Stroke Centers
Proof of Concept and the Concept of Proof

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Dear readers,

If we could magically go into the future approximately 50 years, I suspect we would look back at the current time with fond memories. I say this because we may now be living through the “Golden Era” of stroke care. Over the past 10 to 20 years, there have been several major advances in the care of patients with cerebrovascular disease. These include the ability to image in great detail the brain and related vessels, the widespread availability and use of tissue plasminogen activator, the use of endovascular approaches to treat ischemic strokes and aneurysms, and the formation of stroke centers in many parts of the world. These developments have greatly improved our ability to accurately diagnose and treat patients with stroke and improve their outcomes.

In 2000, the Brain Attack Coalition (BAC) published recommendations for the formation of Primary Stroke Centers (PSCs). This effort was based on concerns that the level of acute stroke care in the United States was uneven at best and suboptimal in many cases. The BAC drew from the experience of Trauma Centers as a paradigm to better organize and enhance the care of patients with an acute stroke. Trauma and stroke do share several important features: (1) both occur without warning; (2) both have very limited time windows to treat and have an improved outcome; and (3) both require specialized care facilities, personnel, and protocols to provide optimal care.

Many elements of a PSC have been shown to effect a good or improved outcome, including stroke units, stroke protocols, and the ability to use tissue plasminogen activator in a safe and efficient manner. Various disease performance measures in a PSC have been shown to reduce the risk of in-hospital complications (ie, aspiration pneumonia, deep venous thrombosis) and reduce the risk of recurrent strokes (ie, antiplatelet therapy, statins). The same is true for elements of a Comprehensive Stroke Center such as a Neuroscience Intensive Care Unit, neurointensivists, and the safe use of procedures such as carotid endarterectomy and stenting.

Despite these positive studies, there has been some uncertainty among some medical professionals and others about the overall effectiveness of stroke centers. For example, tissue plasminogen activator is used in only a small percentage of patients with ischemic stroke, so its overall effectiveness for a population of patients with stroke is relatively low. The efficacy of stroke units is disputed because in some cases, these units may include rehabilitation (especially in Europe).

In this issue of Stroke, Meretoja and colleagues present their study on the effectiveness of PSCs and Comprehensive Stroke Centers (CSCs) in Finland. They defined PSCs and CSCs using most of the criteria published by the BAC. The study was quite large, including >61,000 patients with first-time ischemic strokes admitted to a PSC or CSC hospital compared with a general hospital. The choice of which hospital a patient was admitted to was largely determined by geography, although subtle referral biases could not be excluded.

This large study found a statistically significant 16% reduction in 1 year case-fatality at a CSC and an 11% reduction at a PSC when compared with a general hospital. The absolute reduction in death was 2.4% for a CSC and 1.5% at a PSC compared with a general hospital. Patients treated at a CSC or PSC had a 1% absolute risk reduction of institutional care at 1 year compared with a general hospital. These benefits were adjusted for baseline imbalances in age and other comorbidities.

Several strengths of this study are apparent. It was very complete and comprehensive due to the centralized nature of healthcare records and the documentation of outcomes in Finland. The sample size is quite large, and all major hospitals were visited by a stroke neurologist to assess their level of care. A significant number of patients were treated at either a CSC (32%) or PSC (17%); thus, the study had sufficient statistical power to detect major and minor effects.

Like with any study, there are also some areas of weakness. This study only included patients with ischemic stroke. Patients with cerebral hemorrhages, who may benefit greatly from care at a CSC, were not included. There was no information about baseline stroke severity; thus, this could not be included in the logistic regression models. However, it is unlikely this produced misleading results because any bias based on stroke severity would typically divert the sickest patients to a CSC or PSC and not a general hospital.

As noted, the use of various disease performance measures is an important aspect of patient care at a stroke center. These were not included in the original BAC papers, but the Joint Commission wisely added them as part of the certification process. Standardized quality improvement programs such as...
“Get With the Guidelines—Stroke” have been shown to improve adherence to such performance measures. It is unclear if and how these were implemented at the various stroke centers and hospitals in the Meretoja et al study.

Even with these caveats, the current study provides compelling evidence that either a CSC or PSC saves lives and improves outcomes for patients with ischemic stroke. When extrapolated across a global population, a 1% to 2% reduction in mortality translates into at least 50 000 to 100 000 lives saved each year. An increase in the number of patients who are able to live at home instead of being institutionalized likely would save healthcare systems hundreds of millions or billions of dollars annually.

From all currently available data, it seems clear that we have proved the concept that stroke centers save lives and improve outcomes at the same time as preventing subsequent strokes. Many different components of a PSC and CSC have been shown to improve outcomes, so an overall benefit is certainly reasonable and expected. Future studies will likely explore further the benefits of stroke centers for patients with hemorrhagic strokes and those who need specific interventions.

Subsequent studies will be faced with a challenge in terms of the concept of proof, because the standard of care for stroke is clearly changing. In many areas, gone are the days of placing patients with stroke in a room at the end of the hall and hoping for the best. Even hospitals that do not become stroke centers are adopting some of the best practices shown to be beneficial such as stroke protocols, deep vein thrombosis prophylaxis, aspiration prevention, and the early use of antithrombotics. With this gradual change in the level of care in many hospitals, it might be a challenge to further prove some of the benefits of stroke centers.

Another challenge going forward is to expand the number of hospitals that are stroke centers. In the United States, there are approximately 700 PSCs certified by the Joint Commission in early 2010 out of approximately 5000 acute care hospitals. There may be ≥200 hospitals that are designated PSCs by other entities such as state health departments and other organizations. Many states and regions have begun programs to preferentially divert or transfer patients with acute stroke to the nearest PSC. This is a Class 1 recommendation from the American Heart Association/American Stroke Association.

However, we must remember that the vast majority of strokes occur in people who live in undeveloped and developing nations. The stroke center concept might have important public health implications in those regions, yet resources are limited in some areas. It is hoped that the study by Meretoja and colleagues will be useful for persuading health-care leaders of the importance and value of stroke centers for all patients who have a stroke.

Disclosures
None.

References

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