Introduction

The United States has seen the relative rate of stroke death fall by 35.8% and the actual number of stroke deaths decline by 22.8% from 2000 to 2010, primarily due to reduced stroke incidence and lower case fatality rates [1]. Despite substantial progress in acute stroke care over the last few decades, stroke continues to be the leading cause of long-term disability worldwide. The dearth of multidisciplinary neurorehabilitation centers and teams in Pakistan to address the neuroplasticity potential in the chronic phase of stroke recovery has left stroke survivors to cope with significant physical, cognitive, and emotional disability, and unable to integrate back into society.

Several trials have compared early surgical hematoma evacuation with initial conservative medical treatment in ICH patients, but have failed to show significant differences in the outcomes of these two groups [7-12]. The international multicenter STICH II trial suggested a statistically non-significant trend towards more favorable outcomes for surgery for select candidates [11]. However, this contrasted with a nationwide population-based study in the US, which advocated a highly conservative stance toward surgery for patients with non-traumatic ICH [13]. In the absence of clear guidelines and conclusive results, the decision largely rests on the physician’s expertise and understanding of individual clinical prognostication, in addition to institutional practices and patient preferences.
Stroke is undoubtedly a complex disease process, the rehabilitation of which requires considerable collaborative work by an interdisciplinary team with a holistic, comprehensive, interactive approach [14]. Certified rehabilitation counselors, neuropsychologists, rehabilitation nurses, and occupational, physical and recreational therapists are only some of the key people involved in this team [15]. There is strong evidence that organized, interdisciplinary stroke care will not only reduce mortality rates and the likelihood of institutional care and long-term disability but also may enhance recovery and increase independence [16,17].

Of the 23 centers providing physical medicine and rehabilitation in Pakistan, a majority is concentrated in armed forces hospitals, most of them without a multidisciplinary approach [18]. In fact, the very concept of a multidisciplinary approach, beyond a nurse and a physical therapist for stroke rehabilitation, surprises many.

Clinical Case

Our patient was a 72-year old right-handed gentleman, with known hypertension, NYHA functional class I, who presented to the Emergency Department with sudden onset drowsiness and slurred speech for the last 40 minutes. There was no history of trauma, or coagulopathies, and the patient was not on any anticoagulant or blood-thinning therapy. On examination, this gentleman was fully conscious with a GCS of 15, facial palsy, right-sided hemiparesis and hemisensory loss with a positive Babinski sign. The rest of the cranial nerve, cerebellar and fundoscopic examination revealed no abnormalities.

EKG showed normal sinus rhythm, with tachycardia (97 bpm). His initial blood pressure was 187/101 mmHg, which was managed pharmacologically and brought down to 170/90 mmHg with an hour. Random blood sugar at the time of presentation was measured to be 167 mg/dl.

CT brain was performed and revealed acute intraparenchymal bleed in the left putamen, with no midline shift, intraventricular hemorrhage, hydrocephalus, or extension to the internal capsular region. The volume of the hematoma was estimated, as defined by Broderick et al. [19], to be 10.9 cm³.

We decided to admit the patient to the ICU for conservative management, to be reassessed radiologically within 24 hours. However, within 10 hours of admission, his cognition declined rapidly and he became drowsy with no motor or verbal responses. MRI was performed immediately, and revealed the lesion had substantially increased to 54cm² with surrounding edema and hemorrhage extending to both lateral ventricles.

As a life-saving measure, an emergency parieto-temporal craniotomy employing the trans-Sylvian anterior insular approach was performed to evacuate the hematoma. He was successfully extubated within 24 hours of surgery. He was awake but disoriented, with no speech and only withdrawal to pain on the hemiparetic side. (GCS 8/15). His post-operative stay was significant for hypertensive episodes, which was managed pharmacologically. He also experienced significant abdominal distension despite normal potassium levels, bowel sounds, and passage of stools in the flatus tube.

Two months down the line, this social gentleman can clearly vocalize 4-5 words, comprehend commands, communicate via gestures, and demonstrates withdrawal from pain in the right upper limb. There is an element of hemineglect, and he does require assistance with his daily activities. His wife is his primary caretaker, along with a live-in nurse. Physical and occupational therapy sessions are conducted in-house twice weekly.

Discussion

The effectiveness of craniotomy in the treatment of ICH remains exceedingly controversial. Individual trials, completed and published in the English language over the past 5 decades, have failed to show a statistically significant improvement in outcomes of surgically treated ICH patients [7-12]. The benefits of mass effect reduction, blockage of neuroapathic products release from the hematoma, and prevention of prolonged interaction between the hematoma and normal tissue are countered by the neural damage incurred during the craniotomy to the hematoma and by the possible recurrence of bleeding as a result of the loss of the tamponade effect of the surrounding tissue [20].

In our case, craniotomy via the trans-Sylvian anterior insular approach was performed as a life-saving measure. This approach, first described in 1972 by Suzuki & Sato [21] for evacuation of hypertensive basal ganglia hematomas, was chosen for its suitable angle, shorter course through neural tissue to limit damage and maximize reduction of the inflammatory triggers [22].

Other less invasive surgical techniques may be more beneficial, including endoscopic-assisted ICH evacuation. Currently underway is the National Institutes of Neurological Disorders and Stroke funded trial - MISTIE (Minimally Invasive Surgery Thrombolysis Plus Recombinant Tissue-type Plasminogen Activator for ICH Evacuation), and its surgical arm ICES (Intraoperative Computed Tomography-guided Endoscopic Surgery) for ICH [23]. The minimal access techniques investigated, in addition to other studies employing the stereotactic delivery of tissue plasminogen activator (tPA) to dissolve clots and tPA to dissolve intraventricular hemorrhages [23-25] might be more beneficial for deep clots, intraventricular hemorrhage, and specific subsets of patients with superficial ICH.

Management of blood pressure

Elevated blood pressure is common after ICH, even without prior history of hypertension, and is associated with expansion of the hematoma and a poor outcome. Our patient experienced several hypertensive episodes during his post-operative hospital stay, which were mediated pharmacologically. Usually secondary to uncontrolled chronic hypertension and a nonspecific response to stress, it can also be a protective response (referred to as
the Cushing-Kocher response) to preserve cerebral perfusion. Considerable controversy surrounds the initial treatment of blood pressure after an intracerebral hemorrhage, reflecting the argument of cerebral autoregulation that has adapted to blood pressures than normal versus an elevated intracranial pressure compromising the cerebral perfusion pressure [20]. The notable INTERACT2 trial, investigating early intensive blood pressure lowering to <140mmHg within one hour, as compared to the standard guideline recommended treatment of <180mmHg, have not shown a significant reduction in the rate of the primary outcome of death or major disability, but suggests improvement of functional outcomes [26]. A detailed discussion is beyond the scope of this article.

**Anatomical localization**

Not many studies have investigated putaminal hemorrhage as a distinct localized stroke entity to identify factors predicting recovery and outcomes. Even though the high correlation between the outcome and the volume of the hematoma has been highlighted by numerous studies, we believe the effects of extension of the hemorrhage to involve adjacent structures such as the internal capsule, thalamus, and upper brainstem are more reliable than the size of the hemorrhage alone [27].

**Neuro rehabilitation**

With the dearth of dedicated neurorehabilitation centers employing an interdisciplinary team of rehabilitation counselors, neuropsychologists, nurses, and occupational, physical and recreational therapists, the greatest challenge we faced was in the rehabilitation of our patient. There remains an unmet need to address and educate healthcare providers of the neuroplasticity, and thus recovery, potential in the later and more chronic phases of stroke care. This has left stroke survivors to cope with significant physical, cognitive, and emotional disability, by themselves and unable to integrate back into functioning society.

There are a total of 38 certified rehabilitation specialists in Pakistan, most of which are concentrated in armed forces hospitals catering to veterans of war and to victims of natural disasters. Physiotherapy departments are established in nearly all the major hospitals of the country but are managed mostly by orthopedic surgeons, rheumatologists, or physical therapists [18]. Independent nurses and therapists may be easily available in an urban metropolitan city such as Karachi, but provide their services at what seems a hefty cost to the common man (with a GNI per capita of US $1,360 in 2013) [28].

**Conclusion**

ICH is a devastating illness for which preliminary data from surgical trials indicate that surgery may be helpful. However, this premise remains unproven. Ongoing trials, including STICH II, MISTIE, and ICES, are attempting to determine the potential for surgical efficacy for limited craniotomy and image-guided minimally invasive surgical removal using thrombolysis or endoscopic evacuation. Preliminary results seem promising.

The rates of stroke morbidity and disability are alarming, and their impact on an individual and economic level devastating. In Pakistan, where incidence is on the rise, several campaigns have addressed the need for preventative measures, and have raised awareness of the importance of timely treatment. However, the significant need of rehabilitation to integrate large numbers of stroke survivors into functioning society remains largely underrated and tremendously unmet.

**References**


