Sciences © 2013
References


http://www.americanheart.org/presenter.jhtml?identifier=3027320


Volpato, S., Maraldi, C., Alessandro, B., Ranzini, M.,

Volpato, S., Maraldi, C., Alessandro, B., Ranzini, M.,
