

Improving Stroke Diagnosis and Treatment: An International Collaborative Initiative



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The diagnosis and treatment of stroke represent clinical challenges of critical importance. In the United States, stroke had an estimated prevalence of 3.2% in 2012 [1] and is currently the fourth leading cause of death [2]. Given the increasing age of the U.S. population [3], health care costs attributed to stroke management are estimated to rise from \$70 billion to \$184 billion by 2030 [1]. An effective approach for screening asymptomatic individuals is lacking—only 38% of individuals in one survey were aware of all major symptoms [4]. In addition, only a small majority of patients who undergo revascularization exhibit more functional improvement than would otherwise be anticipated, and there is no reliable technique for identifying such patients prior to intervention. Thus, there is a compelling need for investigation into stroke diagnosis and treatment, with pursuit of new solutions to address these challenges.

As part of the ARRS 2014 Annual Meeting Global Exchange program, ARRS and the Chinese Society of Radiology (CSR) jointly sponsored a focus group session pertaining to stroke diagnosis and treatment. The session, moderated by Alexander Norbash, an interventional neuroradiologist and chair of radiology at Boston University Medical Center, was attended by leaders with relevant background and expertise from both societies. The session provided an opportunity for more-effective sharing of experiences, mutual learning, and bridge building as a foundation for future international collaboration to improve stroke management.

The overarching theme of the dialogue was the substantial variation among current care pathways for stroke. For example, centers vary in their preference of initial diagnostic imaging modality. Some choose routine CT alone; some, CT with CT perfusion and/or CT

angiography; and some prefer MRI, including diffusion-weighted imaging. Among these modalities, there is further variation in scan durations, acquisition parameters, and interpretation schemes. The use of diagnostic catheter angiography in patients with subarachnoid hemorrhage is highly variable, as well. Therapy is similarly variable, with differences in preference for thromboextraction, intravenous or intraarterial thrombolysis, and thrombofragmentation. Acceptable windows for performing these interventions are not standardized; the delay from presentation until initiation of therapy is tremendously discrepant among centers, and the procedures are prone to substantial operator variation in their technique. Such extensive variation throughout clinical pathways greatly hinders the medical community's ability to learn from outcomes pooled from large numbers of patients and to improve care patterns over time.

In an initiative to address this variation, the focus panel explored creation of a national or international registry of stroke patients that would contain details relating to patient diagnosis, treatment, and clinical outcome. Such a large-scale database would foster the sharing of experiences and insights among centers, and empower investigators to better understand which patients benefit from particular tests and interventions. The registry could facilitate the identification of centers obtaining the best outcomes, thereby providing a model to be emulated by other institutions. While the creation of a registry itself would neither require nor resolve discrepancies in preferred management algorithms, a registry would, at the very least, establish a formalized mechanism for documenting such disagreements and ultimately achieve collective (rather than individualized) learning.

Another key area of discussion pertained to the potential benefits of consolidation of diagnostic and therapeutic stroke services in a given geographic region. Such dedicated stroke centers could achieve a very high level of expertise in stroke management, and would be well positioned to standardize stroke care throughout a region. The centers would offer the unique benefits of taking comprehensive responsibility for stroke care in their regions. Care could include partnership with ambulatory care services (e.g., portable CT units and initiation of thrombolytic therapy in the ambulatory setting) and with telemedicine services (e.g., use of handheld devices for monitoring patients and interpreting images from smaller hospitals that, in turn, would assist triage of patients for

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transfer to the primary stroke center). Successful implementation of these large regional stroke centers would likely require establishment of rigorous criteria for a center to achieve such status, including adherence to stroke-specific training programs, credentialing examinations, certification processes, and compliance metrics.

Despite these benefits, creation of regional stroke centers with standardized management pathways poses a substantial organizational challenge that may not be practical in all settings. The model works best in areas that already have a single, large medical center that is dominant in its community; indeed, current successful stroke centers fit this model. Successfully establishing a new regional stroke center will be more difficult in regions that have a number of major institutions. Health care reform per the Affordable Care Act (ACA) of 2010 may help address this problem. The ACA encourages the formation of accountable care organizations and broad health care networks that take responsibility for the comprehensive management of large patient populations. The law also encourages and provides incentives for reporting clinical outcome measures in standardized formats. These large networks would likely be able to realize heightened alignment among their practitioners, who will thereby be more motivated to achieve standardized and optimized care benchmarks for such common medical conditions as stroke.

The focus session also addressed the need for much greater promotion of public education about stroke symptoms and the urgency of treatment. In contrast to most people's general knowledge of cardiac risk factors and symptoms, the public generally has a much lower level of awareness of the clinical aspects of

stroke. Public education would emphasize the most common symptoms and the need to seek immediate medical care when those symptoms occur. A curriculum could be established to standardize training for physicians in providing such public outreach. Public education could be integrated with outreach efforts that some centers now provide to educate patients at high risk for cardiac events.

During the focus session, the impact and importance of stroke as a major national health care problem in both the United States and China was clear. Nonetheless, differences in the two nations' experiences were identified. First, stroke mortality is increasing in China but not in the United States, the reason for which is uncertain. In addition, China's health care centers must deal with different economies of scale when pursuing standardization of clinical care. Namely, the major hospitals in China generally have much larger patient volumes and far fewer physicians per patient than those in the United States. Thus, some approaches being explored by U.S. hospitals, such as maintaining standby teams of physicians to await the arrival of new stroke patients or holding a CT or MRI scanner unoccupied while awaiting the new patient, would not be feasible in major hospitals in China. Also, in China, CT and MRI

are more commonly part of distinct hospital departments, and clinical services other than radiology more frequently operate their own scanners and interventional suites independently, making centralizing and coordinating the use of different scanners and departmental services more difficult. Furthermore, radiologists at the major hospitals tend to be less specialized in their clinical duties, such that establishing dedicated stroke radiologists may be more challenging. In part related to the much larger volume of patients requiring imaging in China and the subsequent requirement for more efficient clinical pathways, CT is more widely used for stroke evaluation in comparison with MRI there than in the United States, potentially combined with CT angiography and CT perfusion as a one-stop shop. Such differences provide opportunities for both countries to learn from each other's experiences and outcomes in improving stroke management.

Looking ahead, the leaders of the two nations' radiology societies identified key areas of action to help standardize and improve the clinical management of stroke. For example, the societies could partner with subspecialty societies to facilitate the formation of a large-scale stroke registry, as previously noted. In addition, checklists could be created to guide the management of patients

with strokes in the emergency department setting, while standardized discharge instructions could be provided to patients admitted with pre-stroke symptoms. Furthermore, a standardized public education curriculum relating to stroke, designed to be easy for clinicians

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to integrate into their practices and engaging for patients, could be developed. Such initiatives could perhaps be structured as scholarship opportunities for radiologists from the two participating countries.

While the challenges in stroke diagnosis and treatment will require long-term, focused effort to address, a provocative and insightful dialog was initiated during the focus session. This initial dialog is intended to serve as the beginning of—and the inspiration for—much deeper discussion between the two societies. Key focus areas for future synergistic work were identified. It is anticipated that these efforts will help to elucidate the optimal diagnostic and therapeutic approaches for stroke management and to help standardize care. If successful, this collaborative process will achieve better care and improved outcomes for stroke patients around the world.

Attending on behalf of ARRS were Alexander Norbash (moderator), Boston University Medical Center; ARRS immediate past president Norman J. Beauchamp, Jr., University of Washington;

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