ORIGINAL ARTICLE

Decompressive Craniotomy and Duraplasty in Patients of Traumatic Bifrontal Contusions

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ABSTRACT

Objective — *To find the outcome of bifrontal decompression craniotomy (DC) for the treatment of traumatic bifrontal contusions.*

Study design — *Descriptive case series.*

Place & Duration of study — *Department of Neurosurgery Jinnah Postgraduate Medical Center (JPMC) Karachi, from January 2011 to March 2014.*

Methodology — *This study included patients with bifrontal contusions secondary to trauma admitted through A&E department, aged between 14 year to 60 year with confirmation on CT scan having Glasgow Coma Scale (GCS) scores between 6-12. Patients who were unfit for surgery or anesthesia and those with coagulation disorders, were excluded. Patients underwent bifrontal DC with evacuation of contusions followed by duraplasty. The age, gender, preoperative size of the contusion, GCS on admission, postoperative complications and Glasgow Outcome Scale (GOS) score after 6 months of surgery were recorded.*

Results — *This study was conducted on 50 patients. Trauma was the commonest type of injury in 43 (86%) cases. Mostly patients were males (84%). Majority of patients were between 21 year and 40 year of age. The GCS score before surgery in these patients was 9 in 13 (26%) patients, 10 in 16 (32%) patients, 11 in 11 (22%) patients, 12 in 6 (12%) and 13 in 4 (8%) patients. The most common size of contusions was 4 and 5 cms, both on right and left side. Of these, none of the patients required reoperation. Three died after aspiration within the postoperative time span of day 5-7. Good recovery was seen in 40 (80%) patients, moderate disability in 6(12%), severe disability in 1 (2%), persistent vegetative state in 2 (4%) and death in 1 (2%) patient.*

Conclusion — *This study showed feasibility and efficacy of DC in bifrontal brain contusions secondary to traumatic brain injury (TBI) with good outcome.*

Key words — *Decompressive craniotomy, Bifrontal contusions, Glasgow Coma Scale score.*

INTRODUCTION:

Decompressive craniotomy is a surgical method performed to immediately reduce intracranial pressure. It is usually indicated in cases of brain contusions and acute subdural hematoma. It has been used for non traumatic lesions as well, in order to accommodate the swollen brain. It consists of a unilateral or bilateral craniotomy with dural augmentation. The bone can be temporarily stored in the abdominal subcutaneous tissue or can be disposed in case of a subsequent cranioplasty (with methylmethacrylate or titanium plate, among other materials).[1]

DC has regained some therapeutic interest during the past decade.[2] However, treatment guidelines for traumatic brain injury from European Brain Injury Consortium, North-American Brain Trauma

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Foundation and International Pediatric Neurosurgery Society consider DC only as a last resort treatment strategy after failure of conservative therapy.[3-5] Due to poor record keeping and significant under-reporting, the magnitude of the problem does not receive sufficient recognition by health policy planners or indeed as an imperative to the development of preventative strategies.[6] This study aimed to present our experience of patients managed surgically with DC.

METHODOLOGY:

This study included patients of bifrontal contusions with severe cerebral edema secondary to trauma. They were admitted through A & E department of JPMC Karachi from January 2011 to March 2014, with CT scan findings of severe intracranial hypertension and edema. Patients who were unfit for surgery or anesthesia and those with coagulation disorders, were excluded. All patients underwent bifrontal DC with duraplasty. This procedure was performed with bicoronal skin incision and both frontal bones were removed as a single piece. The posterior limit of the bone flap removal was up to 2-3 cm behind the coronal suture. After evacuation of contusion, duraplasty was done. The age, gender, preoperative size of the contusion, GCS score on admission, postoperative complications and GOS score after 6 months of surgery were noted (table I). The statistical analysis was done using SPSS version 20.

RESULTS:

The study included 50 patients with the GCS between 6-13. The age ranged from 14 year to 50 year. Trauma was the commonest type of injury in 43(86%) patients. Majority of the patients were males (84%). Most of the patients (n=37) were between 21 year to 40 year of age. Road traffic accidents (RTA) and assaults were the most common etiology in this age group (table II)). The preoperative GCS score was 9 in 13 (26%) patients. The most common size of contusion was between 4 and 5cms.

None of the patients required reoperation. In one patient DC was prematurely stopped due to intraoperative hypotension and bradycardia. Postoperatively complications occurred were hydrocephalus in (10 %), hygroma (6 %) and wound infection (10%). One (2%) patient died after aspiration. Good recovery was seen in 40 (80%)

Table I: GOS in Patients with Head Injury

Level	Term	Definition
1	Dead	No Life
2	Vegetative state	Unaware of self and environment
3	Severe Disability	Unable to live independently
4	Moderate Disability	Able to live independently
5	Mild Disability	Able to return to work/ school

Table II: Age and Mode of Injury (n=50)

No. of Cases	Age (Year)	Assault	Fall	RTA
8	0 – 20	0	1	2
37	21 – 40	3	1	33
5	41 - 60	0	3	2
50	Total	3	4	43

Table III: GOS After 6 Months (n= 50)

No of Patients	%
44	88
2	4
1	2
2	4
1	2

patients, moderate disability found in 6 (12%) patients and severe disability in 1 (2%) patient (table III).

DISCUSSION:

Traumatic brain injury (TBI) is one of the leading causes for morbidity, mortality and economic loss. The impact is much worse in developing countries like Pakistan.[7] This may also result in temporary or permanent disability.[8] These are more common in male population as reflected also in our study.[9] They are more vulnerable to road traffic accidents. RTA is the most common cause of head injury.[9] By far, the most important complication of TBI is the development of an intracranial hematoma, which complicates 25% to 45% of severe TBI cases, 3% to 12% of moderate TBI cases and approximately 1 in 500 patients with mild TBI.[10] Without effective surgical management, an intracranial hematoma may transform, an otherwise benign clinical course with the expectation of recovery, to a situation in which death or permanent vegetative survival will occur. Moreover, prolonged delay in diagnosis or evacuation of an intracranial hematoma may produce a similar result.

The mass effect of an area of contusion is conventionally considered to result from a combination of vasogenic and cytotoxic edema. Vasogenic edema results from the breakdown of the blood brain barrier and extracellular fluid extravasation, while cytotoxic edema results from hypoxic insult resulting in membrane pump failure and cellular swelling. The early swelling around a contusion, occurring within first 24 hours, is often life threatening and cannot be explained by either of these factors. Vasogenic edema sets in only after 12-24 hours. Cytotoxic edema can occur early, but the quantum of cytotoxic edema is insufficient to explain the mass effect that is clinically encountered.[11] For these reasons, the impact that neurosurgeons can have on the care of such patients is enormous, and perhaps, more than in any other area of emergency medicine. The aggressiveness and rapidity with which care is provided for an intracranial hematoma will determine the outcome.[12]

The management of malignant posttraumatic cerebral edema remains a frustrating endeavor for the neurosurgeons. Mortality and morbidity rates remain high despite refinements in medical and pharmacological means of controlling elevated intracranial pressure.[13] Clinical reports showed that early DC for the patients with severe cerebral edema due to head trauma achieved good outcomes, preventing secondary worsening factors of cerebral edema. However, in case that bone flap was removed by DC, brain was escaped to the region of skull defects, which may cause severe compression at peripheral brain region and cerebral edema due to obstruction of venous circulation and then cranioplasty needed at later date. Modified DC has some advantages, such as minimization of increasing intracranial pressure and no need of delayed cranioplasty. On the other hand, DC can reduce morbidity and mortality in critically ill patients with massive ischemic infarction and severe head injury.[14]

Initially, formal craniotomies were done by using bicoronal incision, eversion of frontal region scalp, removal of both frontal bones in two separate pieces leaving median bony stripe over superior saggital sinus. Leaving bone stripped over superior saggital sinus helped a lot in creating room for aggressive expanding edematous brain but it was found not sufficient to the required level. Sooner it was realized that created room for expending brain was not sufficient to meet the demands by making bicoronal incision. Finally it was concluded that there are two hindrances: one the left over bony strip over superior saggital sinus and other was incision itself. The incision making in our procedure was little bit different. It was made at 20-30 degree away from coronal suture towards parietal region (modified bicoronal incision). Majority of the patients showed good outcome after surgery. Huang APH et al also reported DC as safe and effective primary surgical intervention for treatment of hemorrhagic contusion.[15]

Subdural hygroma, contusion/ hematoma progression, intracranial infection, new contralateral extraaxial hematoma, hydrocephalus, bone flap resorption, reoperation (excluding cranioplasty), CSF leak have been described as the complications following DC.[16] Subdural effusions, hydrocephalus and infection were the complications noted in our set of patients. Most authors favor a mechanism of altered CSF dynamics to account for the occurrence of hygromas, others have suggested that increased cerebral perfusion pressure that accompanies DC may play a role.[17] DC has been identified as a risk factor for CSF alterations and development of posttraumatic hydrocephalus. This development is associated with poor outcome following TBI.[18] Relatively, few patients require ventriculoperitoneal shunt treatment before the bone flap is replaced. Ventriculoperitoneal shunt treatment of hydrocephalus in the setting of a large cranial defect, may increase the risk of neurological deterioration consistent with a paradoxical herniation phenomenon.[19]

There are several factors associated with DC that should can lead to a higher rate of infection than with standard craniotomy for general neurosurgical procedures. These postoperative infections can increase morbidity and mortality. Staph. epidermidis, which is a major inhabitant of the skin, has been reported to be the pathogen most commonly associated with postoperative infections and meticulous clean skin preparation and prophylactic antibiotics are important for preventing these infections.

CONCLUSIONS:

DC is feasible and effective procedure for bifrontal brain contusions secondary to TBI. The operative technique used has the advantages such as decompressive effect, immediate reduction of intracranial pressure to its normal levels, thus improving clinical outcome. The immediate postoperative complications, morbidity and mortality rate were also low.

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