Received: 3 March 2021 | Revised: 30 March 2021 | Accepted: 1 April 2021

DOI: 10.1111/acem.14260

THE BRASS TACKS: CONCISE REVIEWS OF PUBLISHED EVIDENCE

Surgical decompression for space-occupying hemispheric infarction

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Editor: Shahriar Zehtabchi

Keywords: hemispheric infarction, neurology, stroke, surgical decompression

NNT color recommendation	Green (benefit > harm)
Summary heading	Surgical decompression improved outcome at 1 year after stroke in those with space-occupying hemispheric infarction
Benefits in NNT	1 in 5 were helped (modified Rankin scale [mRS] ≤ 3 at 1 year) 1 in 3 were helped (reduced mortality at 1 year) 1 in 9 were helped (mRS ≤ 2 at 1 year) 1 in 3 were helped (mRS ≤ 4 at 1 year)
Benefits in percentages (absolute risk reduction)	23% greater chance of mRS ≤ 3 at 1 year 42% reduction in mortality at 1 year 12% greater chance of mRS ≤ 2 at 1 year 38% greater chance of mRS ≤ 4 at 1 year
Harms in NNT (NNH)	Not reported
Harms in percentages	Not reported
Efficacy endpoints	Improved functional outcome as defined by mRS ≤ 2, ≤ 3, and ≤ 4 at 1 year Mortality at 1 year
Harm endpoints	No harm endpoints reported
Who was in the studies	488 patients with space-occupying hemispheric infarction after ischemic stroke

NARRATIVE

Ischemic stroke is associated with several significant complications. One of the most deadly is severe cerebral edema, which may occur in up to 8% of patients in the first 4 days after onset of stroke.[1-3] Earlier meta-analyses suggested surgical decompression with hemicraniectomy and duraplasty, designed to provide space for brain swelling, may improve outcomes.[4,5] However, study sample sizes were small with unclear results for subgroups based on aphasia, late presentation, and vascular territory.[6,7] The review summarized here included randomized controlled trials (RCTs) of patients with supratentorial "space-occupying hemispheric infarction" (i.e., large-territory ischemic stroke expected to develop severe cerebral edema).[8] Participants were randomized to surgical craniotomy versus medical treatment alone, with assessment of functional outcome at 6 to 12 months using the modified Rankin scale (mRS). The primary outcome of the review was mRS score ≤ 3 at 1 year. Secondary outcomes included death at 6 to 12 months, functional independence (mRS ≤ 2), and "reasonable" neurologic outcome (i.e., survival without severe neurologic disability; defined as mRS ≤ 4). The authors contacted investigators and requested individual patient data. In addition to overall pooling, they performed subgroup analyses based on age, sex, presence of aphasia, time to randomization, vascular territory, and National Institute of Health Stroke Scale (NIHSS). Authors adjusted analysis based on prespecified covariates, including age, sex, baseline stroke severity, aphasia, and time from stroke onset to randomization.

The review identified eight published RCTs and one complete but unpublished trial for inclusion. Of 543 patients randomized in

Editor's Note: Brass Tacks are concise reviews of published evidence. This series is a result of collaboration between *Academic Emergency Medicine* and the evidence-based medicine website, www.TheNNT.com. For inquiries please contact the section editor, Shahriar Zehtabchi, MD (e-mail: Shahriar.Zehtabchi@downstate.edu).

the original RCTs, the meta-analysis included 488.[8] Full data were available for seven trials, including the unpublished RCT. All trials evaluated mRS at 1 year, with all except one also evaluating mRS at 6 months. Surgical decompression increased the likelihood of a favorable outcome (mRS ≤ 3) at 1 year compared with medical treatment alone (37.2% vs. 14.6%; adjusted odds ratio [aOR] = 3.0, 95% confidence interval [CI] = 1.6 to 5.6, absolute risk reduction [ARR] = 23%, number needed to treat [NNT] = 5). Surgical decompression was also associated with reduced mortality at 1 year (aOR = 0.16, 95% CI = 0.1 to 0.2; ARR = 42%, NNT = 3), increased chance of mRS ≤ 2 at 1 year (aOR = 2.77, 95% CI = 0.97 to 7.88, ARR = 12%, NNT = 9), and an increased chance of mRS ≤ 4 at 1 year (aOR = 5.34, 95% CI = 3.26 to 8.74, ARR = 38%, NNT = 3).

CAVEATS

There are several limitations associated with these data. Overall outcomes were poor with less than 25% of patients surviving with an mRS ≤ 3. Of note, the mean patient age was in the 40s in the majority of included RCTs, with few patients over age 60. In patients over 60 years, estimates of treatment outcomes were less precise due to low numbers of favorable outcomes. Only 8% of patients over 60 years demonstrated a favorable outcome in the DESTINY II trial, compared with the unpublished DEMITUR trial, which demonstrated a favorable outcome in 66% of patients.[8,9,10] This difference may be due to patient characteristics or adjudication of mRS outcomes. It is unclear if younger patients are being offered this intervention because they are younger or have better premorbid functional status or some other reason. Distribution of harms in this younger population is unclear as well.

Of note, the mRS is a score that measures the degree of disability or dependence in daily activities of patients with a neurologic condition from 0 points (no symptoms) to 6 points (death).[11] Several studies evaluating surgical decompression for ischemic stroke have utilized mRS of ≤3 (moderate disability, unable to walk and attend to bodily needs without assistance) as a favorable outcome,[12,13] including this current meta-analysis, while other studies evaluating thrombolysis utilize a score of ≤2 (slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance).[14] While there appears to be significant difference in functional ability between a score of 2 and 3, literature suggests patients with scores of 2 and 3 have similar quality of life.[15] Literature also suggests a wide inter-rater reliability in assessment of mRS.[16] Additionally, individual studies were small, ranging from 32 to 151 participants. Data reporting was also not complete for all trials. Due to the nature of the treatment blinding was not possible, which may have affected treatment approaches, goal-of-care decisions, and cointerventions. Outcome assessment was also not blinded, and with no way of blinding clinicians and the small number of included patients, biases are likely present. Limitations in study data availability prevented full analysis of all prespecified subgroups. In addition, quality of life was not included as an outcome due to limitations in use of these instruments in the included RCTs and the impact of survival bias. Finally, craniotomy is invasive, burdensome, and resource-intensive and may cause substantial postsurgical complications.[17] Unfortunately, no harm data are reported in this review of trials testing a major surgical procedure, which is a significant limitation. Thus, any negative impact of this procedure on quality of life, particularly for populations who may not benefit, is unclear.

Based on the available evidence, the review summarized here found surgical decompression was associated with improved functional outcome in those with space-occupying hemispheric infarction. Thus, we have assigned a color recommendation of green (benefit > harm). Further study is needed evaluating surgical decompression and quality of life and subgroups such as those receiving decompression 48 hours after stroke onset. However, in patients with large territory ischemic stroke who may develop cerebral edema, emergency clinicians should consult a neurosurgical specialist and assess the risks and benefits of further intervention.

CONFLICT OF INTEREST

The authors have no potential conflicts to disclose.

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How to cite this article: Long B, Gottlieb M. Surgical decompression for space-occupying hemispheric infarction. *Acad Emerg Med*. 2021;00:1–3. https://doi.org/10.1111/acem.14260