DECOMPRESSIVE CRANIECTOMY IN DEEP SPONTANEOUS INTRACEREBRAL HEMORRHAGES

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ABSTRACT

The aim of this study was to analyze efficacy and safety of decompressive craniectomy (DC) in deep spontaneous intracerebral hemorrhage (SICH). Neurosurgical management of SICH is still a controversial issue. Surgical techniques are diverse, from the open large craniotomy, to the minimally invasive techniques like stereotactic aspiration of the SICH, endoscopic evacuation and stereotactic catheter drainage after instillation of thrombolytic agents. Decompressive craniectomy lowers intracranial pressure and improves outcome in patients with SICH. We studied 11 patients with spontaneous intracerebral hemorrhage treated with DC without hematoma evacuation and compared them with patients treated by best medical treatment. We analyzed the patients from clinical (age, sex, the underlying pathology, Glasgow Coma Scale), neuroimagistic (signs of herniation, localization and size of hematoma, midline shift, hematoma expansion) and surgical (time to and indication for surgery) points of view. The outcome after 30 days was apreciated as good (modified Rankin Scale 0–3) or poor (modified Rankin Scale 4–5). Eleven patients (median age 59 years) with deep SICH were treated by DC. Seven patients showed signs of herniation. Nine patients had good and 2 had poor outcomes. Two patients of the surgery group died versus 6 patients from the medical treatment group. We conclude, based on this small cohort, that DC can reduce mortality in some cases. Larger prospective studies are needed to assess safety and efficacy of this method.

Keywords: decompressive craniectomy, surgery, spontaneous intracerebral hemorrhage (SICH)

INTRODUCTION

The neurosurgical management of spontaneous intracerebral hemorrhage (SICH) is still a controversial issue. The aim of this study was to analyze efficacy and safety of decompressive craniectomy (DC) in deep SICH. Spontaneous intracerebral hemorrhage (SICH) is defined as a bleeding into the brain parenchyma which occurs in the absence of trauma or surgery. Surgical techniques are diverse, from the open craniotomy, to the minimally invasive techniques like stereotactic aspiration of the SICH and endoscopic evacuation. Decompressive craniectomy lowers intracranial pressure and improves outcome in patients with intracerebral hemorrhage. The idea of applying it in spontaneous intracerebral hematoma, comes from results obtained by applying this method in massive ischemic stroke , in sinus thrombosis or in traumatic pathology. The toxic effects of hematoma degradation and the complications of mass effect are the main reasons for surgery (1,2).

MATERIAL AND METHODS

We selected 11 patients, 7 males and 4 females with a median age of 59. All patients had deep spontaneous intracerebral hematomas, in 9 cases they were basal ganglia hematomas and in 2 cases were thalamic hematomas. All cases underwent surgery, decompressive craniectomy and also received best medical treatment. We compared this group of patients with another group, treated by best medical treatment only. We selected 15 patients with the same localisation of SICH and the same

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level of consciousness as in the surgically group. There were 9 male patients and 6 female, with a mean age of 62, all with hypertension and without any known coagulation disorders. In 4 cases SICH was localised in the thalamus and in 11 cases in the basal ganglia.

We analyzed the patients from clinical (age, sex, the underlying pathology, Glasgow Coma Scale), neuroimagistic (signs of herniation, localisation and size of hematoma, midline shift, hematoma expansion), and surgical (time to and indication for surgery) points of view.

The outcome after 30 days was apreciated as good (modified Rankin Scale 0-3) or poor (modified Rankin Scale 4–5).

Hematoma size was estimated by the ABC/2 method. (3)

Decompressive craniectomy was performed with 120 and 150 mm diameters. In all patients the dura was opened in star shape, after which a large dural plasty was made and the scalp was sutured in 2 layers. No complication occured related to surgery. The average time elapsed until surgery was 19 hours, but no patient was operated on earlier than 6 hours after the onset of symptoms.

The main reasons for surgery were: altered level of consciousness (with loss of one or more points on the Glasgow Coma Scale from admission) in 9 cases, developing an oculomotor nerve paresis which occured in 7 cases, worsening focal neurologic deficit or a combination of these reasons. Oculomotor nerve paresis indicated the development of transtentorial hernia.

Patients from the medical group were treated with best medical treatment according to the American Heart Association/American Stroke Association guidelines (4).

All patients from both groups were treated either in the intensive care unit or in the stroke unit of the neurology clinic, in the Emergency University Hospital, Bucharest.

RESULTS

The surgery group

We summarized our results in Table 1.

At various intervals of time between 2 and 48 hours, postoperative CT scans were carried out in all cases. An increase in size of the hemorrhage was found in 2 cases compared with preoperative images, with 6 ml and 8 ml. The postoperative midline shift was 2.4 mm, which means a significant decrease comparing to preoperative images.

TABLE 1. *Clinical features, imaging and results in 11 patients with decompressive craniectomy*

Localisation	Basal Ganglia	Thalamus
Number of patients	9	2
Preoperative GCS	7.94 points	5.5 points
Preoperative Oculomotor paresis	6 cases	1 case
Median hematoma volume	43.2 cm^3	52 cm^3
Preoperative Neurologic deficit	8 cases	1 case
Preoperative Midline shift on CT scan	9.47 mm	11 mm
Deaths	0	2
Intraventricular hemorrhage	8	2
Rankin score (modified Rankin scale) at 30 days	7 cases-score 4 1 case-score 3 1 case-score 5	-

Postoperative results after 30 days were: 2 deaths (both thalamic hemorrhage cases with volume above 50 ml), 6 patients with Rankin score of 4 and 1 with 3 and 2 with score 5 (modified Rankin scale).

There is a possibility that decompressive craniectomy can increase the risk of rebleeding. Hematoma expansion was a factor that was always kept in mind related to the timing of surgery. Knowing that rebleeding occurs in 35-40% of cases within the first 3 hours and in 10-15% of cases within 3 to 24 hours after onset (5). We could not accurately determine whether this hematoma growth is due to the natural history of the disease or due to DC. In patients operated on after over 15 hours from the onset we did not see an increase in size of the hematoma which led us to believe surgery did not bring an additional risk.

The effect of DC on perilesional edema remains unknown, but the above data showed that the midline shift is significantly reduced after this type of surgery, thus counteracting the mass effects.

The conservative treatment group

15 patients have been included in this group. We compared these patients with the patients form the surgery group.

The average volume of hematoma was 55.95 ml, varying between 38 ml to 69 ml. The median GCS score was 7.06 points. Patients were reevaluated with CT scan within 72 hours from the onset. In 9 (60%) cases there was a hematoma growth but with no clinical signs of transtentorial herniation of the uncus (oculomotor nerve paresis) which could justify immediate surgery. In 8 cases there was a worsening of the controlateral motor deficit comparing with the neurologic evaluation upon presentation.

TABLE 2. *Comparision between surgically treated patients and medically treated patients*

	Surgically treated patients	**Medically treated patients**
Localisation	Basal ganglia – 9 cases Thalamic – 2 cases	Basal ganglia – 11 cases Thalamic – 4 cases
Hematoma volume (ml)	52.6 ml	55.95 ml
GCS on admission	6.72 points	7.06 points
Midline shift on CT – scan (mm)	10.23 mm	11.6 mm
Medical complications	Pneumonia – 4 cases Urinary tract infections – 3 cases	Pneumonia – 5 cases Urinary tract infections – 4 cases Deep venous thrombosis – 2 cases
Deaths	2 (talamic) – 18.18%	6 (talamic 4, basal ganglia 2) – 40%
Rankin score (modified Rankin scale) at 30 days	7 cases – score 4 1 case – score 3 1 case – score 5	4 cases – score 4 1 case – score 3 4 cases – score 5
Length of Stay (days)	12	19

All 9 patients who had shown an expansion of hematoma have lost 1 or 2 points on GCS compared with the admission score. Midline shift on the CT scan was 11.6 mm.

Results after 30 days were: 6 deaths, in 4 cases evaluated with modified Rankin scale the score 4, in 1 case the Rankin score was 3 and in 4 cases the Rankin score was 5. Of the 6 deaths, 4 were thalamic hemorrhages and 2 in the basal ganglia and all had a volume of more than 55ml. These results confirm the data from the literature regarding the higher mortality of these cases.

Comparison between surgery group and conservative treatment group

We summarized our results in Table 2.

Motor deficits improved in the group of patients treated surgically by decompressive craniectomy.

Complications occurred in both groups and were: pneumonia, urinary infections and deep venous thrombosis. We had no specific complications related to surgery.

The mean duration of hospitalization was 12 days in patients surgically treated (both in the intensive care unit as well as in the stroke unit) and 19 days in those conservatively treated. We consider that these differences regarding the duration of hospitalization cannot be attributed to the treatment type, but mainly to the difficulty of taking over these patients by the rehabilitation centers and in some cases, by their family.

CONCLUSIONS

Finally we can conclude that thalamic hemorrhage with a large bleeding (over 55 ml) has a poor prognosis, either in cases with surgical correction (decompressive craniectomy only) or with conservative treatment.

For bleeding in the basal ganglia, however, decompressive craniectomy is a feasible therapeutic alternative, but requires much larger prospective studies.

We consider decompressive craniectomy a promising therapeutic alternative in cases with basal ganglia hemorrhages with clear signs of increased intracranial pressure which is refractory to all therapeutic measures, with progressive deterioration of consciousness and incomplete controlateral motor deficit.

We may conclude based on this small cohort, that DC may reduce mortality in some cases. Larger prospective studies are needed to assess the safety and efficacy of this method.

REFERENCES

1. **Schmidek H.H., Sweet W.H.** Operative Neurosurgical Techniques, ed. W.B. Saunders Company, 6th edition, 2012, vol 2, p. 823-844.
2. **Fung C., Murek M., Z'Graggen WJ., Krähenbühl A.K. et al.** Decompressive hemicraniectomy in patients with supratentorial intracerebral hemorrhage, *Stroke.* 2012 Dec; 43(12):3207-11.
3. **Khotari R.U., Brott T., Broderick J.P., Barsan W.G., et al.** The ABCs of measuring intracerebral hemorrhage volumes. *Stroke.* 1996; 27:1304-130.
4. **Broderick J., Connolly S., Feldmann E., et al.** Guidelines for the management of spontaneous intracerebral hemorrhage in adults: 2007 update: a guideline from the American Heart Association/ American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. *Stroke* 2007; 38:2001.
5. **Ma L., Liu W.G., Sheng H.S., Fan J., Hu W.W., Chen J.S.** Decompressive craniectomy in addition to hematoma evacuation improves mortality of patients with spontaneous basal ganglia hemorrhage. *J Stroke Cerebrovasc Dis.* 2010; 19:294-298.
6. **Morgenstern L.B., Hemphill J.C. 3rd, Anderson C., et al.** Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2010; 41:2108.