Decompressive craniectomy in malignant middle cerebral artery infarction

To be, or not to be?

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Complete or subtotal infarction in the territory of the middle cerebral artery (MCA) may be complicated by the formation of a space-occupying cerebral edema, which leads to fatal transtentorial herniation within a few days. Even maximum conservative treatment may not change the course of the disease substantially. These so-called malignant MCA infarctions (MMI) are, therefore, life-threatening events and survivors have permanent disability.¹

In other words, using the terminology of the modified Rankin Scale (mRS),² a widely used and validated 7-point functional outcome scale that ranges from 0 (no symptoms) to 6 (death): most patients with MMI will die (mRS 6), few patients will reach a varying degree of disability with (mRS 4–5) or without dependency (mRS 2–3), but not a single patient will survive without significant disability (mRS 0–1).³

Decompressive hemicraniectomy (DHC) is a surgical procedure that was tested in randomized controlled trials (RCT) and has proven effective in reducing mortality and increasing the likelihood of achieving a better functional outcome when performed early, within 48 hours from symptom onset. However, because of the severity of the underlying stroke, a relevant proportion of patients survive in a moderately severe state of disability, i.e., unable to walk without assistance, and unable to attend to own bodily needs without assistance (mRS 4).³ Since the publication of the RCT, there is an ongoing discussion in order to clarify whether this outcome state is acceptable.⁴ A final solution is not in sight, however. In the meantime, physicians are in a difficult dilemma of offering a life-saving and outcome-improving therapy on the one hand that carries the risk of a possibly unacceptable long-term disability on the other hand.

In this issue of *Neurology® Clinical Practice*, Streib et al.⁵ take up the challenge to further clarify the role of early DHC with respect to the functional outcome state and give a clinical decision algorithm to support physicians in their considerations of DHC in MMI. They do so by providing a sound meta-analysis of all published RCT on early DHC that report data on functional outcome at 12 months. For outcome definition as excellent (mRS 0–2), favorable (mRS 0–3), or unfavorable (mRS 4–5), Streib et al. tried to approximate clinical conventions and public perceptions as exactly as possible by evaluating published literature on attitudes of physicians, nurses, and the general public towards the question as to whether a mRS of 4 may still be considered a life worth living. Their meta-analysis showed that early DHC significantly improves excellent outcome (odds ratio [OR] 2.81, number needed to treat [NNT] 15.2) and favorable outcome (OR 2.06, NNT 6.7) but at the same time increases the risk for

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unfavorable outcome significantly (OR 3.03, NNT 3.4). Furthermore, treatment effect was worse in older patients. Based on these results and the assumed attitude of an individual patient towards survival with an mRS of 4, a decision algorithm gives exact numbers about the likelihood that DHC will meet the patient's own goal of care, i.e., maximize survival with acceptable disability vs minimize survival with unacceptable disability.⁵

The obvious strength of the study is that Streib et al. created outcome data with clinical applicability and a decision algorithm that supports physicians in balancing risks and benefits regarding DHC during informed consent. Providing concrete figures helps to simplify complex clinical data, which is essential to facilitate patients' participation in the decision process.

There are, however, 2 key issues regarding the underlying assumptions that need to be discussed: First, may an mRS of 4 be regarded as unfavorable? This would change NNTs dramatically; e.g., in young patients, the NNT for a favorable/unfavorable outcome would change from 1.4/11.0 to 6.7/3.4. Second, is an acute stroke patient able to judge on the acceptability of functional outcome states and concrete percentage figures? Here, the concern is that patients take their final decision on "to be, or not to be" on the basis of a false assumption.

Although Streib et al. tried to get as close as possible to what is truly perceived as favorable outcome in the literature, there are no data on patients' preferences, the attitudes of physicians are heterogeneous,⁶ and the general public does not understand the complex issue of MMI sufficiently to reliably decide on favorable outcome in advance.⁷ Furthermore, it is questionable whether the attitudes of young and healthy persons and acutely affected stroke patients reflect those of chronically disabled patients. We know that the capacities to cope with severe life events and illnesses are generally underestimated and that a significantly higher proportion of survivors of MMI report satisfaction with life despite moderately severe disability compared to advance assessment of healthy adults (77% vs 6%–38%).⁸ Most importantly, humans are not able to assess risks in a sober and rational way. Especially in situations with strong positive or negative consequences, risk estimates appear to have all or nothing characteristics, i.e., zero-risk bias.^{9,10} It is, therefore, questionable as to whether the information of, e.g., a 43%–69% chance of acceptable quality of life (by the way, at the same time this also means a 31%–57% chance of unacceptable outcome) is of any help, especially as the acute stroke patient is only sensitive to the possibility rather than the probability of a favorable outcome.

However, unless we have more data on patients' preferences, risk estimates, and retrospective consent to DHC as well as reliable predictors for the individual degrees of disability, the decision algorithm offered by Streib et al. is a helpful instrument to guide the decision process and informed consent discussion regarding DHC in MMI.

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