INVITED EDITORIAL COMMENTARY

Invited Editorial Commentary: More Than One Way to Treat the Mass Effect

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Unproven concepts about the value of decompressive craniectomy (DC) for intracerebral hemorrhage (ICH) may be arising from its use with large ischemic stroke [1, 2]. Ye et al. [3] present a retrospective study comparing endoscopic surgical removal of clot without decompression to DC with endoscopic clot evacuation in patients with large deep ICH. The authors conclude that endoscopic hematoma evacuation was safe and effective treatment for mass effect for those patients. We think how mass effect is treated deserves further investigation.

Endoscopic evacuation [4–8] and DC [9] are both familiar approaches for neurosurgeons, but the combination is novel. The role of mass effect in creating tissue damage during ICH is not clear, and the consequences of mass effect with or without surgical relief on long-term outcome have not been established. Theoretically for ICH, DC limits the cranial vault component of mass effect without injury to brain tissue, but it does not address the distortion of normal tissue or the toxic/inflammatory consequences of blood in the tissue. Conversely, endoscopy addresses these tissue injuries but carries with it the problem of disrupting the tissues to remove the blood and restore brain anatomy. In this study, the authors have reported 49 cases of endoscopic evacuation without DC and 63 with DC, which is a good population to begin an assessment of safety. Recent reports suggest reducing the clot to a safe size, perhaps 30 mL [10], may be as effective in preventing death as eliminating all hematoma. Perhaps such a reduction is sufficient to treat mass effect.

This observation has not been tested for any technique other than the MISTIE technique [11]. The way in which this reduction in mass effect could be related to benefit is not well understood. Although reduction in mass may be beneficial in this series and in trial data, safety is also a consideration. The more mechanically complicated the operation, the greater the likelihood of causing secondary injury. The authors' report suggests that from the perspective of mortality, mass effect can be treated more than one way safely and possibly with fewer complications than with DC.

The study's limitations restrict its generalizability for routine clinical practice, particularly the before/after comparison design. Group A (endoscopic evacuation alone) was selected from 2014 to 2017 and matched to a historical Group B, patients treated with DC plus evacuation from 2009 to 2014. The entire study spanned 8½ years, opening potential for multiple uncontrollable variations in the type and amount of treatment rendered. Also, the selection method prevented randomization and blinding, which would protect against poor distributions of severity-related covariate factors between the two groups. Thus, until we have a large multisite trial of surgery to remove the blood clot and treat ICH and mass effect, surgery cannot be recommended as a standard. The small sample ($N=112$) is disappointing, especially considering the study originated in China, where the majority of ICH worldwide occurs [12]. Finally, lumbar drainage of cerebral spinal fluid, while potentially beneficial, is not standard, nor are the harms understood [13].

Further research in this area appears to be attracting more attention, as debate about mass effect is increasing [14, 15]. One of the main purposes of surgery is to terminate the acute mass effect. Meta-analysis of surgery suggests a primary surgical treatment may help [8, 11, 16, 17]. Understanding the relationship between surgical technique, relieving mass effect, and outcome will

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provide more direction to future trials. China, with the largest population and high incidence of ICH [18], has utilized multiple relatively standard surgical treatment methods in the last decade, including DC, craniotomy, endoscopic evacuation, and minimally invasive drainage [5–7, 19]. Analyzing this across the whole nation could be helpful. For now, neurologists and neurosurgeons worldwide seem to have general agreement on medical management for ICH, while surgery is not making progress quickly enough [16]. Researchers should concentrate surgical trial efforts on specific subgroups of patients where greatest effect size exists [20]. We need carefully designed randomized trials of standard techniques performed across many sites if we are going to make progress. Otherwise, the debate will continue without the benefit of sufficient data.

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Compliance with Ethical Standards

Conflict of interest

Dr. Hanley reports personal fees from BrainScope, personal fees from Neurotrope, personal fees from Portola Pharmaceuticals, personal fees from Op2Lysis, and grants from NIH, outside the submitted work. Dr. Li declares that he has no conflicts of interest.

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