Hemicraniectomy for large middle cerebral artery territory infarction: outcome in 19 patients

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**Background:** Large space-occupying middle cerebral artery infarction accounts for 10–15% of all supratentorial infarctions and carries a mortality of 50% to 80%. Hemicraniectomy may be useful when optimal medical management has failed.

**Methods:** Between June 1997 and June 2000, 19 patients who fulfilled the clinical and imaging criteria for large middle cerebral artery infarction underwent hemicraniectomy because of impending herniation despite best medical therapy. The National Institute of Health Stroke Scale (NIHSS) assessed neurological status on admission and at one week after surgery. At 3 month follow-up, The Barthel Index (BI) and Rankin Scale (RS) were used to assess the functional outcome among survivors.

**Results:** There were 15 males and 4 females with a mean age of 46.5 years (range 27–76 years). Ten patients (53%) had dominant hemisphere stroke. The mean interval between stroke onset and surgery was 60.3 hours (range 20–103 hours). The mean NIHSS score before surgery was 20.5 (range 17–26) and 10.5 (range 6–22) after surgery. One patient (5.2%) died due to post-operative meningitis. At follow up, mean BI was 56.4 (range 25–90) and RS revealed severe handicap in 4 patients (21%). Patients under 50 years of age had a significantly better outcome with mean BI of 60.7 as compared to only 41.3 (p=0.048) in older patients. Speech function, especially comprehension improved in all patients with dominant hemisphere infarction.

**Conclusion:** These findings add to previous studies suggesting hemicraniectomy may be a useful procedure in patients with large middle cerebral artery territory infarction. The functional outcome is good in younger patients. A randomised controlled trial is required to substantiate these findings.

**Results:**

**Abbreviations:** ACA, anterior cerebral artery; MCA, middle cerebral artery; PCA, posterior cerebral artery.
hemicraniectomy while the rest had right-sided decompression. The mean interval between stroke-onset and admission to hospital was 25.3 hours (SD 26.8; range 1–100 hrs). The mean interval between stroke-onset and decompressive surgery was 60.3 hrs (SD 23.9; range 20–103 hrs). The mean NIHSS score prior to surgery was 20.5 (SD 2.6; range 17–26). The NIHSS score a week after surgery was 10.5 (SD 4; range 6–22). The mean duration of hospital stay was 35.3 days (SD 16; range 19–88 days). At 3 month follow up, the mean BI was 56.3 (SD 19.2; median 55; range 25–90). The RS showed severe handicap in only 21%, while the majority showed significant improvement. One patient (5.2%) died due to post-operative meningitis. Among the patients with dominant hemisphere stroke, the speech function improved in most. We compared the duration of hospital stay, stroke onset to admission times, stroke onset to surgery time, NIHSS scores and BI among patients under 50 and those above 50 years of age. There were no significant differences between the groups for duration of hospital stay, stroke onset to admission times, stroke onset to decompressive surgery time, NIHSS scores or BI. The BI, however, was significantly higher (60.7; SD 18.9; median 57.5; range 30–90) for the below 50 years group as compared to 41.3 (SD 11.8; median 45; range 25–50) for the below 50 years group (p = <0.048).

DISCUSSION

We have described a series of patients with massive hemispherical infarction who underwent decompressive hemicraniectomy. The principal aim of surgery was to save life, since the majority (79%) of them were under 50 years and did not have concomitant serious medical illness. Even though decompressive craniectomy for supratentorial infarction has been done in a few patients sporadically over four decades, it is only in the last two decades that the treatment has been studied systematically. A recent Cochrane review, however, has shown that there is no evidence from the extant literature of an evidence basis for the use of this procedure.

Our study however, adds to the previous findings that suggest both mortality and functional outcome may be better after surgery. This is supported by experimental data from rat models. It has generally been felt that hemicraniectomy must be offered only to patients with non-dominant hemispherical strokes, the reason being that speech is unaffected and functional outcome would therefore be better. Several studies have however reported good language recovery in some patients. We also found that all patients with aphasia had improved and could communicate usefully. Even though most had a degree of expressive dysphasia, they regained their ability to comprehend.

In our study, only one patient died (mortality rate 5.2%), 50 days after surgery because of postoperative meningitis and abscess formation and not due to herniation. The mortality rates in various reports vary from 0% to 27% (see table 1). The problem with our study, like many studies, is that it is retrospective and may be subject to selection bias. Nevertheless, we have demonstrated that the procedure can be performed safely in our set up in a developing country.

We conclude that although hemicraniectomy can be very effective, randomised controlled trials are needed to properly evaluate its place in the management of patients with space-occupying hemispheric stroke.

Table 1 Studies on hemicraniectomy in space-occupying MCA infarction

<table>
<thead>
<tr>
<th>Author (ref no)</th>
<th>Year</th>
<th>No of patients</th>
<th>Mean age (years)</th>
<th>Time to surgery (hrs)</th>
<th>Mortality</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rengachary et al [4]</td>
<td>1981</td>
<td>3</td>
<td>31</td>
<td>76</td>
<td>0</td>
<td>1 independent; 2 disabled</td>
</tr>
<tr>
<td>Young et al [5]</td>
<td>1992</td>
<td>1</td>
<td>59</td>
<td>18</td>
<td>0</td>
<td>Independent</td>
</tr>
<tr>
<td>Kondziolka &amp; Fazl (6)</td>
<td>1988</td>
<td>5</td>
<td>40</td>
<td>52.8</td>
<td>0</td>
<td>All independent</td>
</tr>
<tr>
<td>Delashaw et al (7)</td>
<td>1990</td>
<td>9</td>
<td>57</td>
<td>76.4</td>
<td>11</td>
<td>4 independent; 4 disabled</td>
</tr>
<tr>
<td>Kalia &amp; Yonas (8)</td>
<td>1993</td>
<td>4</td>
<td>34.3</td>
<td>40</td>
<td>0</td>
<td>All independent</td>
</tr>
<tr>
<td>Rieke et al (9)</td>
<td>1995</td>
<td>32 (late surgery)</td>
<td>48.8</td>
<td>39</td>
<td>34.4</td>
<td>Mean BI 62.6</td>
</tr>
<tr>
<td>Carter et al (10)</td>
<td>1997</td>
<td>14</td>
<td>49.2</td>
<td>98</td>
<td>21</td>
<td>8 independent; 3 disabled</td>
</tr>
<tr>
<td>Schwab et al (11)</td>
<td>1998</td>
<td>31 (early surgery)</td>
<td>50.3</td>
<td>21</td>
<td>16</td>
<td>Mean BI 68.8</td>
</tr>
<tr>
<td>Schwab et al* (12)</td>
<td>1998</td>
<td>63 (early plus late surgery)</td>
<td>49.7</td>
<td>30</td>
<td>27</td>
<td>Mean BI 65</td>
</tr>
<tr>
<td>Holkamp et al (13)</td>
<td>2001</td>
<td>12</td>
<td>64.9</td>
<td>42.4</td>
<td>33</td>
<td>Mean BI 28.1</td>
</tr>
<tr>
<td>Present study</td>
<td>2003</td>
<td>19</td>
<td>46.5</td>
<td>60.3</td>
<td>5.2</td>
<td>Mean BI 56.3</td>
</tr>
</tbody>
</table>

*63 patients include 32 patients of Rieke et al (late surgery group).
REFERENCES