

Assess Management and Outcome of Patients with Traumatic Bifrontal Contusion

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Abstract: Background: Cerebral contusions involving the frontal lobes are important from the management point of view as sudden deterioration can occur in such patients at any point of time during the course of treatment. Objective: The purpose of this study is to assess the outcome in patients with bifrontal contusions & compare the conservative vs. surgical treatment. Material & methods: The clinical course of 100 head injury patients in whom CT had shown bifrontal contusion admitted between June 2017 to March 2019 to our hospital, were prospectively analyzed. Results: Early intervention was done in 24 patients of which 12 patients having contusion volume $>50\text{cm}^3$ and 12 patients having contusion volume $>35\text{cm}^3 < 50\text{cm}^3$ with GCS score of 6-8. Repeat CT scan was done in 35 patients showing neurological deterioration (\downarrow 2 points in GCS) or not showing neurological improvement within 48 hrs. Out of these 35 patients, 19 patients were seen having increase in contusion volume & were undergone delayed surgical intervention. Total 10 deaths were observed of which four deaths were observed in post op period. Four patients died due to rapid deterioration within 24 hours of admission. Two patients died after 7 days with GCS 9-13 who were conservatively managed with contusion volume $< 20\text{cm}^3$. Mean value of hospital stay in early intervention was 8.46 ± 2.9 days and in late intervention was 11.58 ± 2.46 days. Both sudden & delayed deterioration complicated the clinical course of this disease with both increased mortality & morbidity in bilateral lesions. Conclusion: The management of a patient with bifrontal contusion is more difficult than a patient with contusions of other area of brain & intracranial hematomas as the bifrontal region is a silent area of brain and the quantum of injury, features of raised intracranial pressure are not clinically evident.

Keywords: Bifrontal, Contusion, Early & delayed, Surgical intervention

1. Introduction

Cerebral contusions frequently involve the frontal lobes where the brain tissue comes in contact with the irregular bony surface of the anterior cranial fossa due to the relative motion of the brain & skull at these sites. Bifrontal contusions often are observed in contrecoup head injuries such as traffic accidents and falling.^[1] These are dynamic lesions that evolve with time which may show progressive or sudden deterioration. Sudden deterioration is especially seen in this region & more so when the lesions are bilateral. These lesions are important from the management point of view as sudden deterioration can occur in such patients at any point of time during the course of treatment as the lesions are in the same axis & their close proximity to the brainstem. Patients with these lesions were managed either conservatively or surgically taking into account the size of the contusion, signs of mass effect on radiological basis & neurological status at the time of presentation. We mainly focused on mode of injury, clinical presentation, diagnosis and the intensive management, in traumatic bifrontal contusion. The purpose of this study is to assess the outcome in patients with bifrontal contusions & compare the conservative vs. surgical treatment in patients presenting with smaller contusions and moderate Glasgow coma scale (GCS) score.

2. Material & Methods

The clinical records of all patients with traumatic brain injury (TBI) having only bifrontal contusion confirmed by Computed Tomography (CT) scan admitted between June 2017 to March 2019 to our hospital, were prospectively

analyzed. All the patients were transferred from the intensive care unit after initial resuscitation. Initial decision for conservative or surgical intervention was taken on the basis of guidelines described in Text book Youmans Neurological Surgery.^[2] Early surgery was done in patients with contusion volume $> 50\text{cm}^3$ regardless of GCS or frontal contusion greater than 20cm^3 with a midline shift of 5mm or cisternal compression in CT scan with GCS 6-8. Rests of the patients were observed with conservative treatment. Surgical management done was Bifrontal craniotomy leaving a strip of bone over the superior sagittal sinus with contusectomy and lax duraplasty. The patients with age < 18 yrs, penetrating injury, brainstem injury, hemodynamic instability, Pregnancy or lactation, other associated injuries and history of prior neurologic disease or disability were excluded. Invasive intra cranial pressure (ICP) monitoring was not done. Instead of ICP monitoring we did repeat CT scan in patients showing neurological deterioration (Decrease 2 points in GCS) or not showing neurological improvement within 48 hrs. Delayed surgery was done in patients whose repeat CT showed increased in contusion volume $35 - 45\text{cm}^3$. The following clinical parameters were recorded – demographic data, time from injury to primary surgical intervention, preoperative GCS, mode of injury, time of deterioration, duration of hospital stay and Glasgow outcome score and GCS at discharge and at 1 month. Preoperative non-contrast CT scans were reviewed for contusion volume, cisternal compression, mass effect and midline shift. Postoperative CT scans were reviewed for any residual contusion, mass effect, midline shift or complication.

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3. Results

There were total 3149 patients of brain contusions of different region who were treated in this period out of which 100(3.1%) patients having only bifrontal contusion included in the study. Majority of the patients were in the age group of 21–40yrs. The commonest mode of injury was fall from moving vehicle in 74% patients followed, fall from height in 22% patients & assault in 4% patients. The male to female ratio was 7.3:1. Majority (94%) of patients had LOC, 24% of patients was suffering from vomiting and only 4% of patients had seizure and ENT bleed each. Motor deficient i.e. hemiplegia was present in very few patients (9%) on admission. Pupil was abnormal in 6% of patients. 60% of patients had skull bone fracture in occipital bone, and 9% had skull bone fracture in frontal bone. Early intervention was done in 24 patients of which 12 patients having contusion volume $>50\text{cm}^3$ and 12 patients having contusion volume $>35\text{cm}^3 < 50\text{cm}^3$ with GCS score of 6-8. Repeat CT scan was done in 35 patients showing neurological deterioration (\downarrow 2 points in GCS) or not showing neurological improvement within 48 hrs. Out of these 35 patients, 19 patients were seen having increase in contusion volume & were undergone delayed surgical intervention. Total 10 deaths were observed of which four deaths were observed in post op period. Four patients died due to rapid deterioration within 24 hours of admission. Two patients died after 7 days with GCS 9-13 who were conservatively managed with contusion volume $< 20\text{cm}^3$. Mean value of hospital stay in early intervention was 8.46 ± 2.9 days and in late intervention was 11.58 ± 2.46 days. At the end of one month, out of 90 alive patients who were either managed conservatively or underwent surgery, complications were seen in 14 patients with 5 patients suffered from hydrocephalus and subdural hygroma each and 2 patients suffered from chronic subdural hematomas and cerebrospinal fluid rhinorrhea each. In this study, majority of patients had good outcome on discharge (55%) and at the end of one month (61%).

4. Discussion

Contusive injury to the brain invariably is complicated by secondary injury due to microvascular dysfunction,^[3] which worsens with time and leads to growth or expansion of the primary lesion. Microvascular dysfunction has numerous causes and correlates, including endothelial swelling, vasoconstriction, vasospasm, and occlusion due to platelet and leukocyte aggregation and adhesion. Cerebral cortical contusions are the most common computed tomographic (CT) finding in head injured patients, but only few need operative treatment.^[4] The extravasated blood from the primary contusion, the edema, and the additional extravasated blood resulting from hemorrhagic progression of contusion together produce mass effect, which compresses adjacent healthy tissues, and if unchecked, leads to further ischemia. Together, these processes raise intracranial pressure (ICP), may cause herniation syndromes, and may necessitate surgical decompression to prevent death. Anterior skull base is frequently injured following head injuries & brain contusions are common sequelae of traumatic brain injury (TBI) at this area. Cerebral contusions are dynamic lesions that evolve with time which may show

progressive or sudden deterioration. Sudden deterioration is especially seen in bifrontal region & more severe when the lesions are bilateral.^[2] Four of our patients died due to sudden deterioration (< 24 hrs of admission) who was admitted with GCS 14/15. This may be because shift (progression of contusion) is antero-posterior rather than lateral, so that the classical “warning” lateralising signs develop very much later.^[4] It is recommended that patients with GCS 8 or less, contusion greater than 20cm^3 , midline shift of 5 mm or more, cisternal compression on CT scan and any lesion greater than 50cm^3 must be treated surgically.^[5,6] Likewise we have operated 24 patients who are fitting into these criteria but 35 patients who were having lesser contusion volume & better GCS manage conservatively, later clinically deteriorated out of which 19 patients had undergone delayed operation due to increase in contusion volume radiologically. Thus we will emphasize early surgical intervention in bifrontal contusion with volume of $20\text{cm}^3 - 35\text{cm}^3$ regardless of GCS (in contrast to 50cm^3). This is particularly true when ICP monitoring, enough ICU back up & proper monitoring of patients in wards for conservative management are not possible. The patients most likely to develop raised ICP are those with extensive bifrontal contusions, but an ICP of less than 30 mm of Hg in the first few days after injury does not exclude later deterioration.^[4] Four of our patients died after 7 days, therefore if ICP monitoring is used, it may be needed for several days which increase the risk of complications. Some authors describe a less invasive predictor of the patient's clinical course with quantitative blood flow determination by Xenon enhanced CT in GCS greater than eight to prevent clinically undetected deterioration from central herniation.^[8] Brain swelling in a contused area is commonly seen and is often a common cause of neurological deterioration leading to death. There are three phases of brain swelling due to contusion. The ultra-early phase occurs within first 24 h and is often the cause of clinical deterioration or death. The second phase occurs after 24-72 hrs and progresses for 7-10 days.^[11] The standard surgical treatment for hemorrhagic contusion is craniotomy with evacuation of contusions. But this procedure is less effective when brain injury is diffuse and with severely raised intracranial pressure resulting from brain edema.^[12,13] In decompressive craniectomy followed by contusectomy patients had higher average GOS as compare to only craniotomy followed by contusectomy. Decompressive craniotomy is a better option in comparison to limited craniotomy with lesion evacuation to reduce raised intracranial pressure in these patients.^[14,15] Moreover, brain lobectomy or contusectomy along with decompressive craniotomy is a useful adjuvant in the management of severe head injury with contusion larger than 20cm^3 . Aggressive management of brain contusion can lead to better outcome.^[16] Mean value of hospital stay in early intervention was 8.46 ± 2.9 days and in late intervention was 11.58 ± 2.46 days.

5. Conclusion

The management of a patient with bifrontal contusion is more difficult than a patient with contusions of other area of brain & intracranial hematomas as the bifrontal region is a silent area of brain and the quantum of injury, features of raised intracranial pressure are not clinically evident. These

lesions always need special attention as sudden & rapid deterioration is the rule if intervention is not undertaken in proper time. Prompt and early recognition of the signs of deterioration, decision for early intervention (contusion with volume 20cm³ - 35cm³) regardless of GCS can help improve the outcome in such patients. Bilateral cases are more prone for clinical deterioration & poor outcome. Decompressive Craniectomy 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.

6. Limitations of the Study

The study could not reveal the relationship between the timing of surgery and the prognosis.

ICP monitoring was not taken as a part of management. There was lack of control group.

Furthermore, we did not compare different management algorithms in treating these patients. For example, it is unclear if prophylactic intubation and sedation or other form of escalation of therapy (scheduled mannitol rather than hypertonic saline, paralysis, etc.) would have achieved similar clinical outcomes without the need for decompressive surgery.

Clearly, these questions and others can only be answered with larger series with a control group, preferably in a randomized fashion

<i>Characteristic of patients</i>	<i>No. of Patients</i>
Gender	
Male	78
Female	22
Admission GCS Score	
Mild	56
Moderate	16
Severe	28
Mode of Injury	
Road Traffic Accident (RTA)	74
Fall From Height	22
Assault	04
Bone Fracture	
Occipital	60
Frontal	09
Contusion Volume	
≤ 20cm ³	27
21 cm ³ - 35cm ³	47
36 cm ³ - 50 cm ³	12
>50 cm ³	14
Intervention	
Early	24
Late	19
Length of stay	
Early	8.46 ± 2.9 days
Late	11.58 ± 2.46 days
GOS at 1month	
Good	61
Poor	29
Mortality	10

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