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Research Article

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

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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 dominancy, 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.

More Information

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Keywords: Large ICH; Outcome; Decompressive craniectomy; Surgery for ICH; Capsuloganglionic bleed; Basal ganglia bleed

Abbreviations: GCS: Glasgow Coma Scale; GOS: Glasgow Outcome Scale; BG Bleed: Basal Ganglia Bleed; ICH: Intracerebral Hematoma; CT: Computed Tomography; MRI: Magnetic Resonance Imaging; IVH: Intraventricular Hematoma

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.

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, preexisting 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 cm^3 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 19 patients (70.37%) where as diabetes mellitus was noted in 7 patients (25.9%). The details of all the 27 patients were given in table 1.

The range of pre-operative GCS is 5 – 11 with mean of 7.55. Twenty of the 27 patients (74%) are with the pre-operative GCS of ≤ 8. The pupillary asymmetry was present in 7 patients. The side of lesion was on right side in 16 patients and on the left side in 11 patients. The mean midline shift of all the patients was 9.45 mm. The range of midline shift was from 5 – 16 mm.

Mortality was noted in 17 out of 27 patients (63%) in 30 days. The survival group consists of 10 patients. The range of GCS in the survival group was 7 - 10 ml whereas that in the mortality group was 6 - 11 ml. The mean GCS in the survival group was 8.3 compared to the mean GCS of the mortality group of 7.58. The factors compared between survival and mortality group were shown in table 2.

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 where as 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

Table 1: Various factors and their comparison between survival group and mortality group.

	Survival group	Mortality group	*p* value
N = 27	10	17	-
Mean Age	46.5	53.7	0.0294 (student t test)
Mean GCS	8.3	7.12	0.0306 (student t test)
Pupillary asymmetry present (7)	3	4	1.0000 (Fischer exact test)
Left side of the lesion (11)	4	7	1.0000 (Fischer exact test)
Mean midline shift in mm	8.74	9.88	0.3279 (student t test)
Mean volume of the bleed in ml	53.5	77.35	0.0081 (student t test)
Intraventricular extension of the bleed present (16)	3	13	0.0402(Fischer exact test)

Table 2: Various studies which showed the significance of GCS and volume of ICH as outcome predictors.

GCS as predictor of poor outcome	Studies
≤ 8	Li [9], Bhatia [10], Broderick [12], Tuhrim [13], Yousuf [14]
< 8	Suthar [15], Nilsson [16], Present study
Volume as predictor of poor outcome	**Studies**
25 ml	Tshikwela [17]
30 ml	Hemphill III [18], Sia [19], Cho [20], Nag [21], Suthar [15], Celikbilek [22], Safatli (32 ml) [23]
40 ml	Franke [24]. Bhatia [10] (42 ml)
50 ml	Helweg-Larsen [6], Narayan [25], Li [9]
60 ml	Broderick [12], Nilsson [16], Yousuf [14], Zia [26], Lin & Howng [27], Present study

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 hemorrahge, 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 thatlow 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]. Bhatia, 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 intra ventricular 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%).

Table 3: The 30 day mortality rates of patients with small (< 30 ml), medium (30 – 60 ml) and large (> 60 ml) basal ganglia bleeds in various studies.

Data regarding deep/ basal ganglia bleeds	30 day mortality for volume < 30 ml	30 day mortality for volume 30 - 60 ml	30 day mortality for volume > 60 ml
Broderick et al. [12] USA	23%	64%	93%
Nilsson et al. [16] Sweden	30%	41%	77%
Yousuf et al. [14] Malaysia	12.9%	41.4%	63.0%
Present study	-	36.4%	81%

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.

Table 4: Studies with decompressive craniectomy without clot evacuation done for ICH.

Author	Study design	N	Age	Level of pre-operative consciousness	Hematoma location	No. of patients with IVH	Volume
Ramnarayan et al. [2]	Case series	23	31-68	GCS ≤ 8 (7)	Basal ganglia (23)	6	> 60 ml in 7 patients
Fung et al. [3]	Case control	12	48 (median)	8 (median)	Basal ganglia (5), lobar (7)	NA	61.25 ml (median)
Heuts et al. [4]	Prospective study	5	43 (mean)	7 (median)	Basal ganglia (3), lobar (2)	2	53 ml (median)
Esquenazi et al. [5]	uncontrolled retrospective series	10	48 (mean)	11 (mean)	Basal ganglia, deep lobar	NA	75 ml (mean)
Present study	Prospective study	27	51 (mean)	7.55 (mean)	Basal ganglia (27)	16	68.51 ml (mean)

Table 5:

serial no.	age in years	gender	pupillary asymmetry	side of the lesion	midline shift in mm	volume in ml	IVH	Hypertension	Diabetes mellitus	pre op gcs	interval between ictus and surgery	GOS at discharge
1	44	M	present	right	8	50	absent	yes	no	9	47	3
2	38	M	absent	right	16	113	absent	yes	no	5	7	1
3	65	M	absent	left	8	32	absent	yes	no	7	12	3
4	57	M	absent	right	10	86	absent	yes	no	8	246	1
5	56	M	present	left	8	41	present	yes	yes	8	74	1
6	41	M	present	right	10	62	present	no	no	9	8	3
7	70	M	absent	right	8	75	present	no	yes	6	7	1
8	47	F	absent	left	8	75	absent	yes	no	6	63	1
9	39	M	absent	right	13	62	present	yes	no	7	64	3
10	61	M	absent	left	14	86	present	yes	no	8	57	1
11	58	m	present	right	9	104	absent	yes	no	6	15	1
12	66	M	present	right	13	98	absent	no	no	6	35	1
13	53	F	absent	left	7	44	absent	yes	yes	10	20	3
14	49	M	absent	right	6	38	present	no	no	11	22	1
15	47	M	absent	right	5	54	absent	yes	no	8	18	3
16	46	M	absent	left	12	88	absent	yes	no	7	94	1
17	40	M	absent	right	13	60	present	yes	no	7	57	3
18	50	M	absent	right	13	70	present	yes	yes	6	15	1
19	55	M	present	left	8	60	present	yes	no	9	35	1
20	52	F	absent	right	5	31	present	yes	yes	7	20	1
21	44	M	present	right	8	56	absent	yes	no	9	81	3
22	52	M	absent	left	10	110	present	yes	no	6	10	1
23	40	M	absent	left	9.4	76	absent	no	no	9	15	3
24	56	M	absent	right	10	72	present	no	no	7	64	1
25	51	F	absent	right	7	92	absent	no	yes	7	12	1
26	52	F	absent	left	6	39	absent	no	yes	8	24	3
27	49	M	absent	left	11	76	present	yes	no	8	26	1

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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