

EDITORIALS



Hemicraniectomy — To Halve or Halve Not

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A large ischemic stroke that is starting to swell is one of the most alarming situations faced by neurologists and neurosurgeons. The problem progresses relentlessly, usually ending in death. This type of ischemic brain swelling has been attributed to edema, but it does not respond to the usual treatments, so it has been called “malignant edema,” although there is no connection to a brain tumor. About 5% of strokes result in this complication, and almost all are caused by embolic occlusion of the proximal middle cerebral artery. The patient’s condition usually deteriorates on the third to fifth day after the stroke, with drowsiness followed by coma and pupillary enlargement. Imaging studies show an expanding stroke that distorts the adjacent brain tissue.¹

Two decades ago, surgeons capitalized on observations that removing half the skull — decompressive hemicraniectomy — relieved intracranial pressure and prevented brain death in many such patients. Models of swelling caused by stroke in animals and clinical observations suggested that early craniectomy, before serious problems arose, was associated with better results than delayed surgery.² A pooled analysis of three small, randomized trials that together enrolled 93 patients showed that the procedure saved lives, and it has since been widely adopted.³ Those trials were restricted to patients who were 60 years of age or younger, in hopes of good neurologic recovery. However, most patients who have strokes are older, and there has been uncertainty about the results of decompression in that population. Several other serious concerns were left unaddressed. Foremost was the apprehension that surgery would salvage a patient’s life, only to result in severe disability. On that basis, a number of prominent neurologists warned against the surgery.

Hemicraniectomy requires the removal of a large piece of skull extending from just above the ear to the sagittal sinus and, though lifesaving, it leaves the patient with half a cranium. As the brain swelling subsides over a period of weeks, the open half of the head sags grotesquely, and brain pulsations can be seen and palpated though the skin. The severed bone is “banked” in a freezer or preserved by implanting it in the patient’s abdominal wall. Patients wear helmets to protect the brain until the bone or an acrylic skull prosthesis can be attached with the use of steel clips or wires.

In this issue of the *Journal*, Jüttler and colleagues,⁴ who pioneered with Hacke the use of hemicraniectomy to treat edema associated with stroke, report the results of a randomized trial involving patients in the age group that is typically affected by strokes. In the study by Jüttler et al., the rate of survival doubled as a result of surgery, but mortality at 6 months (70% among patients in the control group and 33% among patients in the surgery group) still attests to the dire nature of brain swelling.

The question asked by patients and families preceding hemicraniectomy — “Will I be left with substantial neurologic difficulty?” — was broadly answerable before the trial. The answer was yes, because it takes a very large stroke to cause massive brain swelling, and almost without exception, its manifestations will include hemiplegia and either aphasia (if the stroke is in the left hemisphere) or agnosia (if the stroke is in the right hemisphere). It was therefore not unexpected in this trial that 1 year after the stroke, half of surviving patients in both treatment groups continued to have a modified Rankin scale score of 4 (unable to walk without

assistance and unable to attend to own bodily needs without assistance) and an additional one third of patients in both groups had a score of 5 (bedridden, incontinent, and requiring constant nursing care and attention). These outcomes, while bracing, are about the same with or without the operation, and it can be stated that hemicraniectomy does not increase the number of disabled patients. This study also does not provide support for previous claims that surgery improves functional outcome, at least in this age group.

In many ways, hemicraniectomy tests the fortitude of patients and their families who, in the moment, must make a decision about survival. Numerical values for the likelihood of severe disability have now been provided by the trial and may be discussed with the patient or a surrogate decision maker. However, the choice must be made early and quickly, just as the brain begins to swell, and advance directives typically do not cover these specific circumstances. My experience may be unusual, but it has been interesting to observe how many patients and families take a chance on surgery, even if it means there may be a lifetime of disability. Of course, patients who decline surgery also gamble on the possibility that they will survive but be dependent on others.

This gives a glimpse into the minds of persons faced with rapid decisions that occur countless times throughout medical practice. The majority of patients in previous studies answered

affirmatively that they were satisfied with the outcome after hemicraniectomy and would have consented to the procedure again if they had it to do over,⁵⁻⁷ but so did most of the control group in this trial. People seem content to escape with their lives. Such is the inconclusive nature of statistical outcomes applied to this primal and ultimate choice.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

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1. Ropper AH, Shafran B. Brain edema after stroke: clinical syndrome and intracranial pressure. *Arch Neurol* 1984;41:26-9.
2. Doerfler A, Forsting M, Reith W, et al. Decompressive craniectomy in a rat model of "malignant" cerebral hemispheric stroke: experimental support for an aggressive therapeutic approach. *J Neurosurg* 1996;85:853-9.
3. Vahedi K, Hofmeijer J, Juettler E, et al. Early decompressive surgery in malignant infarction of the middle cerebral artery: a pooled analysis of three randomised controlled trials. *Lancet Neurol* 2007;6:215-22.
4. Jüttler E, Unterberg A, Woitzik J, et al. Hemicraniectomy in older patients with extensive middle-cerebral-artery stroke. *N Engl J Med* 2014;370:1091-100.
5. Vahedi K, Benoist L, Kurtz AJ, et al. Quality of life after decompressive craniectomy for malignant middle cerebral artery infarction. *J Neurol Neurosurg Psychiatry* 2005;76:1181-2.
6. Benezam B, Sahuquillo J, Poca MA, et al. Quality of life and neurobehavioral changes in survivors of malignant middle cerebral artery infarction. *J Neurol* 2009;256:1126-33.
7. Skoglund TS, Eriksson-Ritzén C, Sörbo A, Jensen C, Rydenhag B. Health status and life satisfaction after decompressive craniectomy for malignant middle cerebral artery infarction. *Acta Neurol Scand* 2008;117:305-10.

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Movement toward Optimization of CLL Therapy

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Improved therapeutic approaches in chronic lymphocytic leukemia (CLL) have recently attracted special attention, not only from hematologists and oncologists but also from a large segment of the medical profession, because findings in this disease can affect several other diseases. One important aspect of recent advances in CLL therapy, which has been regularly neglected by past investigators, is that the disease primarily affects the elderly population, with a median age at diagnosis of 72 years and with multiple clinically significant coexisting conditions. This neglect is unfortunate, but it is understandable

because it stems from safety concerns that an elderly patient with a coexisting condition (e.g., compromised renal function) is considered ineligible to be entered into a therapeutic research study. The result of this long-standing neglect is that whatever progress in CLL has been achieved, it has excluded the most representative and perhaps the largest population with the disease.

Goede et al.¹ introduce us to a new agent for CLL therapy in this issue of the *Journal*. An important attribute of this study is that the largest population of patients enrolled was elderly with a considerable number of coexisting conditions.