

OUTCOME ANALYSIS OF BASIFRONTAL CONTUSION IN A TERTIARY CARE TRAUMA CENTRE

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ABSTRACT

Background: Basifrontal contusions are common focal parenchymal injuries following traumatic brain injury (TBI), resulting from impact of the frontal lobes against the irregular anterior cranial fossa. Though often considered benign, these contusions can lead to sudden neurological deterioration, particularly when bilateral or associated with contusion expansion. The objective is to evaluate clinical presentation, management strategies, and outcomes of patients presenting with basifrontal contusions at a tertiary care center. **Materials and Methods:** A prospective observational study was conducted on 54 patients with radiologically confirmed basifrontal contusions admitted to Thanjavur Medical College Hospital between January 2025 and December 2025. Clinical parameters, radiological features, management (conservative vs surgical), timing of surgery, and outcomes were analyzed. **Result:** Of the 54 patients, 45 were male and 9 female. Road traffic accidents were the commonest mechanism (79.6%). Unilateral basifrontal contusions were observed in 33 patients, while 21 had bilateral involvement. Twelve patients underwent surgical intervention. Overall mortality was 27.8%, with significantly higher mortality among patients with bilateral contusions and delayed surgery (>24 hours). **Conclusion:** Bilateral basifrontal contusions and delayed surgical intervention are associated with higher mortality. Early surgical decompression in selected patients with severe head injury improves survival. Basifrontal contusions should be managed with vigilant monitoring and timely intervention.

INTRODUCTION

Traumatic brain injury (TBI) remains a major cause of morbidity and mortality worldwide, particularly in developing countries where road traffic accidents are increasing rapidly.^[1] Among focal parenchymal injuries, cerebral contusions represent a common pathological entity, with the frontal and temporal lobes being most frequently affected.^[2]

Basifrontal contusions occur due to the anatomical vulnerability of the inferior frontal lobes, which impact against the irregular bony surfaces of the anterior cranial fossa, including the orbital plates, sphenoid ridge, and crista galli.^[3] These injuries are typically caused by acceleration–deceleration forces and may present with minimal initial symptoms, leading to underestimation of their severity.

Despite being perceived as relatively benign, basifrontal contusions are clinically significant due to their propensity for hemorrhagic progression, cerebral edema, and sudden neurological deterioration.^[4] Bilateral involvement further

increases the risk of raised intracranial pressure and mortality. Moreover, long-term neurobehavioral sequelae such as personality changes, executive dysfunction, anosmia, and memory impairment are commonly observed.^[5]

There is limited institutional data from India regarding the natural history and management outcomes of basifrontal contusions. This study aims to analyze our institutional experience and identify prognostic factors influencing outcome.

Objectives

1. To study the clinical and radiological profile of patients with basifrontal contusions
2. To evaluate management strategies and timing of surgical intervention
3. To assess outcome and mortality predictors

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Setting: Department of Neurosurgery, Thanjavur Medical College Hospital, Tamil Nadu, India.

Study Period: January 2025 to December 2025.

Study Population: Fifty-four consecutive patients with CT-confirmed basifrontal contusions were included.

Inclusion Criteria

- Age \geq 18 years
- Radiologically proven unilateral or bilateral basifrontal contusion
- TBI due to blunt trauma

Exclusion Criteria

- Penetrating brain injury
- Associated major intracranial hematomas requiring immediate surgery
- Polytrauma with non-survivable injuries

Data Collection: Clinical parameters recorded included age, sex, mechanism of injury, Glasgow Coma Scale (GCS) at admission, and neurological status. Radiological variables included laterality, contusion volume, and progression on serial CT scans.

The following clinical parameters were recorded – demographic data, time from injury to primary surgical intervention, preoperative GCS, unilateral/bilateral lesion, mechanism of injury, time of deterioration, and Glasgow outcome score at discharge. Preoperative non-contrast CT scans were reviewed for contusion volume, associated lesions like subdural hemorrhage, subarachnoid hemorrhage, mass effect and midline shift. Postoperative CT scans were reviewed for any residual contusion, mass effect or midline shift. Post-operative complications, duration of hospital stay and GCS at discharge were also recorded.

Management Protocol: Patients were managed either conservatively or surgically based on neurological status, CT findings, and intracranial pressure parameters. Surgical intervention included unilateral or bifrontal craniectomy with contusion evacuation and duraplasty.

Initial decision for conservative or surgical intervention was taken on the basis of guidelines

described in Text book Youmans Neurological Surgery (6th edition). Early surgery was done in patients with contusion volume $>$ 50 cm³ regardless of GCS or frontal contusion greater than 20cm³ with a midline shift of 5mm or cisternal compression in CT scan with GCS 6-8. Rest of the patients were observed with conservative treatment. Surgical management done were Bifrontal-decompressive craniectomy with contusectomy and lax duraplasty, The surgical procedure adopted was according to the radiological features & surgeon's discretion. Invasive intra cranial pressure (ICP) monitoring was not done & instead repeat CT scan was done 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 cm³.

Outcome Measures: Primary outcome was survival. Secondary outcomes included relationship between laterality, timing of surgery, and mortality.

RESULTS

Of the 54 patients, 45 were male and 9 female. Majority of the patients were in the age group of 40 – 49 yrs followed by 20 -29 yrs. The commonest mode of injury was road traffic accident 43 (79.6%) fall from moving vehicle in 8(15%) patients followed by assault in 2(4%) patients. Bilateral basifrontal contusion was encountered in 21 patients whereas unilateral lesion in 33 patients. [Table 1].

CT scan-based assessment of contusion volume and laterality showed unilateral contusion in 33 patients and bilateral contusion in 21 patients. Early intervention was done in 12 patients of which 9 patients having contusion volume $>$ 50cm³ and 13 patients having contusion volume $>$ 35cm³ to $<$ 50cm³ with GCS score of 6-8. [Table 3] The time from injury to primary surgical intervention ranged from 8 hrs to 23 hrs in 9 cases ,3 cases had delayed intervention [Table 4] Outcome analysis showing higher mortality among bilateral basifrontal contusions and operated cases with delayed intervention [Table 5] Patients with moderate and severe head injury based on GCS had higher mortality than the patients with good GCS [Table 6]

Table 1: Demographic Characteristics and Injury Profile (n = 54)

Variable	Number of Patients (n)	Percentage (%)
Sex		
Male	45	83.3
Female	9	16.7
Mode of Injury		
Road traffic accident	43	79.6
Fall	8	14.8
Assault	2	3.7
Others	1	1.9
Laterality of Contusion		
Unilateral	33	61.1
Bilateral	21	38.9

Table 2: Glasgow Coma Scale (GCS) at Admission

GCS Category	GCS Score	Number of Patients	Percentage (%)
Mild	13–15	35	64.8
Moderate	9–12	6	1.1
Severe	≤8	13	24.1

Table 3: Radiological Characteristics of Basifrontal Contusions

Radiological Variable	Number of Patients	Percentage (%)
Contusion Volume		
< 30 ml	35	64.8
30–50 ml	13	24.1
> 50 ml	6	1.1
Laterality		
Unilateral	33	61
Bilateral	21	39

Table 4: Management Strategy and Timing of Surgery

Parameter	Number of Patients	Percentage (%)
Conservative management	42	78
Surgical management	12	22
Timing of Surgery		
< 24 hours	9	75
> 24 hours	3	25

Table 5: Outcome Based on Laterality and Surgical Intervention

Variable	Survived (%)	Death (%)	Total	P value
Unilateral contusion	30	3	33	0.01*
Bilateral contusion	9	12	21	
Total	39	15	54	
Operated patients	Survived (%)	Death (%)	Total	0.02*
– Unilateral	4	1	5	
– Bilateral	1	6	7	
Total	5	7	12	

*P value <0.05 Significant using chi square Test

Table 6: Outcome of Operated Patients According to Severity

Severity (GCS)	Survived (%)	Expired (%)	Total	P value
Mild	1 (14)	1(20)	2	0.84 (NS)
Moderate	2 (28)	2 (40)	4	
Severe	4 (58)	2 (40)	6	
Total	7	5	12	

P value >0.05 Not significant using chi square Test

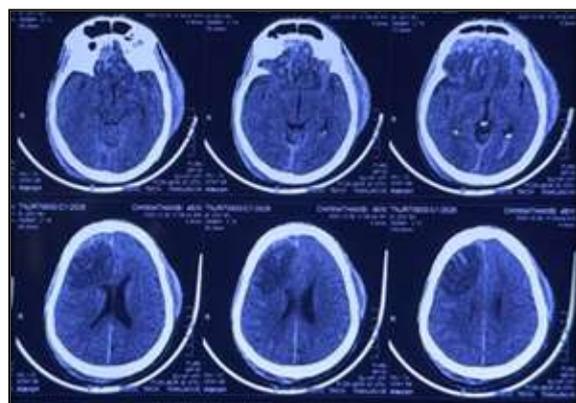
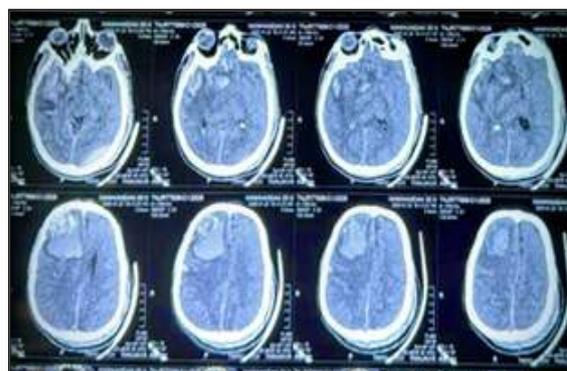
**Figure 1: Pre-OP CT Brain****Figure 2: Pre-OP CT Brain**



Figure 3: Bicoronal skin Incision

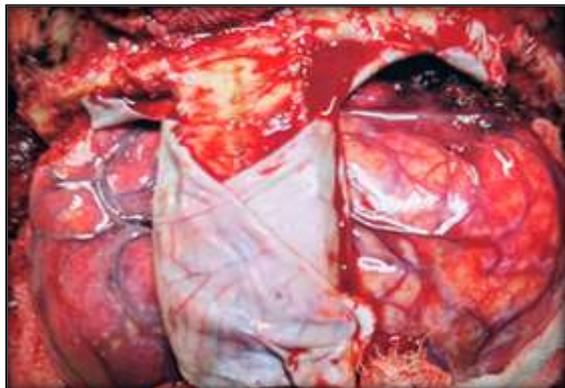


Figure 4: Intra-OP Showing bifrontal craniectomy

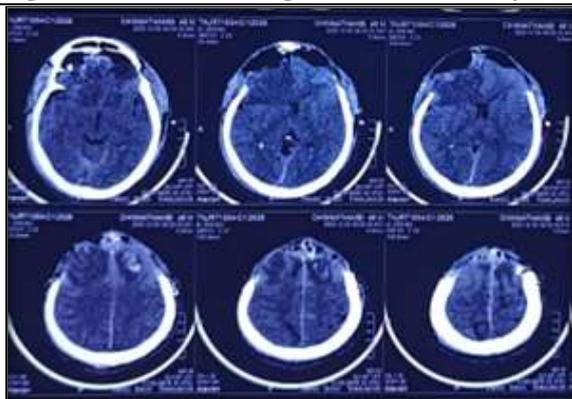


Figure 5: Post-OP CT Brain

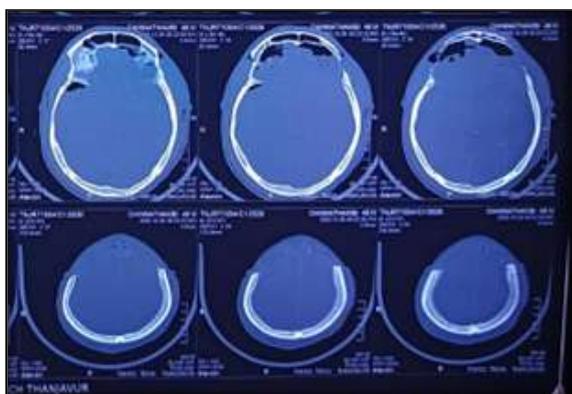


Figure 6: Post-OP CT Brain

DISCUSSION

Basifrontal contusions represent a unique subset of focal traumatic brain injuries. The frontal lobes are particularly vulnerable to impact against the anterior cranial fossa during blunt trauma.^[6] In our study, road traffic accidents were the predominant mechanism, consistent with previous literature from developing countries.^[7]

Pathophysiology: The injury mechanism involves a combination of coup and contrecoup forces, resulting in microvascular disruption and hemorrhagic necrosis.^[8] Secondary injury cascades such as excitotoxicity, neuroinflammation, and cerebral edema contribute to contusion expansion within the first 24–48 hours.^[9]

Clinical Significance: Basifrontal contusions may present with subtle neuropsychiatric symptoms that are often overlooked during initial evaluation. Anosmia, though underreported, signifies involvement of olfactory pathways and may have long-term quality-of-life implications.^[10]

Radiological Progression: Progressive hemorrhagic contusion is a well-recognized phenomenon, with studies reporting enlargement in up to 40% of cases.^[11] This highlights the importance of serial CT imaging.

Management Considerations: The majority of patients can be managed conservatively with favorable outcomes. Surgical intervention is reserved for patients with neurological deterioration, significant mass effect, or refractory intracranial hypertension.^[12] In our series, early surgery (<24 hours) was associated with improved survival, particularly in severe head injury and bilateral contusions.

Prognostic Factors: Bilateral involvement and delayed surgery were associated with higher mortality, consistent with previous studies.^[13,14]

CONCLUSION

The management of a patient with basifrontal contusion is more difficult than a patient with contusions of other area of brain & intracranial hematomas as the basifrontal 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 than unilateral lesions. Basifrontal contusions should not be regarded as benign injuries. Bilateral basifrontal contusions carry a significantly higher mortality risk. Early surgical intervention in selected patients with severe head

injury improves survival, while delayed surgery is associated with poor outcomes. Vigilant clinical monitoring, serial imaging, and timely intervention are essential. Long-term neurobehavioral sequelae necessitate multidisciplinary rehabilitation and early counseling.

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