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EDITORIAL

Treatment of Intracerebral Hemorrhage—Is the Glass Half Full or Half Empty?

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It is traditional for all intracerebral hemorrhage (ICH) articles to begin with the bleak statement that we have no treatment for this devastating disease. That is only partially true. While there are no specific treatments for ICH, most ICHs are small [1] and well cared for in neurointensive care units [2]. This excellent special issue of *Translational Stroke Research* also fills one with optimism for the many therapies just over the horizon.

ICH is a disease whose pathophysiology likely involves the consequences of mass effect, edema, blood's neuronal toxicity, and inflammation just to name a few. It may be naive to think that a single agent or a single procedure can remedy this wide gamut of injury mechanisms. While we used to speak of the "cocktail" approach to ischemic stroke, we have usually refrained from such terms with respect to ICH therapy. However, such combined approaches may not only be additive but synergistic in their effect. Further, combined therapies may be necessary to surpass a certain threshold to demonstrate clinical efficacy. As an example, a large ICH may just be too big for the effects of an iron-lowering drug, and a combined surgical and medical approach would be needed for maximal benefit. Alternatively, surgery for a small deep ICH may cause more problems by coursing through the normal healthy brain on the way to the ICH, and a pure medical approach is likely optimal. Combining medical treatments, for example, hemostasis, iron reduction, and inflammation prevention, makes theoretical sense as well. A true therapeutic approach must therefore be logical and directed to the specific clinical situation. Just like one size may not fit all, one therapy may not work in a broad ICH pool. An illustration of this is hemostatic therapy for ICH. An unselected approach failed to pass the risk/benefit test [3], but ongoing studies selecting patients with documented active bleeding and low risk of vascular ischemia may be the way to go [4].

As this issue goes to press, we are poised to hear the results of several pivotal clinical trials that will directly impact the care of ICH patients. It is logical to believe that removing the clot can curtail many of the ICH pathologic mechanisms mentioned above. However, surgical trials in the past have been disappointing. Newer, more refined studies are becoming available. Newer surgical approaches include STICH II (http://research.ncl.ac.uk/stich/). This study is looking at surgical removal of hematomas that are within 1 cm from the brain surface. The MISTIE trials (http://braininjuryoutcomes.com/mistie-about) are using minimally invasive techniques combined with thrombolysis to remove brain hematoma.

Medical therapies result from the basic and translational laboratory efforts examining the effects of the toxic components of blood released among the neurons and glia following an ICH and the detrimental effects of cerebral edema. Medical treatment of ICH includes an exciting new study of iron chelation using deferoxamine after the report of a successful Phase I study [5]. We will soon also know more about blood pressure control in acute ICH after the INTERACT II trial (http://www.strokecenter.org/trials/clinicalstudies/751/description) and ATACH II release results (http://www.atach-2.com/).

While this special issue considers many other potential direct therapies for ICH, there is no reason to wait in our aggressive treatment of ICH patients. Several studies have now shown that we may give up too early on ICH patients [6], and more investigation is under way to determine if aggressive treatment reduces mortality and improves functional outcome.

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So it seems clear that the glass is *at least* half full, and while new therapies are desperately needed, what we know now and will learn about in the next couple of years go a long way to helping patients with ICH.

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