

Navigating the Poststroke Continuum of Care

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Stroke is a significant source of death and disability worldwide. The increasing prevalence of stroke survivors forecasts substantial socioeconomic burden and a greater need for comprehensive poststroke rehabilitative services. Despite the rapidly rising burden of cerebrovascular disease, particularly in developing countries, there has been limited implementation of multidisciplinary stroke units, a proven care modality in reducing patient mortality and improving functional outcomes. Transitioning from these acute inpatient settings to in- and outpatient rehabilitation or long-term care environments has consistently been identified as an obstacle to quality stroke rehabilitation. To address the barriers preventing the seamless delivery of poststroke care, an evaluation of patient–caregiver perspectives, treatment challenges, and system-wide shortcomings is presented. The fragmentation of the current poststroke chain of care could benefit from the introduction of case managers or “navigators,” discharge planning, electronic medical records, and evidence-based neurorehabilitation guidelines. By aiding in successful care transitions, these proposed efforts could advance post-acute stroke patients along the care continuum to achieve their rehabilitative goals. **Key Words:** Acute stroke therapy—integrated stroke care delivery—long-term neurorehabilitation—stroke rehabilitation.

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Stroke has emerged as a major global health problem—in terms of death and major disability—that will only continue to increase over the next 20 years as the population ages.^{1,2} Of the 16 million people worldwide who suffer a first-time stroke each year, more than 10 million survive.³ Because of this trend, the prevalence of stroke survivors is estimated to reach 77 million by the year 2030.³ Survi-

vors can suffer from major poststroke sequelae ranging from upper motor neuron syndrome (UMNS), including spasticity, to substantial cognitive and behavioral deficits, such as depression and urinary incontinence,⁴ resulting in significant, far-reaching societal and economic burdens. The impact of stroke is quantified in disability-adjusted life-years (DALYs), where 1 DALY is 1 year of healthy life lost. Worldwide, the average number of poststroke DALYs is projected to be 53.8 million in 2015 and as high as 60.9 million by 2030.^{2,3} Stroke has a substantial impact on society, resulting from diminished workplace productivity—not only of stroke victims and survivors, but also of their caregivers, who often have their own job commitments interrupted or are forced to leave their jobs in order to provide care for a family member.⁵

Because of the high prevalence of stroke survival and its associated socioeconomic consequences, there is an immediate need to establish a comprehensive poststroke continuum of care to address the varied needs of stroke survivors, caregivers, and society at large. To identify the necessary components of this continuum, this review

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outlines the fundamentals of acute, postacute, and long-term stroke patient care and highlights the challenges that currently exist in each of these stroke treatment scenarios. Measures to address these challenges are proposed to advance efforts toward an inclusive and integrated care delivery program for stroke survivors.

Acute Stroke Care

The immediate evaluation of a stroke patient in any emergency room (ER) setting begins with the primary assessment and stabilization of the patient's airway, breathing, and circulation (ABCs).⁶ Next, a secondary assessment addresses any potential neurologic deficits or possible comorbidities related to the precipitating cerebrovascular incident.⁶

After taking an accurate history and performing a careful physical examination, ER personnel are likely to use brain imaging modalities, which have become extremely important in guiding the initial evaluation and management of acute stroke patients.^{6,7} The most commonly used diagnostic imaging strategy, non-contrast-enhanced computed tomographic (CT) scanning of the brain, is increasingly being used to detect intracranial hemorrhages or to rule out other possible causes (e.g., neoplasm) of neurologic deficits.^{6,7} However, small cortical or subcortical infarctions may not be readily visualized by CT, which has led some individual centers to opt for magnetic resonance neuroimaging (MR).⁶

Whether CT or MR is performed following acute stroke, treatment of an ischemic event with intravenous recombinant tissue plasminogen activator (t-PA) should not be delayed.⁶ For patients who meet the eligibility criteria, intravenous t-PA may be administered within 3 hours of onset of ischemic stroke. Possible adverse events associated with t-PA treatment may include bleeding complications and angioedema leading to partial airway obstruction.⁶

To promptly and efficiently deliver acute stroke treatment, multidisciplinary specialized stroke units (SUs) have been developed and have been shown to decrease mortality after a cerebrovascular event (Table 1).⁸ Patients whose care includes intensive monitoring of blood pressure, oxygen saturation, body temperature, and cardiac rhythm in a multidisciplinary SU have better functional outcomes and improved mortality compared with those treated in conventional SUs, where these variables are not consistently evaluated.⁹ In a recent example, care provided in a multidisciplinary SU in South Africa resulted in reduced inpatient mortality and increased rehabilitation referral rates, suggesting improved stroke care even in a resource-constrained setting.¹⁰ A cohort study revealed that specialized SUs in North America significantly reduced inpatient case-fatality rates and lengths of hospital stays when compared to general neurology/medical wards.¹¹ Lastly, a large multicenter observational study evaluating implementation of SUs in Australia

revealed improved outcomes for patients of all ages and among patients with indicators of poor prognosis.¹²

Despite the growing evidence showing the value of specialized SUs, relatively few acute stroke patients receive their care in a multidisciplinary setting. In North America and Europe, fewer than 40% of stroke patients are admitted to SUs.¹³ Furthermore, almost half of the stroke survivors in the United States are followed by primary care physicians—not specialists—even though neurologists are more likely to prescribe appropriate pharmacotherapy and discharge patients to inpatient rehabilitation, and have significantly lower 3-month patient mortality rates.¹⁴ Lack of interdisciplinary SU care is a problem that extends well beyond North America. According to a survey of more than 25 European countries, fewer than 10% of hospitals admitting acute stroke patients have optimal treatment facilities, and 1 out of 3 European hospitals do not meet minimum criteria to be considered an acceptable treatment facility.¹⁵ Another study evaluating SUs in Australian hospitals with top tier SUs found that, on average, 382 stroke patients were admitted per year, but the mean number of patients treated in the SU was 331, suggesting that hospitals are not using their SUs maximally.¹⁶

It is not surprising that in low- and middle-income countries, where 87% of all stroke deaths occurred in 1995,³ access to SUs is rare. Compare these findings with the status of SU care in Scandinavian countries, particularly Sweden, where more than 80% of all acute stroke patients are offered SU services, which has led to low case fatality rates and readily available access to thrombolytic therapy.^{13,17} A 2002 study of global mortality rates related to stroke estimated that Sweden had one of the lowest mortality rates worldwide—approximately 40 deaths per 100,000 people.¹⁸ The major barriers to effective stroke care in the developing world include a lack of organized health care systems to facilitate proper SU infrastructure and the relatively high cost of t-PA therapy.¹⁹ Other barriers to proper care include low community awareness of stroke symptoms, absent patient education for stroke risk factors, and the global shortage of health care workers, particularly in developing countries.^{1,19} Worldwide implementation of SU care has been hampered by these obstacles, despite the evidence supporting SUs as the most effective vehicle for reducing stroke mortality and improving patient outcomes.¹ In Argentina, only 5.7% of patients are admitted to SUs, with a significantly higher rate of admission to SUs seen at academic institutions (8.5% academic *v* 3.2% nonacademic; $P < .001$).²⁰ The limited resources available and lack of stroke care standards at nonacademic centers are reflective of an increased rate of morbidity and mortality: both the rate of risk-adjusted in-hospital pneumonia and the rate of risk-adjusted in-hospital mortality for stroke patients are significantly higher at nonacademic institutions (15.5% nonacademic *vs* 9.6% academic [$P = .003$]; 9.9% nonacademic *v* 5.5%

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