Research Article

Factors associated with mortality after decompressive craniectomy in large basal ganglia bleeds

Amit Kumar Thotakura*, Nageswara Rao Marabathina, Rama Krishnareddy Mareddy and Sivaramanjaneyulu Yeddanapudi

Department of Neurosurgery, NRI Academy of Sciences, Chinakakani, Guntur, 522503, Andhra Pradesh, India

Abstract

Aim: To assess the efficacy of decompressive craniectomy in patients with large basal ganglia (BG) bleed. To establish predictive criteria of mortality after surgery in patients with BG bleed.

Materials: This prospective study includes all patients of large spontaneous BG bleed operated by decompressive craniectomy without hematoma evacuation from October 2012 to September 2015. Data was collected on patient age, gender, distribution of bleed, affected hemisphere dominance, preexisting medical conditions, admission Glasgow Coma Score (GCS), midline shift on CT or MRI Brain, hematoma volume and anisocoria, duration (hours) between the onset of stroke and operation, post-operative complications, and the duration of hospital stay. This data was correlated with one month mortality of the patients.

Results: Total number of patients were 27. Mean age was 51 years and mean GCS was 7.55 (range 5-11). The mean volume of the bleed was 68.51 ml. Mortality was noted in 17 out of 27 patients (63%) in 30 days. Thirteen of the 16 patients with intraventricular extension of BG bleed had mortality. The factors that showed statistically significant correlation with one month mortality were age, GCS at admission, volume of the bleed and the intraventricular extension.

Conclusion: Large BG bleed was associated with high mortality and morbidity. Age of 50 years or more and GCS ≤ 8 at presentation were poor prognostic factors for decompressive craniectomy in patients with BG bleed. Patients with large BG bleed of volume > 60 ml and intraventricular extension had poor prognosis.

Introduction

The role of surgery in haemorrhagic stroke is not defined properly. Various surgical procedures were described earlier for deep seated intracerebral hematoma (ICH) [1]. We want to present the results of a case series of patients with large basal ganglia hematoma, who were operated by only Decompressive Craniectomy without clot evacuation. This procedure was studied by some authors earlier [2-5].

The objective of our study was to assess the efficacy of decompressive craniectomy in patients with large Basal ganglia (BG) bleed. To establish predictive criteria of mortality after surgery in patients with BG bleed.

Methods

This prospective study includes all patients of large spontaneous BG bleed operated by decompressive craniectomy without hematoma evacuation from October 2012 to September 2015 at NRI Academy of Sciences.

Patients presenting with spontaneous BG bleed were admitted in neuro intensive care unit. Stroke was diagnosed by clinical history, physical examination and head CT. All the patients were examined neurologically, observed in the intensive care unit. They were intubated, and ventilated, when necessary. All these patients were given anti edema agents, such as Mannitol and Furosemide. They were monitored clinically without invasive ICP monitoring. Clinical neurological deterioration was defined by drop in GCS by 2 points with a minimum drop in motor score by 1. If the patient began to deteriorate neurologically, emergency repeat head CT was performed. When clinical deterioration correlated with radiological findings of increase in mass effect, then emergency decompressive craniectomy was performed.

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All the patients with basal ganglia bleed extending to internal capsular region and involving thalamic regions were included in the study. Patients with severe medical co-morbidity, age > 70 years, bleed caused by trauma, primary intraventricular hemorrhage, posterior fossa bleeds, supratentorial lobar bleeds, disorders of blood coagulation were excluded from the study. Data was collected on patient age, gender, distribution of bleed, affected hemisphere dominancy, pre-existing medical conditions or risk factors, admission Glasgow Coma Score (GCS), papillary asymmetry, midline shift on CT or MRI Brain, hematoma volume, duration between the onset of stroke and surgery, post-operative complications and duration of hospital stay. The three dimensions of the hematoma were measured in centimeters (length, breadth, height) and the volume in cm³ was calculated by the formula lxbxh divided by 2.

**Surgical technique**

The patient is positioned supine with the head turned contralaterally about 45 degrees. A skin marking for standard decompressive craniectomy was given. Scalp along with temporalis muscle was elevated. A free bone craniectomy flap measuring 13 x 10 cm was done and harvested in the anterior abdominal wall. Dura opened in a curvilinear fashion to the bony margins. Duroplasty was done with pericranium. Scalp closed in layers.

In the follow up, the patients were assessed with Glasgow outcome scale (GOS) at 1 month and 3 months time. The Institutional Ethical Committee approval was taken to conduct the study. Descriptive statistics of patient variables were calculated. The correlation between survival group and mortality group was tested with Fischer exact test in case of categorical variables and with student ‘t’ test in case of continuous variables.

**Results**

Total number of patients were 27, out of which males were 22 (81.5 %). Age range of the patients was 38 to 70 years with mean of 51 years. History of alcoholism was present in 11 patients (40.74%) where as that of smoking was present in 9 patients (33.3%). Risk factor like hypertension was present in 16 patients (59.3%). Only three of the 16 patients survived. The largest volume of the bleed survived was 76 ml in a 40 year old patient. The range of the volume of the bleed in survival group was 32 – 76 ml whereas that in mortality group was 31 – 113 ml.

The mean volume of the bleed present (16) was 31 ml (p = 0.0402 (Fischer exact test)).

The mean interval between ictus and the surgery was 42.5 hours. The mean interval in the mortality group was 47.18 hours and that of survival group was 34.6 hours (p = 0.5218). Though the time of intervention was early in the survival group there was no statistical difference between the two groups probably because of small numbers.

The mean volume of the bleed in all the patients was 68.51 ml. The mean volume of the bleed in the survival group was 53.5 ml whereas that of the mortality group was 77.35 ml (p = 0.0081). Patients with large volume (> 60 ml) of bleed were 16 in number (59.3%). Only three of the 16 patients survived. The largest volume of the bleed survived was 76 ml in a 40 year old patient. The range of the volume of the bleed in survival group was 32 – 76 ml whereas that in mortality group was 31 – 113 ml.

The average follow up of the patients was 4.2 months with range of 3 to 8 months. The GOS at 3 months was four in 5 patients and three in 4 patients and one in 1 patient. One patient had died at 2 ½ months time with cardiac failure.

**Discussion**

Intracerebral hemorrhage accounts for 10% to 15% of all intracranial hemorrhages. Studies

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cases of stroke and is associated with the highest mortality, with only 38% of affected patients surviving the first year [6]. Helweg-Larsen, et al. showed that the survival within 1 month in the hospital was 50% to 60% for patients with hematoma of the basal ganglia [6].

Brief review of literature was done regarding the various factors (Age, GCS, Volume of ICH, intraventricular haemorrhage) that affect the outcome in patients with BG bleed.

**Age:** Kanno, et al. noted a better long term outcome in younger patients (< 59 years) [7]. Similarly Kilincer, et al. concluded that age ≥ 60 years is a predictor of poor outcome [8]. In our study, 12 of the 15 patients (80%) with age of 50 years or more had mortality. Age more than 50 years is a poor prognostic factor in patients with basal ganglia bleed.

**GCS:** GCS was an important predictor of outcome in patients with ICH. This was confirmed by many authors (Table 2). Li, et al. in a retrospective study of surgical treatment for large spontaneous basal ganglia hemorrhage, concluded GCS ≤ 8 as the risk factor for unfavourable outcome [9]. Bhatia, et al. in his prospective study of in-hospital mortality and discharge outcome in spontaneous ICH concluded that low GCS (≤ 8) is an independent predictor of mortality [10]. Takeuchi, et al. in a retrospective study of large hemispheric hypertensive ICH, concluded that low preoperative GCS results in poor outcome [11]. In our study, there is significant statistical difference between mean GCS of survival group (8.3) and that of mortality group (7.58). GCS less than 8 is a poor prognostic factor in patients with basal ganglia bleed.

**Volume of ICH:** Volume of intracerebral hemorrhage was the strongest predictor of 30-day mortality for all locations of intracerebral hemorrhage [12]. They predicted 30 day mortality in a patient with GCS 8 or less with parenchymal hemorrhage volume of 60 ml or more on their initial computed tomogram to be 91%. Helweg-Larsen, et al. showed that the mortality of patients with ICH of 50 ml or more will be 90% [6]. Similarly, various authors studied and found hematoma volume of ICH as poor predictor of outcome (Table 3). In our study, 13 of the 16 patients (81.25%) with volume of bleed more than 60 ml had mortality. Volume more than 60 ml is a poor prognostic factor in patients with basal ganglia bleed. This is comparable to mortality rate noted in similar patients of other studies. However, nearly two-thirds of patients with ICH volume 30 - 60 ml could survive after surgery (Table 4).

**IVH:** Hallevi, et al. found that patients with IVH were twice as likely to have a poor outcome when compared to patients without IVH [28]. Bhata, et al. [10] and Nag, et al. [21]. Also concluded that presence of IVH is an independent predictor of mortality. Poor outcome was noted in patients with intraventricular extension by Narayan, et al. [25]. In the present study, the mortality rate in patients with intraventricular extension is 81.25% (13 of the 16 patients). Intraventricular extension is a poor prognostic factor in patients with basal ganglia bleed.

Decompressive Craniectomy without clot evacuation was shown to be effective in cases of ICH earlier. Earlier four studies including the present study was tabulated (Table 5). The present study along with Ramnarayan, et al. study were larger studies including patients with only basal ganglia bleed. The mortality was high in the present study due to large mean ICH volume (68.5 ml) and more percentage of patients with IVH (nearly 60%).

**Limitations**

This hospital-based single center study did not provide true prevalence of ICH in the community. Sample size was small and the follow-up period of three months allowed only short term outcome assessment. This study included only operative patients but not conservatively treated patients.

**Future scope**

Multicenter study can be done on large number of patients to define the guidelines and indications of surgery in patients of ICH. The Decompressive craniectomy can be compared to newer surgical procedures like endoscopic evacuation of hematoma particularly in large deep seated ICH.
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Conclusion

Large intracerebral hemorrhage is associated with high mortality and morbidity. Age of 50 years or more and GCS ≤ 8 at presentation are poor prognostic factors for decompressive craniectomy in patients with BG bleed. Patients with large BG bleed (ICH volume > 60 ml) and intraventricular extension will have poor outcome.

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