Organized Stroke Care
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The firm scientific basis for organized stroke care is relatively short, little more than 10 years. During the past year, existing knowledge has not only been consolidated but also extended in several areas with important implications on clinical practice. Three areas can be identified: (1) organization of prehospital services, (2) hospital treatment, and (3) follow-up care. Progress has been highly variable among the 3 areas and around the world based on local practices and differences in health care systems and resources. Overall, more progress is evident in hospital care, primarily creation and promotion of “stroke units”.

Recent studies have supported the effectiveness of in-hospital organized (stroke unit) care, and that management in a stroke rehabilitation unit confers survival benefits 10 years after stroke, probably because long-term survival is related to early reduction in disability. An estimate based on data from the North East Melbourne Stroke Incidence Study showed that although tPA was the most potent intervention, management in stroke units had the greatest population benefit.

Stroke unit care as provided in routine clinical practice in England, Wales, and Northern Ireland was associated with reduced case fatality by ~25%, which is in line with previously reported data from the Swedish national registry of stroke care (Riks-Stroke), and with the figure obtained from systematic analysis of stroke unit trial data. In a Japanese observational study, admission to an acute stroke unit during weekends and holidays, when level of multidisciplinary care and rehabilitation efforts was reduced, was associated with more unfavourable outcomes.

Organization of prehospital care has received less attention but is recognized as an important component. Included in this domain would be protocols and methods for action by “first responders” and ultimately field triage of suspected stroke to determine the optimal hospital destination.

Both Canada and the US have articulated concepts of integrated “Stroke Systems of Care” that include all 3 components listed above, but these have not been fully implemented. Testing the effectiveness and cost/benefit of such systems will also be a challenge.

In the US particularly, the ASA Systems Plan points out that “... the current fragmented approach to stroke care in most regions of the United States provides inadequate linkages and coordination among the fundamental components of stroke care”. Although an overarching plan for correcting this problem is a welcome concept, its design and implementation will be a daunting challenge.

At the present time the hospital component of an overall “Stroke System of Care” is being better developed in the US. The Brain Attack Coalition has articulated characteristics of both Primary and Comprehensive Stroke Centers. The concept of a center goes beyond a “stroke unit” to include processes that start at the door with rapid evaluation of the patient for rPA-use and extend to interaction with the local community for stroke education. The American Stroke Association in partnership with the Joint Commission for Accreditation of Health Care Organizations (JCAHO) has developed a certification program for Primary Stroke Centers (PCS), and this program has been highly subscribed and has grown rapidly. At present there are 150 certified PCS’s. Whether a comparable program for Comprehensive Centers will be developed is under consideration. At least 3 states have developed their own certification for Stroke Centers. No data are yet available on the impact or effectiveness of these programs.

Two programs in the US have been developed which focus on poststroke care. UCLA has developed and piloted a program called Stroke PROTECT, which systematically implements 8 evidence-based medication/behavioral interventions in the hospital. High 90-day adherence rates have been reported from this program. The American Stroke Association has developed a program called “Get with the Guidelines,” which provides implementation and tracking tools to hospitals aimed at better secondary prevention practices, and ultimately outcomes, after stroke.

Integrating various components (eg, Primary and Comprehensive Centers, outpatient programs, etc) into a coordinated “system” may be more challenging in the US, with its fragmented system of care, than in countries with a single payer system. This difficult work, which will encounter economic and political obstacles, is just beginning.

Canada has been active in the organization of stroke care for several years. A Stroke Strategy for Canada was published in 2003 based on work in the Ontario province that created key partnerships to address stroke care and help insure that knowledge and research advances were more widely implemented to reduce the burden of stroke. The Canadian Stroke Consortium is a network of investigators/institutions that...
carry out clinical trials in stroke, whereas the Canadian Stroke Network is a collaboration of 24 universities with government, nonprofit and industry with the purpose of reducing individual and societal burden of stroke. The Heart and Stroke Foundation of Canada has been an active partner in these efforts. Data on the long-term impact of these efforts is expected in the future.

**Stroke Unit Care is Not Portable**
Importantly, recent randomized trials1,2,17 and a systematic review18 clearly show that mobile stroke teams, although intuitively appealing, cannot replace care at a geographically discrete stroke unit. Compared with care in general wards, stroke team care improved some aspects of the process of care (also shown in an Australian study19), but clinical outcomes were similar. Compared with a comprehensive stroke unit, stroke team patients were significantly less likely to survive, return home or regain independence. Most aspects of the process of care were also poorer than in the stroke unit. Consequently, an adequately resources stroke unit should be the mainstay of any hospital service.

**Extending Hospital-Based Stroke Unit Care: Early Supported Discharge**
Traditionally, stroke patients have received a substantial part of their rehabilitation in hospital. Services have now been developed at several centers which offer patients in hospital early discharge with rehabilitation at home given or coordinated by a multidisciplinary team (early supported discharge [ESD]). A recent meta-analysis based on individual patients data from 11 trials (1597 patients)20 show that appropriately resourced ESD services provided for a selected group of patients can reduce long-term dependence and admission to institutional care as well as reducing the length of hospital stay by \(\approx 8\) days.21 Patients suitable for ESD tend to be a selected elderly group with mild-moderate disability. No adverse impact was observed on the mood or subjective health status of patients or carers.

ESD appears as a most useful component in an integral stroke-service, but the structure is probably more complex to establish than in-hospital stroke services, partly depends on other resources available, and is certainly a challenge to implement in clinical practice. A long-term follow-up study from one of the ESD trials showed beneficial effect on extended activities in daily living 5 years after stroke.22

**Extending Hospital-Based Stroke Care: Using Technology to Deliver Care to Rural Areas**
Using telemedicine to provide urgent stroke care, specifically to expand the use of tPA, is being used in the US23 and Europe24,25 with some success. Widespread application of low-cost internet–based systems might extend the use of tPA beyond large urban systems, but overall cost and safety will be important issues.

**Is Organized Stroke Care Cost-Effective?**
Further data on cost-effectiveness of organized stroke services have accrued during the past year. Kalra et al1 demonstrated that stroke unit was a more cost-effective intervention than either the stroke team or home care, and a systematic review26 found “some” evidence that the mean total cost per patient of rehabilitation in a stroke unit was comparable to care provided in another hospital ward. For ESD services there was “moderate” evidence that such services provided care at modestly lower total costs than usual care for stroke patients with mild to moderate disability,26 well in line with findings most recently reported from the Trondheim ESD trial.27 The systematic review identified several methodological problems in analyzing the economic evidence. However, there is no support that organized stroke care is less cost-effective than other alternatives of care.

**Organized Stroke Care Remains Underused: Time to Act**
Organization of stroke services plays a key role in the provision of effective therapies and in improving the overall outcome after stroke. Despite strong scientific evidence and guidelines support, organized stroke care is still far from implemented, and inequalities in care continue to exist, even locally.28 By country, reported proportion of patients treated in stroke units range from 23% in Australia, 31% in Canada, 50% in the UK, to \(\approx 80\)% in the Scandinavian countries.29 In Japan, \(<3\)% of acute hospitals have a dedicated stroke unit.30 Importantly, organized stroke care is virtually nonexistent in large parts of the world. A recent World Health Organization publication31 reports that 80% of all chronic diseases, most commonly heart disease and stroke, occur in low and middle income countries, which face a rapid upsurge in vascular risk factors, especially in urban settings. These risk levels foretell a devastating burden of stroke in the near future. Stroke risk factors and patterns in low and middle income countries are largely similar to other regions, as shown by recent epidemiological studies from Africa and South America.32,33 Introduction of organized stroke care, adapted to local practice, is urgently needed also in these areas.

**References**


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