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Original Research Paper

Radiology

A STUDY OF PROFILE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN MAXILLO-FACIAL INJURIES IN A TERTIARY CARE CENTER

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ABSTRACT Maxillofacial injuries account for a large group of patients in the emergency department in tertiary care hospital, presenting as an isolated injury or a part of poly trauma. Road traffic accidents are the commonest cause of maxillofacial injuries. Such injuries are clinically important as they cause facial disfigurement and thus imposing emotional, morbidity and cosmetic dependence. To observe these fractures and decide appropriate management lines, there is a need for imaging aid. The main purpose of imaging guidance is to find and characterize the fractures and associated injuries.

Aim: Study of profile of multi detector computed tomography in maxillo-facial injury in a tertiary care centre.

Materials and methods:

The cases coming to the emergency department and then forwarded to department of Radiology, MGM medical college and hospital, Aurangabad for CT scan formed the source of the data and were studied in detail. Detailed history of the cases was taken. Written and informed consent were taken for undergoing CT scan examination. Patients were scanned using 16 slice Toshiba acquilion machine. The data was tabulated and observed and conclusions were made.

Results: Total 175 number of patient were included in the study and CT scan for maxillo-facial injuries were conducted. Diagnosis of the maxillofacial injuries were done and the fractures were classified according to age, gender, location and its subsets. According to our study 21-30 years of age group was the most common age group to be involved in maxillo-facial injuries. Frequency of maxillo-facial injuries was found to be more in male than female. Maxillo facial injuries occurred mostly due to road traffic accidents. Orbit was seen as the most common bone to be fractured followed by fracture of maxilla bone. Orbital wall fracture happen to be overall most common bone affected amongst all the other facial bones.

KEYWORDS : Multidetector Computed Tomography, Maxilo-facial, Fractures

INTRODUCTION

Maxillofacial regions include maxilla bone, mandibular bone, nasal bone, orbital region bones, zygomaticbone, ethmoid bones and frontal sinuses.

Complex facial fractures include Le Fort fractures, naso septal fractures, naso-orbito-ethmoid complex fracture, orbital fractures, occlusion bearing maxillary and palatal fracture and zygomatico-maxillary complex. The conceptual construct of facial buttresses provides a rigid protective framework for the orbital contents, sinuses, teeth, and nasal cavity.

Disruption of the facial buttresses can change facial dimensions and alter normal function, necessitating surgical fixation for restoration.

Conventional radiographs have been the initial modality in these patients but due to superimposition of bony structures, it has failed to provide adequate information and thus resulting in decline in assessing the severity of the injury.

CT greatly simplifies interpretation. MDCT, the emerging technology, can easily find the fractures in case of maxillo-facial injuries and characterize them. The advances in technology of computer software algorithm in CT have made the generation of coronal and sagittal reconstructed images as well as 3D images quick and economical. MDCT also gives information related to severity of fractures, number of fragments of fracture and associated displacements or impactions in adjacent soft tissue.

Thus due to rapid progression in diagnostic imaging specially using MDCT as a modality, accuracy to find out injuries, characterization of injuries and outcome of patients in maxillofacial traumas has been improved.

OBJECTIVES:

1) To identify the most common age group and sex involved in maxillo-facial injury.
2) To assess the role of multi-detector computed tomography in detecting the different bone injuries.
3) To assess the role of multi detector computed tomography in detection, localize the exact number and site of maxillo-facial fractures.
4) To describe the involvement of facial complexes of various patterns of injury in maxillofacial region.
5) To find out the incidence of maxillofacial injury in a tertiary care centre.

Facial fractures were observed in 5 areas:

1) Frontal bone fractures involvement
2) Zygomatic bone fractures involvement
3) Naso-orbito-ethmoid fractures
4) Maxillary fracture
5) Mandibular fractures

Frontal bone injuries were classified:

1) walls of frontal sinuses.
2) Orbital injuries according to the walls involved (16) lateral, medial, roof & floor.

These were further classified as which fractures were blow out fractures and how many of them showed adjacent impaction of soft tissue.

Maxillary region fractures described according to the region involved:

1) Anterior wall of sinus
2) Lateral wall of sinus
3) Medial wall of sinus
4) Alveolar process
5) Palatine process
6) Zygomatic process
7) Frontal process

Mandible bone fractures described according to the location :

1) Condyloid process
2) Coronoid process
3) Angle
4) Alveolar ridge
5) Ramus
6) Body
7) Parasymphysis

These were further divided into communited fractures and TM joint dislocation occurrence.

Sphenoid bone fractures was classified according to involvement of:

1) Pterygoid plate
2) Lateral wall of sphenoid sinus
3) Roof of sphenoid sinus
4) Base of sphenoid sinus

Parts of ethmoid bone fracture involved:

1) Lamina Papyracea
2) Cribriform Plate
3) Ethmoidal sinus walls

Zygomatic bone fractures were divided into:

1) Trimalar/tripod fracture
2) Isolated zygomatic arch fracture

Complex mid facial injuries were classified according to the Le Fort classification:

1) Le Fort I fracture
2) Le Fort II fracture
3) Le Fort III fracture

MATERIALS AND METHODS:

It is a time bound retrospective observational study.
The study was done over a period of 18 months from August 2019 to March 2021 and total 175 patients were included in the study.

Patients included in the study were patients who were referred to the department of radiology, MGM medical college and hospital Aurangabad for CT scan in a setup of maxillo-facial injury.

Detailed history, presenting complaints of the patient were taken. The data was tabulated and observed and conclusions were made.

INCLUSION CRITERIA:

Patients with complaint of trauma and clinical signs of maxillo-facial injuries, who underwent CT examination and were positive for fracture involvement.

EXCLUSION CRITERIA:

General contraindication for computed tomography e.g.: pregnancy

Patient not giving consent to be part of this study

RESULTS:

1) Distribution of patients according to age group.

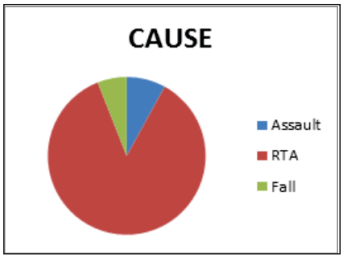
The frequency of maxillo-facial injuries according to different age group was distributed. Commonest age group involved was 21-30 years of age (34%), succeeded by 31- 40 years (26%). The youngest age at presentation was 1 years and the oldest patient was of 71 years.

2)Distribution of patients according to gender
Table number 1

Distribution of Patient according to gender		
Gender	No of patients	%
Female	14	8
Male	161	92

Frequency of maxillo-facial injuries was found to be more in male than female . Out of the 175 patient included in study, 161 patients (92%) were male and only 14 patients were female(8%).

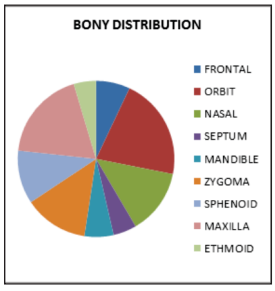
3)Distribution of patients according to causative factor
Table number 2



Maxillo facial injuries occur mostly due to road traffic accidents (RTA) accounting for 86% of patient in our study. Less common cause of presentation was assault followed by fall from height.

4)Distribution of patients according to fractures in maxillo-facial region

Table number 3



Distribution of various fractures in maxillo facial region showed that orbit was the most common bone to be fractured in maxillo-facial injuries accounting for 105 patients, followed by fracture of maxilla bone having 93 patients and ethmoid bone was the least involved having 23 patients.

5) Distribution of patients according to fractures of orbit

Lateral wall was the commonest among all the other orbital walls to be involved, with 66 patients showing lateral wall fracture out of total 105 patients with orbital wall fractures. Out of 105 patients, 22 patients showed blow out fractures of the involved walls. Out of these 22 patients with blow out fractures, 10 patients showed impingement of adjacent soft muscle.

6) Distribution of patients according to le fort fractures
Table number 4

Distribution of Lefort fractures		
Types	Number	%
I	4	9.5
II	23	54.7
III	15	35.7

Out of 175 patients with maxillo-facial injuries, total of 42

patients presented with complex mid facial fractures – Le Forte fractures. Among these 42 patients, the most common type observed was type II of Le Fortes fracture accounting for 54.7% patients.

8)Distribution of patients according to involvement of nasal septum

Out of total 175 patients with maxillo-facial injuries only 24 patients (14%) showed its involvement.

9) Distribution of patients according to involvement of nasal bone

Out of total 175 patients with maxillo facial injuries only 67 patients (38.28%) showed its involvement.

10) Distribution of fractures of mandible in maxillo-facial injuries

Body was the commonest part to be involved, with 16 patients showing fracture of body of mandible out of total 30 patients with mandibular fractures. The least common fracture involvement in mandible was noted to be coronoid process of mandible having a single patient. Out of 30 patients 11 patients who had Condyloid process fracture had associated TM joint dislocation.

DISCUSSION:

The study was conducted in department of radiology, MGM medical college and hospital. According to our study 21-30 years of age group was the most common age group to be involved in maxillo-facial injuries and followed by 31-40 years of age. The youngest age of presentation was 1 years and the oldest patient was of 71 years.

Frequency of maxillo-facial injuries was found to be more in male than female, affecting 161 male patients and only 14 female patients .(Table 1). Kieser et al study also had similar results with 80% facial fractures (of all injuries) in males (11).

Maxillo facial injuries occurred mostly due to road traffic accidents (RTA) accounting for 86% of patient in our study. Less common cause of presentation was assault followed by fall from height. Table 2.

Road traffic accidents were the most frequent cause of facial fractures as seen in various studies (12,13). Assault was seen as the second most common cause as seen in our study, although few of the authors concluded assault as the most common cause (12,13).

In distribution of various fractures in maxillo facial region ,orbit was seen as the most common bone to be fractured accounting for 105 patients, followed by fracture of maxilla bone having 93 patients. Ryan T. Whitesell et al study also showed that orbit was the most common to be fractured in face (14). Study conducted by Raju N also stated anterior wall of maxillary sinus to be the second most common. It was then followed by nasal bone (67 patients) and zygomatic bone (66 patients). Only 23 patients showed involvement of ethmoid bone thus being the least fractured according to our study .Table 3.

We found that out of total 175 patients with maxillo-facial injuries, 24 and 67 patients s showed involvement of nasal septum and nasal bone respectively.

Distribution of fractures of mandible in maxillo-facial injuries showed that body was the commonest part to be involved accounting for 16 patients out of total 30 patients with mandibular fractures, followed by fracture of alveolar margins accounting for 13 patients, condyloid process with 11 patients, parasymphysis and angle of mandible both having 4 patients each, ramus having 3 patient's involvement. The least common fracture observed in mandible was coronoid process only having a single case among total 30 patients with mandibular fracture.

Kruger states that the body of mandible fracture accounted for 16-36% of mandibular fractures, higher incidence occurred in patients with motor vehicle accidents as the causative factor (12).

CONCLUSION:

MDCT is an accurate, non-invasive technique for evaluation of patients with maxillofacial injuries. In the setting of acute trauma, MDCT has the advantage of shorter scan time and is increasingly available. Multiparametric reconstruction and 3D images help in better evaluation of fractures.

The CT based multiparametric reconstruction images, together with recent advances in computer graphics, enabled the radiologists to visualize, manipulate and evaluate the volumetric data quickly, permitting immediate application of advanced imaging for the assessment of maxillofacial region. This has been useful for the evaluation of maxillofacial injuries, especially for the surgeons to decide the treatment line. Familiarity with the normal anatomy and the common pattern of facial fractures with aid the radiologist in to providing an accurate and detailed analysis of facial fractures.

This study emphasises on the valuable role of MDCT in the evaluation of maxillo-facial injuries. The aid of such images lies in detailed descriptive assessment of facial trauma. It helps with easier detection of fractures of the frontal and maxillary bones which is difficult to assess on the conventional imaging techniques and as well as in describing their associated displacement or impaction in patients with complex mid facial fractures. Three dimensional images have a limited role in fractures involving the naso-orbito-ethmoid region and also when there is minimal fracture displacement.

CASES

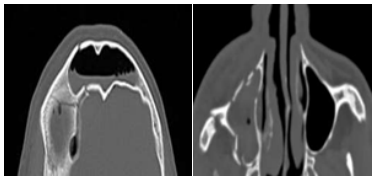


Figure 1: Paranasal sinus fractures (A & B)

'A' demonstrates linear minimally displaced fracture of anterior and posterior walls of frontal sinus with resultant hemosinus.

'B 'demonstrates communited displaced fracture of anterior posterior and medial walls of right maxillary sinus with fracture fragment displaced inwards with resultant hemosinus.

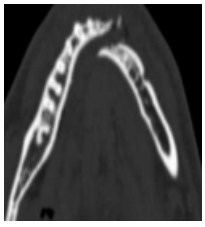


Figure 2: Mandibular fractures (A & B)

Demonstrates displaced fracture of ramus of mandible on right side.

Demonstrates fracture of mandible in parasymphyseal region on left side with fracture line extending to alveolar margin.

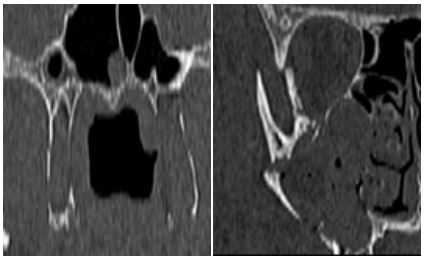
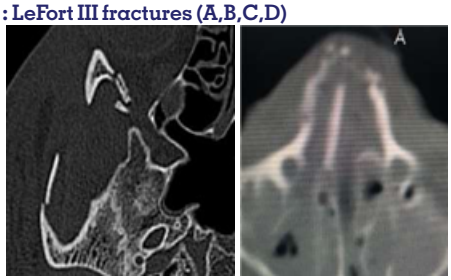


Figure : LeFort III fractures (A,B,C,D)



A. Communited fracture of right medial and lateral pterygoid plates.
B. Communited fracture of lateral wall of right orbit and communited fracture of floor of orbit with herniation of orbital fat into right maxillary sinus s/o blow out fracture.
C. Communited fracture of right zygomatic arch.
D. Communited fracture of bilateral nasal bones.

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