ORIGINAL RESEARCH PAPER

Volume - 9 | Issue - 10 | October - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CT EVALUATION OF PATTERNS OF SKULL BASE FRACTURES IN HEAD TRAUMA PATIENTS

Radiology

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ABSTRACT

Introduction: Basal skull fractures (BSF) are a distinctive form of head trauma that occasionally go unnoticed and may lead to cerebrospinal fluid (CSF) leaks and meningitis. There is a need to reassess the incidence and pattern of BSF, the importance of clinical signs in diagnosis, and management protocol, especially in India, where adequate literature is lacking.
Aim: This study aims to evaluate the prevalence and patterns of skull base fractures in head injury patients in correlation with the associated findings on CT, thereby helping clinicians in planning the appropriate treatment and avoiding the potential complications of missed BSF.
Material And Methods: A total of 500 cases, including all age groups with a history of head trauma who underwent CT scan within 24 hours of admission, were selected, and the severity of the head injury was assessed using Glassgow Coma Scale (GCS) score.
Results: The incidence of BSF was 16.2%, with the middle cranial fossa being the most commonly involved compartment. There was a statistically significant association between head injury severity and BSF and between the number of fracture lines and associated signs of BSF. The sensitivity of clinical signs in predicting BSF was 53.2%, while specificity was 82.1%.
Conclusion: This study showed that the pattern of BSF was consistent with data from previously published studies

KEYWORDS

INTRODUCTION

Basal skull fracture (BSF) may occasionally go unnoticed due to suboptimal computed tomography (CT) brain as many patients are alcoholic as well as irritable and hence are not cooperative during the study.[1] Moreover, there is a heavy workload in emergency set-up for the radiologist, trauma team, and neurosurgeon, so BSF may further remain undiagnosed. They carry an important clinical significance because, they could lead to debilitating complications such as neurovascular injuries, cerebrospinal fluid (CSF) leaks, meningitis, or even death if missed or diagnosed late.[2]

In most studies, the underlying mechanism of injury was consistently reported to be road accidents, a phenomenon that can be attributed to various factors depending on geographic location[3]. The condition may even be worse in developing countries like India due to inadequate implementation of data collection system where head injury (HI) appears to be the single most common cause of mortality, morbidity, and loss of productivity among cases of road traffic accidents (RTA).[4,5]

MATERIALS AND METHODS

A cross-sectional observational study was performed for a period of 12 months from February 2019 to 2020 at Alluri Sitharama Raju Academy of Medical Sciences. Five hundred patients who presented to the casualty with a history of head trauma were included in the study. The clinical features in the form of ear bleed or nose bleed at the time of admission, raccoon eyes, and CSF leak, if any, were recorded.

The exclusion criteria included the history of previous head trauma, pre-existing bone pathology, recent brain surgery, and images with severe artifacts.

The patients were subjected to a CT scan with a high speed dual CT GE medical system using a built-in head trauma protocol. The images were interpreted on a GE workstation.

RESULTS

A total of 500 patients with a history of head trauma were analyzed in the study. Of these patients, 86% (430) were males, and 14% (70) were females. The study included patients between 15 years and 72 years, with the predominantly affected age group being 26-35 years, constituting 32.8% of the total cases.

Eighty-one patients (16.2 %) showed BSF, and the rest 419 (83.8%) showed no evidence of BSF. The patients with BSF were broadly classified as mild, moderate, and severe head injury based on the GCS scoring, with 11, 33, and 37 patients falling in each category, respectively. The mortality rate was 3% in moderate and 18.9% in severe head injury patients. The commonest mode of injury was shown to be road traffic accidents, which constituted 80.2% of the cases, followed by fall from height and assault. The number of patients who developed CSF leak was also analyzed, nine patients (11.1%) showed CSF rhinorrhoea, and three (3.7%) showed CSF otorrhoea at some time during the stay in the hospital.

Table 1- Distribution Of BSF In Various Skull Compartments

Type Of Fracture	No. Of Cases
ACF	28
MCF	34
PCF	8
ACF+MCF	8
MCF+PCF	2
ACF+MCF+PCF	1

Table 2- Correlation Of ACF Fractures With Clinical Signs

	No Fracture	Frontal Sinus #	Orbital Roof #	Combination	Total
NO SIGNS	400	11	-	3	414
RHINORRHAGIA	35	2	-	4	41
RACOON EYE	22	-	3	4	29
SUBCONJUNCTIVAL HEMORRHAGE	12	-	1	-	13
COMBINATION	3	-	-	-	3
TOTAL	472	13	4	11	500

Table 3- Correlation Of MCF Fractures With Clinical Signs

	No Fracture	Squamous Temporal	Mastoid	Petrous	Combination	Total
NO SIGNS	460	6	-	2	7	475
OTORRHOEA	1	-	-	-	2	3
OTORRHAGIA	4	-	-	2	2	8
HEMOTYMPANUM	-	-	9	-	4	13
COMBINATION	1	-	-	-	-	1
TOTAL	466	6	9	4	15	500

Table 4- Relationship Between Associated Signs On CT And Number Of Fracture Lines

Associated Signs	Number Of Fracture Lines					
	None	1	2	3	>3	TOTAL
ABSENT	347	3	-	-	2	352

PRESENT	72	38	9	7	22	148
TOTAL	419	41	9	7	24	500

As shown in table 4, 93.82% (76/81) of patients who had a BSF also had associated signs as revealed by CT, whereas 82.8% (347/419) with no BSF also had no associated signs.

The associated signs that were observed on CT scan include hemorrhagic brain contusion (62), subarachnoid hemorrhage (53), pneumocranium (52), subdural hematoma (40), brain edema (34), epidural hematoma (31), hemosinuses (31), blood in the mastoid air cells (29), and intracranial foreign body (3).

Further, it was noted that the majority of BSF had a single fracture line followed by complex fractures with more than three fracture lines. There was a statistically significant association between an increasing number of fracture lines and the presence of associated signs on CT scan.

DISCUSSION

Various studies have shown that BSF occurs in 3.5%–45.4% of all HI patients.[6] Most of the published data are from the western and developed countries having a lower prevalence of HI compared to underdeveloped and developing countries.[7,8]. The prevalence of BSF in this study was 15.2%, with males showing a higher incidence of head injury, which could be due to the fact that they are engaged in more physical and outdoor activities compared to females, making them more susceptible to trauma. The younger age group (15-35 years) showed significant involvement, which can be attributed to inexperience, tendency to take risks, and alcoholism.

In our study, middle cranial fossa fractures had a slightly higher prevalence due to the thin bones and multiple foramina.[7,9]. Posterior cranial fossa fractures are rare, which could be due to the thick occipital bone and the site of impact commonly being from the sides or front. In the MCF, the mastoid was the most commonly fractured bone in our study. It was noted was that the CSF rhinorrhoea was more commonly encountered than CSF otorrhoea despite MCF being more common in our study.

It was also noted that of the 11 patients who had BSF involving combinations of skull base compartments, seven had a mild, one had moderate, and three had a severe head injury as determined by GCS irrespective of the aetiological factors. This suggests that BSF involving a combination of skull base compartments might have no direct relationship with the severity of the head injury.

There was a statistically significant association between BSF and associated signs, with 93.82% of patients who had a BSF also having associated signs on CT. Thus, a fracture line should always be sought in those patients who are presenting with the associated signs so that they can receive the appropriate interventions. It was also noted that 48.6% of patients with associated signs on CT did not have BSF. This rate can be attributed to the inclusion of a wide range of associated signs, such as contusions and subarachnoid hemorrhages.

There was a statistically significant association between the number of fracture lines and associated signs on CT scans which suggests that patients with more fracture lines were more likely to show associated signs on CT scans. Hence it should be noted that, in patients with multiple fracture lines on a CT scan, associated signs should be sought and managed accordingly to prevent potential complications. In the presence of BSF, it is always important to assess the integrity of the base of skull lines as their disruption indicates craniocervical junction dissociation, which is life-threatening.

Clinical signs showed low sensitivity of 40.7% (33/81) in predicting BSF in our study. This is in contrast to the previous studies that showed good clinical signs with a sensitivity of 71% – 77% in predicting BSF.[1,6] However, evaluation of the sensitivity of clinical signs in predicting BSF was not the objective of this study as the experience of the emergency room medical officers is an essential criterion in predicting such an entity. This study, however, showed a statistically significant association between head injury severity evaluated by GCS and BSF on CT scan. This finding is significant in resource-poor set-ups, to refer patients with a severe type of head injury (predicted based on GCS) to higher centers for appropriate management.

CONCLUSION

BSF is a relatively rare entity in head trauma. Clinical signs of BSF are supportive but not definitive, so CT brain scan is the gold standard to detect BSF.

ABBREVIATIONS-

Basal skull fracture (BSF), head injury (HI), road traffic accidents (RTA), Glassgow Coma Scale (GCS), cerebrospinal fluid (CSF), anterior cranial fossa (ACF), middle cranial fossa (MCF), posterior cranial fossa (PCF).

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