Minimally Invasive Hemorrhage Evacuation

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With new therapies and interventions in the ischemic stroke realm leading to improved outcomes, attention is turning to treatment of hemorrhagic stroke therapies that strive to improve both morbidity and mortality. The thought that “time is brain” likely also applies to damage to neural structures neighboring hemorrhagic clots and efforts to create a method for hemorrhagic clot evacuation while minimizing damage to still intact brain tissue is actively being investigated.

Open surgical evacuation, when tested against initial medical management only, was shown to improve outcomes in traumatic intracerebral hemorrhage (ICH) but had a small outcome advantage in spontaneous lobar hemorrhage and no advantage to the larger group of spontaneous ICH in the STITCH, STICH II, and STICH trials, respectively, performed in the United Kingdom.1-3 Although the reason for a lack of significant difference in open surgical evacuation compared with medically managed therapy is not known definitively, it is felt that perhaps the damage to the brain during surgical evacuation or incomplete evacuation may contribute to the lack of significant improvement from medically managed patients.

New treatment techniques are now being explored to improve the access to the clot while minimizing the effect on the intervening brain tissue. These new, minimally invasive techniques range from image-guided placement of brain catheters that use chemical thrombolysis to stereotactic placement of brain tubular access devices that allow for minimal disruption of tissue while being able to access the clot under visualization.

These minimally invasive techniques have shown some positive results with the outcomes of the Minimally Invasive Surgery and rtTPA for Intracerebral Hemorrhage Evacuation (MISTIE) trials I and II demonstrating that the intraparenchymal clot can be safely broken down and removed via catheter evacuation with the use of recombinant tissue-type plasminogen activator (rt-TPA).4 The Clot Lysis: Evaluating Accelerated Resolution of Intraventricular Hemorrhage (CLEAR) trials demonstrate that the intraventricular hemorrhage (IVH) can be removed faster than physiologic breakdown of the hemorrhage using rt-TPA without harm to the patient.5 Both techniques are currently being evaluated in stage III clinical trials to see if the outcomes show improvements in morbidity and mortality using the modified Rankin Scale score as the primary end point.

The use of larger-caliber minimal access devices placed via stereotactic imaging for direct breakdown and aspiration of clot are also currently being studied. Recently, the Penumbra Apollo system (Penumbra Inc., Alameda, California, USA) results from a multicenter study demonstrated that ICH and IVH evacuation could be achieved using their stereotactically placed minimal access device.6 The NICO Brainpath system (NICO Corporation, Indianapolis, Indiana, USA), which is a tubular retraction system that is placed using a preplanned trans-sulcal stereonavigation trajectory (Figure 1), is also showing favorable results with the Minimally invasive Subcortical Parafascicular Access for Clot Evacuation (MiSPACE) studies that demonstrate successful evacuation of the hemorrhage and is moving on toward the safety and feasibility stages of evaluation in multicenter trials.7

With numerous multi-institutional studies under way, this is an exciting time for understanding the pathologic implications of ICH, which in itself has been a relatively neglected counterpart of ischemic stroke. The neurosurgical community may be getting new useful and proven tools to help improve the quality and length of their patients’ lives after ICH and IVH.
Figure 1. Brainpath intracerebral hemorrhage evacuation. (A) Insertion of Nico Brainpath tube using Brainlab intraoperative neuronavigation system trajectory. (B) Egress of hematoma after removal of tunneling inner cannula. (C) Preoperative axial computed tomography (CT) image of intracerebral hemorrhage. (D) Postoperative axial CT image demonstrating complete evacuation of hemorrhage.
REFERENCES


