I am become misery, the spoiler of lives? I think NOT

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I do not intend to be pretentious, nor to belittle the much larger issues Robert Oppenheimer raised, but my title paraphrases him when he said, recalling the Bhagavad Gita, “I am become death … the destroyer of worlds,” referring to his role in the successful construction of the atomic bomb. This concept bears on one of the difficult questions neurosurgeons must ask when faced with the patient with a large middle cerebral artery (MCA) territory infarction and impending herniation. With medical treatment, death is rapid in up to 80% of patients. Decompressive craniectomy, however, significantly reduces this to perhaps 30%, but at what cost? Are we creating misery for our patients and their families? Neurosurgeons, patients and their families, not to mention society as a whole from the utilitarian perspective, would benefit from knowing the answer to this question in advance of embarking on surgery.

In this issue of the Journal of Neurosurgery, Rahme et al. have done a tremendous amount of work reviewing the literature on clinical and quality of life (QOL) outcome measures after decompressive craniectomy for supratentorial ischemic stroke. When you consider all the efforts we make to avoid dying, and our fears about it, it may not be surprising that the evidence from this review suggests that most people prefer to do what they can to avoid it, even if it means surviving with disability.

Trepanation may be one of the oldest neurosurgical procedures, but only recently have clinical trials been done that provide high-quality medical evidence as to its efficacy or lack thereof. According to Clower and Finger, in the mid-19th century, Ephraim George Squier, an American archeologist, obtained an incomplete skull with a strange hole in it. The skull was from an Inca cemetery in the Valley of Yucay. It was examined in 1865 by physicians who concluded that the hole had been made purposely by human hands before the person died. Numerous skulls with “surgical” openings from pre-Inca and Inca times (from circa 4000 BCE) as well as similar ones from France and Europe have since been discovered. Why trepanation was done is the subject of various theories, although the most popular are that it was to release demons that caused infantile convulsions or in patients with headaches and seizures caused by skull fractures. According to Kakar et al., in more modern times, Kocher and, later, Cushing used decompressive craniectomy for treatment of increased intracranial pressure, first in patients with brain tumors and then for head injuries and vascular malformations. The use of external decompression became less common with advances in imaging and surgical and medical management that allowed surgeons to remove space-occupying lesions and replace the bone in a single operation. This, combined with recognition of the sometimes dismal condition of survivors of decompressive procedures, led to much-reduced use and to questions about the indications for decompressive craniectomy.

External decompressive procedures have been performed for decades for ischemic stroke, but recent clinical trials have led to a resurgence in its use. The functional outcomes are probably better now than in the past because of evidence that decompressing early, before there are prolonged episodes of decreased cerebral perfusion and brain tissue death, and performing a large decompression that allows the brain to expand out and not be further damaged at the bony edges of the craniectomy, are important. Also there have been improvements in rehabilitation and support devices for survivors.

Several clinical trials have been conducted, and they have provided high-level evidence on decompressive craniectomy for ischemic stroke. Vahedi et al. summarized the 3 published randomized trials (“DECIMAL,” “DESTINY,” and “HAMLET”). The key inclusion criteria were an age between 18 and 60 years, substantial neurological deficit (National Institutes of Health Stroke Scale score of > 15, which would generally be a patient with severe hemiparesis or hemiplegia and the associated findings of a large MCA infarction), decreased level of consciousness, and infarction involving > 50% of the MCA territory or > 145 cm³ on diffusion-weighted MRI studies. The surgery was to be performed within 48 hours of stroke onset. Patients were randomized to decompressive craniectomy or best medical care. Among 93 patients, 51 underwent surgery. Surgery was associated with significant reductions in death (29% with surgery compared to 78% with medi-
cal care), modified Rankin Scale score (mRS) > 4 (24% compared to 75%), and mRS Score > 3 (ambulatory; 21% compared to 43%). All of these differences were highly statistically significant. There is no question that decompressive craniectomy for this indication saves lives. The controversy is clinical significance and QOL of the survivors. One argument has been made that in many stroke trials, the cutoff point in the mRS score has been between 3 and 4, and that one should consider not only the effect of the treatment on numbers of patients who achieve a mRS score of 0–3, but also whether the treatment increases the number of severely disabled survivors (mRS Score 4–5). An mRS score of 4 is moderately severe disability (unable to walk without assistance and unable to attend to own bodily needs without assistance), and an mRS score of 5 is severe disability (bedridden, incontinent, and requiring constant nursing care and attention). Analysis of the 3 pooled trials shows that decompressive craniectomy increased the number of patients with an mRS score of 4 from 1 to 16. There was no difference in the number of patients with an mRS score of 5 (2 in each group).

What do the findings of Rahme et al. tell us about the problem that decompressive craniectomy reduces death but increases the number of patients who need assistance to walk and attend to their own bodily needs? The papers these authors reviewed included 382 patients with a mean age of 50 years. Only 87 (25%) had left hemisphere decompressions. The mean time to surgery was 44 hours, and 39% of those for whom information was available had signs of transtentorial herniation. Thus, in relation to the clinical trials, these patients were similar to those in the randomized trials. Of the 382 patients there were 268 survivors (70%), although QOL, satisfaction, and information on depression were available in only subsets of these patients, at most 192 (72%). The mRS score was 5 in 11% of patients. Depression was common: 56% of patients were depressed and 25% severely so. Satisfaction, usually determined by asking the patient and/or caregiver if they would consent to the procedure again, was high, with 77% of those satisfied with their decision to have the surgery.

The findings were similar among the various papers and are also in keeping with other recent studies. Kip-kuth et al. asked 28 patients or their caregivers 6 and 12 months after they underwent decompressive craniectomy for ischemic stroke if they would consent to the procedure again, considering that the alternative might be death. They reported that 23 (82%) of 28 patients would and 5 would not. Of those 5, 2 were dead and 3 had an mRS score of 5. Indeed, all of the patients who were mRS Score 5 would not consent again, whereas all patients who were mRS Score 4 or better indicated that they would. There was no way to predict this response from the characteristics of the patients before they underwent the surgery. With this in mind, first it would be interesting to look at the data and determine the QOL measures by mRS score to determine if poor QOL, more depression, and not agreeing to consent are associated with a poor mRS score. Second, can the authors examine the data to determine if there are baseline factors like age, hemisphere involved, or involvement of additional vascular territories that can predict that the outcome will be an mRS score of 5 or 6 (death)? They indicate that many of the papers do not include sufficient information to determine this, but could they contact the various authors and collaboratively compile the actual patient data?

Anecdotally, the findings are consistent with my impression that if patients recover the ability to walk, even with a cane or walker, then they usually agree that they would undergo the procedure again. Although it may not be borne out in the data, I also have the impression that the side of decompression is not that important, but that age and the appearance of the brain on CT or MRI studies are. Patients who are functionally older or who have brain atrophy or white matter disease on imaging may not do well. Some studies have suggested older age and brain atrophy adversely affect the outcome, whereas the hemisphere involved does not. Timing is probably important as well, with the suggestion that undergoing surgery sooner is better than later.

Some limitations of this analysis need to be mentioned. Only the English-language literature was reviewed. Thus, the findings may only be relevant to cultures providing data in this language. There are numerous guidelines for conducting meta-analyses and systematic reviews of the literature that were not strictly adhered to here. The authors included patients from randomized trials, prospective cohort studies, and retrospective studies. I think this is acceptable here, since the goal is to assess QOL in survivors, not efficacy of treatment. A concern is that the QOL outcomes should be assessed independently by unbiased observers. It is well known that assessment of outcomes by treating physicians may be more favorable than by independent assessors. There were 22 (6%) of 382 patients lost to follow-up, or potentially 8% of the survivors. The number of patients with data for some of the outcomes also is a small subset of all patients, so there must be quite a bit of uncertainty in the data. For the QOL measures, there are data on 192 (72%) of the 267 survivors. Applying a worst-case scenario could substantially alter the findings. The authors note this, and point out that the findings are biased toward a best-case scenario.

Another important point is raised by the authors in their discussion: QOL includes physical and psychosocial components. Each is influenced by premorbid lifestyle, personality, family and social support, and then by the effects of the illness. In effect, this is a 2 × 2 table in its simplest form. Patients who are unhappy and dysthymic before their stroke may be destined to be more so afterward, whereas people who are always positive and who take everything in stride may cope much better. And every surgeon has seen the value of a supportive family. But accessing these factors within a few hours before making a decision to perform decompressive craniectomy may be impossible, and indeed it may be inappropriate, given the lack of solid evidence to back up what I have suggested. Finally, some aspects of the qualitative outcome measures, such as depression, are treatable to some extent. Furthermore, medical advances in treatment for depression, posttraumatic stress disorder, and such conditions that negatively impact QOL continue to be made.

In summary, the evidence suggests that decompress-
sive craniectomy for selected patients with MCA infarction is lifesaving and results in better outcome among the survivors. Even though surgery is associated with an increase in the number of severely disabled survivors, most of these patients state that they would opt to have the surgery again.

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Disclosure

The author reports no conflict of interest.

References


Response

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This life is worth living… since it is what we make it.

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We would like to thank Dr. Macdonald for this remarkably thoughtful and insightful editorial. We would also like to express our appreciation for the support he lends to our finding that decompressive hemicraniectomy (DH) is indeed a beneficial procedure for patients with malignant MCA territory infarction, despite the significant physical disability that may ensue from such devastating strokes.

As Dr. Macdonald points out, our study is far from being methodologically perfect, and its weaknesses and limitations were clearly stated in the discussion. Nevertheless, we believe it constitutes the best possible summary of patient-centered outcome data published to date. For a better understanding of the impact of physical disability on patients’ well-being, it would have been desirable to measure correlations between functional (mRS score, Barthel Index) and patient-centered (QOL, depression, satisfaction) outcomes. Even more interesting would have been to study the prognostic value of preoperative variables such as patient age, involvement of additional vascular territories, and side of affected hemisphere. Unfortunately, for most studies, individual patient data were not reported, thus making it impossible to test such correlations.

Could we have contacted the various authors and, through a collaborative effort, compiled a large multiinstitutional database? Probably yes. But would this extremely challenging and time-consuming endeavor have helped us overcome the more critical pitfalls of our analysis—namely, the retrospective and uncontrolled nature of most studies; their inherent selection and publication biases; and the heterogeneity in study design, patient eligibility criteria, timing of surgery, and method of outcome assessment among various papers? Definitely not. Instead, we believe that outcome data derived from a few well-designed prospective studies with relatively similar methodology and inclusion/exclusion criteria, such as the DECIMAL,11 DE ST I N Y6 and HAMLET3 trials, would carry much more scientific weight. We thus look forward to patient-centered outcome data from the European trials.

Although our analysis was limited to papers written in English, only 4 studies originated from centers in the US, whereas the majority (12 of 16) were conducted in non-English-speaking countries, including 11 from Europe (Germany, 6; France, 2; Netherlands, 1; Sweden, 1; Spain, 1) and 1 from India. Consequently, it is expected that our findings would remain valid across various different societies and cultures.

We agree with Dr. Macdonald that patient age and timing of surgery are more important than the side of stroke in determining outcome. That patients older than 60 years generally have worse functional recoveries than younger ones has been documented by a few papers1,4 and constitutes the main research question in an ongoing randomized controlled trial.3 Likewise, there is some inconclusive evidence from experimental and clinical studies to suggest that early surgery, performed before signs of herniation develop, may be associated with a smaller infarct size and a better functional outcome.3,10 We do not consider patients with dominant-side infarction to be poor candidates for decompressive surgery. In fact, studies have shown that the functional outcome and QOL tend to be comparable between patients with dominant- and those with nondominant-hemisphere infarctions.11,12 It may be that, by interfering with their ability to recognize their deficits and participate in physical therapy, hemineglect can be as detrimental to patients as aphasia. Furthermore, a significant improvement of aphasic symptoms occurs in the majority of patients with dominant-hemisphere infarction.7

Similarly to Dr. Macdonald and to Kiphuth et al.,8 we have observed that functional outcome is a key factor in determining patient satisfaction and retrospective consent to DH. However, other factors also affect the way patients perceive their outcome, including their premorbid
personality and lifestyle, their cultural background, the presence or absence of a strong family and social support, and the presence or absence of poststroke depression. In a small-scale, single-institution study of 14 patients, the first author (R.R.) found that only 1 of 8 interviewed survivors would not retrospectively give consent for DH. That patient was a previously highly functional and professionally successful young woman (45 years old) with very little family support, who remained significantly disabled after her stroke (mRS Score 4) and was still institutionalized at her 3-year follow-up.

Quoting the American physician, psychologist, and philosopher William James (1842–1910), the epigraph of this letter seems to reflect the opinion of many survivors of malignant MCA infarction and DH. However, it should be remembered that whether a specific patient will ultimately regret having undergone DH and survived remains difficult to predict preoperatively. What turns out to be a perfectly acceptable QOL for one patient may constitute a miserable life that is worse than death for another. For this reason, when discussing DH, patients and families should be approached with extreme honesty, objectivity, and humility, while every effort is made not to influence their decision. Statements such as “If it was me, I would have chosen…” should be strictly avoided. Instead, it should be made clear that DH will help most patients survive their acute stroke, that most survivors will have significant permanent disability and may become dependent on others in their daily activities, but, most important, that the vast majority of survivors end up accepting their new life and realizing that, after all, it’s still worth living.

“This is not the life I enjoyed prior to my stroke. Nor is it how I envisioned spending my fifties. However, it is still a life worth living,” has said David R. Larach, M.D., a survivor of left malignant MCA infarction and DH.

References