SHORT REPORT

Hemicraniectomy in elderly patients with space occupying media infarction: improved survival but poor functional outcome

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Abstract

Objective—To assess the survival rate and functional outcome in elderly patients with space occupying supratentorial infarction who underwent hemicraniectomy compared with those who received medical treatment alone.

Methods—All patients older than 55 years with space occupying middle cerebral artery (MCA) infarction treated in our clinic between January 1998 and July 1999 were included in this retrospective analysis. Patients were eligible for decompressive surgery if they were younger than 75 and had no severe comorbidity. Hemicraniectomy was performed regardless of the affected hemisphere. All patients were followed up for assessment of functional outcome; data were assessed according to the Barthel index and modified Rankin scale and cover a period of 3 to 9 months after infarction.

Results—Twelve out of 24 patients underwent hemicraniectomy. Eight patients who were operated on survived; only one patient died of transtentorial herniation, three other deaths were due to medical complications. None of the survivors had a Barthel score above 60 or a Rankin score below 4. Nine out of 12 medically treated patients died of transtentorial herniation, one patient died of medical complications. The two surviving patients had a Barthel score below 60 and a Rankin score of 4.

Conclusions—Craniectomy in elderly patients with space occupying MCA infarction improves survival rates compared with medical treatment alone. However,

functional outcome and level of independence are poor. Craniectomy in elderly patients should not be performed unless a prospective randomised trial proves beneficial.

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Keywords: cerebral infarction; elderly patients; hemicraniectomy

Large space occupying infarctions in the middle cerebral artery (MCA) territory have a mortality of up to 80% even with maximal medical treatment.^{1 2} This “malignant” character is caused by a perifocal oedema leading to unsustainably raised intracranial pressure (ICP). Clinically, patients exhibit progressive worsening of consciousness and signs of mesencephalic dysfunction; ultimately, death from transtentorial or uncal herniation may be the result.^{1 3 4}

In the past 20 years, several series have been published about patients who were surgically decompressed for large supratentorial infarctions with clinical and CT signs of raised ICP.^{5–11} Most authors reported excellent survival rates and surprisingly good clinical outcomes (table 1). These positive results were further supported by experimental data from rat models.^{12 13} However, in all the patient series except one⁹ mean age was below 50 years.

As the vast majority of stroke victims are older than 50 years,¹⁴ we compared survival rates and functional outcome after hemicraniectomy in elderly patients with space occupying supratentorial infarctions with those who received medical treatment alone.

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Table 1 Studies on hemicraniectomy in space occupying MCA infarction

Author	Year	No of patients	Mean age (y)	Lethality (%)	Functional outcome
Rengachary <i>et al</i> ¹¹	1981	3	31	0	2 patients BI<60; 1 patient>90‡
Kondziolka and Fazl ¹⁰	1988	5	40.1	0	All patients BI>60‡
Delashaw <i>et al</i> ⁶	1990	9	57	11	4 patients BI>60
Jourdan <i>et al</i> ⁷	1993	7*	NA	28	All patients BI>60‡
Kalia and Yonas ⁸	1993	4†	34.3	0	All patients BI>60‡
Carter <i>et al</i> ⁹	1997	14	49.2	21	8 patients BI>60
Schwab <i>et al</i> ⁵	1998	63	49.7	27	Mean BI 65

*In 7 of 9 patients hemicraniectomy was performed due to ischaemic infarction.

†All patients underwent strokectomy.

‡BI scores are estimated following clinical and functional descriptions.

BI=Barthel index; NA=not applicable.

Table 2 Elderly patients with space occupying MCA infarction and hemicraniectomy

Patient No	Age/sex	Territory of infarction	Aetiology	Delay stroke/operation	Follow up			
					Time	BI	RS	Living situation
1	55, F	L MCA	Arterial embolus	30 h	8 months	55	4	Rehabilitation clinic
2	56, M	R MCA/pACA	Arterial embolus	25 h	4 months	60	4	Rehabilitation clinic
3	58, F	R MCA	Carotid dissection	9 d	3 months	35	4	Home for elderly
4	60, F	R MCA	Arterial embolus	130 h	3 months	0	5	Nursing home
5	60, M	R MCA	Arterial embolus	24 h	4 months	0	5	Nursing home
6	67, M	L MCA	Atrial fibrillation	29 h	†8 months	NA	NA	NA
7	67, M	R MCA/pACA	Atrial fibrillation	14 h	4 months	25	4	Rehabilitation clinic
8	69, M	R MCA	Cryptogenic	13 h	8 months	40	4	Day clinic
9	70, F	R MCA/pACA	Atrial fibrillation	30 h	†3 months	NA	NA	NA
10	70, M	L MCA/PCA	Atrial fibrillation	24 h	†17 days	NA	NA	NA
11	73, F	R MCA/pACA	Atrial fibrillation	48 h	†8 days	NA	NA	NA
12	74, M	R MCA/ACA	Perioperative bypass	100 h	9 months	10	5	Nursing home

p=Partial; MCA=middle cerebral artery; PCA=posterior cerebral artery; ACA=anterior cerebral artery; NA=not applicable; BI=Barthel index; RS=Rankin scale; NA=not applicable. †Patient died at x days or months.

Patients and methods

All patients with space occupying supratentorial infarctions older than 55 years treated in our clinic between January 1998 and July 1999 were included in this analysis. Patients were not eligible for hemicraniectomy if they were older than 75 years or had severe medical or neurological comorbidity. All patients were treated conservatively following a fixed protocol with maintenance of a mean arterial pressure of 90–110 mm Hg, glucose serum concentrations of 5–6 mmol/l, and care for sufficient oxygenation and protection from aspiration.

The decision for surgery was based on a large hypodense infarct demarcation in the MCA territory regardless of lateralisation as visible on cranial CT with a midline shift of 5 mm or more indicating space occupying oedema. Clinically, deterioration of consciousness as a first sign of rising ICP had to be present. Hemicraniectomy was performed before other clinical signs of herniation. If additional signs of lateral herniation developed before surgery, an antioedematous treatment with mannitol infusions and controlled hyperventilation (paCO₂ 30 mm Hg) was started. Hemicraniectomy was performed with a diameter of at least 12 cm and an augmented dura plastic was inserted as described previously.⁵

Follow up data of all patients refer to the period of 3 to 9 months after ischaemic infarction. For assessment of clinical outcome and activities of daily living, the Barthel index and modified Rankin scale were used.

Results

Twelve out of 24 elderly patients with space occupying MCA infarction underwent hemicraniectomy (for summarised data see table 2); four patients were not operated on due to advanced age and eight because of pre-existing comorbidity (table 3).

The mean (SD) age of the operated patients was 64.9 (6.7) years. Six patients had an ischaemic infarction restricted to the MCA territory, five patients had additional anterior cerebral artery (ACA) and one additional posterior cerebral artery (PCA) infarction. One patient had a progressive stroke, with an interval of 9 days between the initial symptoms and decompressive surgery. Without this patient the average time between onset of symptoms and craniectomy was 42.4 (SD 37.6) hours (range 13–130 hours). Four patients died during the period of follow up, but only one death resulted from transtentorial herniation after progression of an additional partial ACA infarction. Another 70 year old male patient died 17 days after hemicraniectomy from septic circulatory failure and two further patients died, one in a rehabilitation centre and one in a nursing home, presumably from heart failure and pulmonary embolism, respectively.

Of the eight surviving patients operated on (66%) none had a Barthel index score above 60 (range 0–60) and no patient had a Rankin score below 4 (range 4–5).

Mean age of the 12 medically treated patients was 72.5 (SD 8.9) years. Nine of these patients (75 %) died of transtentorial herniation in the first days after infarction. Another

Table 3 Elderly patients with space occupying MCA infarction and medical treatment alone

Patient No	Age/sex	Territory of infarction	Aetiology	Contraindication for hemicraniectomy	Follow up			
					Time	BI	RS	Living situation
1	57, F	L MCA/ACA	Paraneoplastic coagulopathy	Lung cancer	†2 days	NA	NA	NA
2	60, F	L MCA/bilat. ACA	Bilateral ICA occlusion	Bilateral ACA infarction	†7 days	NA	NA	NA
3	69, F	L MCA	L ICA occlusion	Previous disabling strokes	†8 days	NA	NA	NA
4	70, F	L MCA	Atrial fibrillation	Coronary heart disease	†5 days	NA	NA	NA
5	72, F	L MCA/ACA	Atrial fibrillation	Cardiac disease	†3 days	NA	NA	NA
6	72, M	Bilateral MCA/pACA	Atrial fibrillation	Bilateral MCA infarction	†4 days	NA	NA	NA
7	73, M	L MCA	Atrial fibrillation	Cardiac disease	8 months	10	4	Nursing home
8	74, M	L MCA	Cryptogenic	Cardiac disease	9 months	25	4	Nursing home
9	75, M	L MCA/ACA	L ICA occlusion	Advanced age	†1 day	NA	NA	NA
10	77, M	L MCA/ACA	Atrial fibrillation	Advanced age	†3 days	NA	NA	NA
11	79, F	R MCA/ACA	Atrial fibrillation	Advanced age	†5 days	NA	NA	NA
12	92, F	R MCA/pACA	Atrial fibrillation	Advanced age	†12 days	NA	NA	NA

p=Partial; MCA=middle cerebral artery; ACA=anterior cerebral artery; ICA=internal carotid artery; BI=Barthel index; RS=Rankin scale; NA=not applicable. †Patient died at x days.

patient died shortly after ischaemia of pneumonia. The two surviving patients had Barthel index scores of 25 and 10 and Rankin score of 4.

Discussion

Current data suggest that hemicraniectomy is an effective treatment for large space occupying MCA infarctions in terms of survival rate and functional outcome. Indeed, mortality from herniation was low in our group of patients operated on, although overall mortality increased to 33% due to non-neurological complications. In line with published data on conservatively treated patients, mortality due to transtentorial herniation was much higher in the non-operated patients (75%).^{1,2}

During follow up, none of the surviving patients, either surgically or medically treated, showed a Barthel index score above 60 and a Rankin score below 4; this indicates severely disabled and completely dependent patients in both groups. The poor functional results in the surgically treated patients contrast markedly with all other studies of hemicraniectomy for space occupying supratentorial infarctions.⁵⁻¹¹

Factors with possible influence on the outcome—other than advanced age—may be the high proportion of patients with additional ACA or PCA infarctions or a delay between onset of symptoms and decompressive surgery.

In our series, six patients operated on had combined MCA/ACA or MCA/PCA infarctions. However, only one death in these patients could be attributed to herniation. In the surviving subgroup, the three patients with combined infarctions did not show worse Barthel index scores compared with the five patients with isolated MCA infarctions. In a recent large hemicraniectomy study,⁵ more than one third of patients had combined infarctions, but no negative impact on the functional outcome in this subgroup was reported. These findings argue against a major negative influence of combined infarctions on the outcome in our series compared with others.

Previous studies suggest a better outcome of patients treated with early rather than delayed hemicraniectomy.^{6,9-11} However, no inverse

correlation between time to surgery and outcome was detected in our patients. The average delay of 42 hours was shorter than in most earlier studies.^{6,8-11} Thus, the poor outcome in our series cannot be explained by a delay between stroke and hemicraniectomy.

In summary, advanced age is the only differing variable when comparing our patients who were operated on with earlier investigations. Although mortality from herniation was low after hemicraniectomy, clinical outcome and level of independence were poor. Even the patient with the best Barthel index score of 60 still needed massive assistance for his daily life. Our data suggest that in elderly patients with large space occupying supratentorial infarctions decompressive surgery should not be performed.

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