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Research Article

A Comparative Study Between Decompressive Hemicraniectomy vs. Decompression with Hematoma Evacuation for Spontaneous Intracranial Hematomas Requiring Surgery in a Tertiary Care Center in Bengaluru, South India. Lessons for Rural Neurosurgeons

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Abstract

Objective: To assess the feasibility of plain decompressive hemicraniectomy in the treatment of spontaneous hypertensive intracranial bleeds as a low cost and low skill alternative for decompression and hematoma evacuation.

Methodology: A retrospective cohort analysis of all the spontaneous hypertensive bleeds operated in a tertiary care center in southern India was planned, and all surgical cases were analyzed and the mortality and morbidity difference between procedures employed were understood.

Results: Of the 36 patients operated with decompression with hematoma evacuation a high mortality rate of 26 cases was noticed (72.22%) which was significantly more than plain decompressive hemicraniectomy (8 deaths out of 20patients or 40%) was seen across all patients irrespective of preoperative GCS or comorbidities.

Conclusion: Decompressive hemicraniectomy is a viable alternative to decompression with hematoma evacuation. This is especially relevant in rural settings where expertise and equipment are in short supply and transport to higher centres implies a delay in surgery which is often associated with significant morbidity and mortality.

Keywords: Decompressive Hemicraniectomy; Decompression with Hematoma Evacuation; Spontaneous Intracranial Hematomas; Rural Neurosurgery

Introduction

Neurosurgical emergencies are time bound. The emergent nature of the disease along with sudden rise in intracranial pressure precipitate a crisis of existence for the organism. The problem is especially acutely felt in rural centres where the lack of facilities and expertise can hamper the delivery of efficient and timely neurosurgical care to patients who require it. The simple decompressive hemicraniectomy (DHC) is a simple procedure to decrease ICP and limit the damage to the brain while at the same time promote recovery and healing. It requires minimal expertise and minimal

facilities thereby making it the mainstay of neurosurgical emergencies.

We in this study attempted to retrospectively compare the efficacy and efficiency of this procedure with decompression with hematoma evacuation (DHE) which is practiced in centres with better facilities and expertise, to determine if DHC can be made a standard of care in rural areas to ensure timely and efficient treatment of neurosurgical emergencies such as Spontaneous intracerebral bleeds (SICH or ICH) without compromising on quality of care.

Materials and Methods

Data regarding all spontaneous Intracerebral hematomas (ICH) secondary to hypertension were collected retrospectively form the records in a tertiary care high volume centres in Bengaluru city, in south India. The patients and surgeries were collected for a period between 2018 and 2020. The data regarding demographics, Glasgow Coma Scale (GCS) pre and after surgery, distribution of bleed, Surgery, outcomes, deficits, and other parameters were tabulated and analyzed. Significance was tested by a chi square analysis. The data compiled, collated and analyzed is presented below.

Results

The preference of decompressive hemicraniectomy (DHC) vs hematoma evacuation (DHE) was left to the preference of the operating surgeon. The surgeons' experience varied from 4-5years post-graduation to trainees performing surgery under supervision. As the analysis is a retrospective one, control over types of surgery done could not be exercised. In our study 33.3% were simple DHC while a majority of the surgeries were DHE (60%) as shown in table 1.

Surgery	Number of patients	Percentage
Decompressive hemicraniectomy	20	33.3%
Decompressive hemicraniectomy with evacuation of ICH	36	60%
EVD placement	4	6.7%

Table 1: Percentage of surgeries done for ICH.

Surgeries were done only for GCS of patients being less than 9, justifying an increased ICP precipitating herniation of the brain parenchyma. Surgery was also not encouraged for GCS less than 5 as such a low GCS implied that herniation was already underway thereby making prognosis for these patient's bleak. 16 surgeries out of 60 were for GCS of 5 and below. Extraneous circumstances such as young age of the patient, insistence of relatives and sudden deterioration of the patient while in the ICU were considered for the above-mentioned procedures. Along with these 2 surgeries External Ventricular Drain placement was also done for certain cases where secondary intraventricular hemorrhage was present leading to obstructive hydrocephalus. The details can be seen in table 2. Left sided and right sided bleeds were approximately in equal number as demonstrated in table 3. Left sided bleeds add to the final morbidity due to the damage to speech (dominant hemisphere) long term morbidity is thus appropriately higher.

Surgery	GCS 4	GCS 5	GCS 6	GCS 7	GCS 8	GCS 9	Total
Decompressive Hemicraniectomy	0	2	2	0	8	8	20
Decompressive hemicraniectomy with evacuation of ICH	6	8	10	4	6	2	36
EVD placement	0	0	0	2	2	0	4

Table 2: Correlation between surgery done and GCS of the patient.

Surgery	Right side	Left side	Total
Decompressive Hemicraniectomy	8	12	20
Decompressive hemicraniectomy with evacuation of ICH	16	20	36
EVD placement	4	0	4
Total	28	32	60

Table 3: Location of the hematoma vs. type of surgery done.

When mortality is considered, DHE seems to have a higher mortality than simple DHC, with a chi-square statistic of 5.5967 with the p-value of 0.017995 showing significance. The data is shown in table 4, and in figure 1. Most of the mortality occurred with patients who presented with a preoperative midline shift of 10mm or worse. The midline shifts were measured on CT scans of the brain using standard measurement techniques (Table 5 and figure 2).

Surgery	Mortality	Discharged	Total
Decompressive Hemicraniectomy	8	12	20
Decompressive hemicraniectomy with evacuation of ICH	26	10	36
EVD placement	0	4	4
Total	34	26	60

Table 4: Mortality of each respective procedure showing a significant difference between DHC and DHE.

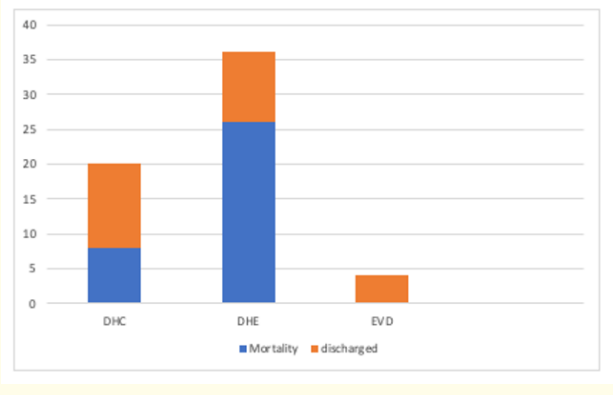

Figure 1: Mortality per procedure done showing marked increase in mortality in patients undergoing DHE as compared to DHC and EVD procedures.

Midline shift	Decompressive hemicraniectomy		Decompressive hemicraniectomy with hematoma evacuation		EVD placement	
	Death	Discharged	Death	Discharged	Death	Dis-charged
0-5mm	0	0	0	0	0	4
6-10mm	2	10	4	6	0	0
11-15mm	6	2	16	6	0	0
16-20mm	0	0	4	0	0	0

Table 5: Correlation between midline shift and mortality for spontaneous ICH presented for each different surgery type employed.

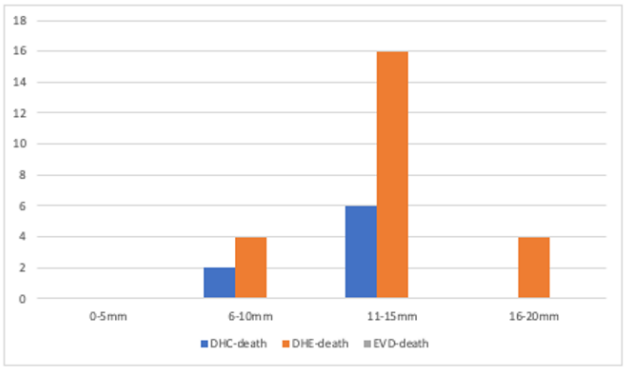

Figure 2: Correlation between midline shift measured on a preoperative CT scan and mortality of the patients operated by either procedure.

Discussion

The management of supratentorial bleeds is still controversial today. ICP elevation caused by these bleeds is by various methods [1]. The first and most obvious is by the additional volume of the hematoma which is capable of expansion, especially in the first 24 hours, to the already tightly balanced equilibrium in the cranial cavity overwhelming the cerebral autoregulatory mechanism [1,2]. Coupled with this, osmotically active proteins in the blood activate vasogenic oedema in the surrounding brain parenchyma with 60-75% of patients experiencing substantial increase in perilesional oedema in the first 24 hours [1,2]. The third cause of increase ICP ironically is surgical hematoma evacuation which can cause tissue manipulation and venous obstruction due to coagulation of venous channels during surgery [1,2].

To overcome these problems, a simple decompressive craniectomy may achieve appropriate ICP reduction by directing the vector of oedema away from the sensitive midline structures such as mesencephalon and diencephalon, laterally towards the calvarial bone defect. Thus, with the resultant increase in intracranial perfusion, cerebral herniation is prevented, and death averted, as proscribed by many trials [3,4].

The advent of the publication of the results of the STITCH trials have made surgery for ICH less common, although there is reluctant acknowledgement of the fact that ICH patients with potential

herniation will benefit from ICP reduction through surgery [4,5]. Much research has therefore gone into techniques that minimally disrupt the intact normal brain, but extract the hematoma leaving a brain with reduced ICP along with minimal damage to ensure minimal deficit post procedure [5-8]. Techniques such as endoscopic evacuation of hematoma, stereotactic aspiration etc. while novel and applicable in theory are perhaps more applicable to deep seated bleeds where access through open surgery is tough and damaging to normal brain structures [6].

The crux of the discussion is however that no procedure either minimally invasive or otherwise has been shown to achieve greater brain function preservation in comparison to each other [7-9]. Thus, treatment protocols while helpful only form broad based guidelines to management of ICH [10]. Individualization of the treatment options for each patient measuring the extent of the bleed, the nature of the ICP as well as risk factors of the patient which contribute in no small way to the overall morbidity and mortality of the patient [11].

The current study only includes surgically relevant ICHs where decompression was indicated in preventing herniation and death [11]. In this category of patients, a comparison was made between plain decompressive craniectomy and hematoma evacuation with decompression to determine the best surgery for these bleeds [11,12]. The results state clearly, that while mortality has been reduced appreciably, morbidity remains a major challenge in long term care for patients with ICH. No appreciable difference was seen in the recovery, duration of hospital stays or complications between the procedures [11,12]. Hematoma evacuation however took much longer to perform in the operation theatre, and was more technically demanding, needing more experienced surgeons to handle the cases. Thus, smaller centres with less experienced surgeons could just proceed with a decompressive craniectomy without hematoma evacuation knowing that the surgery they offer would probably allow their patients the same chances of survival and improvement as hematoma evacuation done in higher centres [12]. Thus, rural, and poorly equipped centres can still offer correct and efficient emergency care that corresponds ethically and evidentially to the highest standards of care without worrying about expensive investments in training and material.

Conclusion

Decompressive hemicraniectomy with or without hematoma evacuation offers no difference in benefit to the patient. Hence centres with minimal facilities and limited experience and expertise can offer plain decompression to patients of ICH knowing that the treatment they offer will not in any way compromise the recovery of the patient in any meaningful way.

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