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# Maxillofacial Fractures and Multidetector Computed Tomography: A Prospective Cross-Sectional Approach

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**Abstract**
Maxillofacial fractures are a significant healthcare concern, often resulting from trauma such as accidents, sports injuries and assaults. They can have severe physical and psychological impacts on patients' quality of life. This study aims to investigate the utility and effectiveness of Multidetector Computed Tomography (MDCT) in assessing maxillofacial fractures, addressing the clinical significance of this imaging modality. The study design is a prospective observational study, with inclusion and exclusion criteria clearly defined to ensure a representative population of patients with suspected maxillofacial fractures. The data collection process is thorough and comprehensive, with the involvement of two experienced radiologists and resolution of discrepancies through consensus or involving a third radiologist. The study analyzed 25 participants with an average age of 42.72 years, with the majority under 30 years old. The majority were male, with 68% being male and 32% female. The most common type of maxillofacial fractures was maxillary sinus wall fracture (60%) followed by nasal (56%), orbital (44 %) and zygomatico-maxillary complex (16 %) and mandibular (16 %). The study provides valuable insights into the epidemiology and pattern of maxillofacial injuries. MDCT is crucial for diagnosing and characterizing complex injuries, such as maxillary sinus wall fractures.

## INTRODUCTION

Maxillofacial fractures are a common consequence of traumatic injuries and require accurate assessment for appropriate clinical management. These fractures are a significant healthcare concern, often resulting from trauma caused by accidents, sports injuries, or assaults. These fractures can lead to functional impairments, aesthetic deformities, and psychological distress for affected individuals[1]. Maxillofacial fractures are complex, involving numerous bones and joints and can result from various causes like accidents, falls and injuries. They can be hidden and difficult to identify, leading to complications. Timely and accurate diagnosis is crucial for the effective management of maxillofacial fractures, as it directly influences treatment decisions and patient outcomes. Functional and aesthetic consequences of maxillofacial fractures are significant, necessitating accurate assessment[2,3]. Multidetector Computed Tomography (MDCT) has emerged as a valuable diagnostic tool in the evaluation of maxillofacial fractures, providing detailed anatomical information and aiding in treatment planning. It has emerged as a pivotal imaging modality in the assessment of maxillofacial fractures[4,5]. In recent years, it has revolutionized the diagnostic approach to these fractures due to its exceptional capabilities in providing high-resolution, three-dimensional images of the facial skeleton.

MDCT offers several advantages in the assessment of maxillofacial fractures, including high spatial resolution, rapid image acquisition and the ability to visualize both bone and soft tissue structures. It allows for the precise localization, classification and characterization of fractures, helping clinicians make informed decisions regarding surgical or conservative management. MDCT also assists in identifying associated injuries, such as intracranial or cervical spine trauma, which may be critical for patient care[6,7].

MDCT is a highly sensitive and specific method for detecting maxillofacial fractures, providing detailed 3D visualizations for precise treatment planning. It can detect subtle fractures, aid in early intervention and provide treatment guidance. MDCT also promotes patient-centered care, addressing functional and aesthetic concerns, reducing the risk of unnecessary procedures and minimizing psychological distress[8].

Furthermore, MDCT aids in preoperative planning by offering three-dimensional reconstructions that enhance the surgeon's understanding of the fracture patterns. This technology enables virtual surgery, facilitating the development of patient-specific treatment strategies and reducing the risk of complications during surgical intervention. Post-treatment follow-up can also benefit from MDCT, allowing for the assessment of fracture healing and the detection of complications, such as infection or hardware-related issues[9].

Multidetector Computed Tomography has revolutionized the assessment of maxillofacial fractures by providing comprehensive, high-quality imaging that is indispensable for accurate diagnosis and treatment planning. Its role in the management of these injuries continues to evolve, offering improved patient outcomes and ensuring a higher standard of care for individuals with maxillofacial fractures.

### Aims and Objectives:

- The primary aim of this study is to determine the prevalence of maxillofacial fractures within the study population.
- To assess the utility and effectiveness of multidetector computed tomography in diagnosing and characterizing maxillofacial fractures.

## MATERIALS AND METHODS

**Study Design:** This study was conducted as a prospective observational study

**Study Setting:** The study was conducted at a tertiary health centre of Tamil Nadu, which is equipped with a state-of-the-art MDCT scanner and has a dedicated maxillofacial trauma unit.

**Study Period:** The study was conducted over a period of 6 months (December 2023-May 2024)

**Study Participants:** The study included patients presenting with suspected maxillofacial fractures who are referred for MDCT imaging.

### Inclusion Criteria:

- Patients of all age groups and genders with suspected maxillofacial fractures.
- Patients who have undergone multidetector computed tomography (MDCT) imaging for maxillofacial trauma assessment.
- Patients with available MDCT images and clinical records.

### Exclusion Criteria:

- Patients with incomplete MDCT images or poor image quality.
- Patients with a history of previous maxillofacial surgery.
- Patients with contraindications for MDCT, such as severe allergies to contrast agents or a history of renal impairment.

**Sample Size:** The sample size of 25 patients (17-males and 08 females) was determined using statistical methods to ensure adequate power to detect meaningful differences in diagnostic accuracy and treatment planning with MDCT.

**Data Collection:**
**MDCT Imaging Protocol:**

- MDCT scans was performed using a standardized protocol, including axial, coronal, and sagittal views.
- Contrast-enhanced MDCT was used as deemed necessary by the treating physician.
- Radiological images wasobtained with a slice thickness of [insert slice thickness] and reconstructed with [insert reconstruction interval].

**Clinical Data:**

- Demographic information (age, gender).
- Mechanism of injury.
- Clinical presentation and symptoms.
- Results of physical examinations.
- Clinical management and surgical interventions, if any.

**Image Analysis:**

- MDCT images was reviewed independently by two experienced radiologists blinded to the clinical data.
- Assessment of maxillofacial fractures included identifying the location, type, and severity of fractures.
- Any discrepancies in image interpretation was resolved through consensus or by involving a third radiologist.

**Data Analysis:**

- Descriptive statistics was used to summarize patient demographics and fracture characteristics.
- The extent and severity of maxillofacial fractures was graded according to a standardized classification system (e.g., Le Fort classification).
- Statistical analyses (e.g., Chi-square tests, t-tests) was used to assess the association between MDCT findings and clinical outcomes, treatment planning, and surgical interventions.

**Ethical Considerations:**

- The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.
- Informed consent was obtained from all study participants.
- Patient confidentiality was strictly maintained, and data will be de-identified for analysis.

## RESULTS AND DISCUSSIONS

This table shows the age and gender distribution of 25 participants, with an average age of 42.72 years

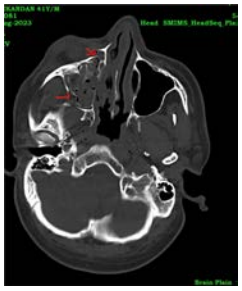

Fig. 1: MCDT Pictures of maxillofacial fractures – Linear minimally displaced fracture involving the anterior and posterolateral wall of the maxillary sinus

Fig. 2: Comminuted fracture involving the nasal bone

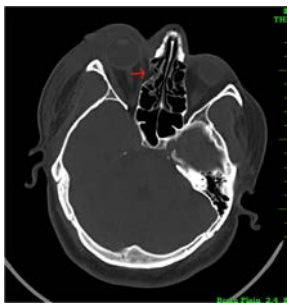

Fig. 3: Comminuted fracture involving the right lamina papyracea (medial wall of orbit)

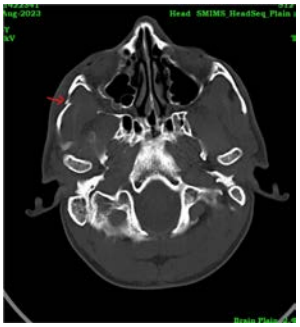

Fig. 4: Linear minimally displaced fracture involving the right zygomatic arch

**Table:1 Age and gender distribution of study participants:**

| Variables | n = 25 (%) |
|---|---|
| **Age (years):** | |
| Mean ± SD- | 42.72±11.242 |
| Mode- | 37 |
| Range - | 20-65 (45) |
| **Age groups:** | |
| ≤30 years- | 22 (88%) |
| ≥30 years- | 3 (12%) |
| **Gender:** | |
| Male- | 17 (68%) |
| Female - | 08 (32%) |

**Table:2 Distribution of different maxillofacial fractures in study patients according to the MDCT findings**

| | Frequency(n=25) | Percentage (%) |
|---|---|---|
| Orbital fracture | 11 | 44 |
| Nasal fracture | 14 | 56 |
| Maxillary sinus wall fracture | 15 | 60 |
| Zygomatico-maxillary complex fracture | 4 | 16 |
| Mandibular fracture | 4 | 16 |
| Frontal sinus fracture | 3 | 12 |
| Le Fort II fracture | 2 | 8 |
| Le Fort I fracture | 2 | 8 |
| Le Fort III fracture | 1 | 4 |
| Naso-orbito-ethmoidal arch fracture | 1 | 4 |
| Isolated zygomatic arch fracture | 1 | 4 |

and a range of 20-65 years. The most frequently occurring age is 37 years. The majority of participants are under 30 years old, with 22 (88%) falling into this age group. The majority are male, with 68% being male and 32% female. The table provides a clear overview of the study's diversity and gender composition.

This table shows the distribution of maxillofacial fractures in 25 patients, as determined by MDCT findings. Maxillary sinus wall fractures were the most common type, accounting for 60% of cases. The nasal fractures fractures were the second most common, accounting for 56% of cases.Orbital fractures were the most frequently encountered type, accounting for 44% of cases. Zygomatico-maxillary complex and mandibular fractures were found in 4 patients, while frontal sinus fractures were found in 3 patients. Le Fort II, Le Fort I, Le Fort III, naso-orbito-ethmoidal arch, and isolated zygomatic arch fractures were also found.

Maxillofacial fractures encompass a range of injuries to the facial skeleton, including the bones of the skull, face and jaw. Understanding the prevalence and patterns of these fractures is crucial for improving patient care and guiding treatment decisions. Maxillofacial fractures can result from various causes such as accidents, falls, sports injuries and assaults. They can have significant implications for a patient's overall health, facial aesthetics and functional outcomes. Multidetector computed tomography (MDCT) is a valuable imaging tool for assessing these fractures due to its ability to provide detailed, three-dimensional views of the facial bones. This study aims to leverage MDCT to comprehensively evaluate maxillofacial fractures and contribute to the existing body of knowledge in this field. This study examines the prevalence of maxillofacial fractures using a prospective cross-sectional approach.

The demographic data shows an average age of 42.72 years, with the most frequently occurring age being 37 years. The age distribution is consistent with previous studies on maxillofacial fractures, which often involve individuals across various age brackets. A significant 88% of participants fall into the age <30 category, possibly due to factors like sports injuries, accidents, and interpersonal violence[10]. The gender distribution is predominantly male, comprising 68% of the sample. This disparity can be attributed to sociocultural and behavioral factors, such as risk-taking activities among males. Comparing the findings with previous studies can help interpret the findings and understand the consistency of age and gender distributions with broader trends in maxillofacial trauma[11].

The current study analyzed the distribution of maxillofacial fractures in 25 patients using Multidetector Computed Tomography (MDCT). Maxillary sinus wall fractures were the most common type, accounting for 60% of cases. The nasal fractures fractures were the second most common, accounting for 56% of cases. Orbital fractures were the most frequently encountered type, accounting for 44% of cases. MDCT's ability to provide detailed imaging of the maxillofacial region made it a valuable tool for detecting these fractures[6,8].

Regarding the distribution of maxillofacial fractures, the predominance of maxillary sinus fractures followed by nasal fractures aligns with Bakardjiev[12]'s study, that have reported similar findings. Orbital fractures are frequently associated with blunt trauma to the face, such as motor vehicle accidents or assaults, while nasal fractures are often seen in both blunt and penetrating traumas. The high incidence of maxillary sinus wall fractures is

noteworthy and emphasizes the importance of MDCT in accurately diagnosing these injuries, which may not be evident on conventional radiographs.

The study also found that zygomatico-maxillary complex and mandibular fractures were found in a smaller subset of patients, indicating that these types are less common than orbital and nasal fractures. The study's inclusion of cases with zygomatico- maxillary and mandibular fractures are important as they can have severe consequences and require specialized management[13].

The presence of various types of maxillofacial fractures, such as Le Fort II, Le Fort I, Le Fort III, naso-orbito-ethmoidal arch and isolated zygomatic arch fractures, demonstrates the wide variety of maxillofacial fractures and the importance of comprehensive imaging techniques like MDCT for accurate diagnosis. Overall, the study reinforces the utility of MDCT in the assessment of maxillofacial fractures and their diverse presentations. Similar findings are found in studies by Campos[14] and Wu[15].

**Limitations:**

- The study may be limited by potential selection bias, as it includes only patients referred for MDCT imaging.
- External factors such as image quality and patient cooperation may influence the diagnostic accuracy of MDCT.

## CONCLUSION

The study on maxillofacial fractures, using Multidetector Computed Tomography (MDCT), offers valuable insights into the epidemiology and pattern of these injuries. MDCT is crucial in accurately diagnosing and characterizing maxillofacial fractures, particularly identifying complex injuries like maxillary sinus wall fractures. The study's findings align with overall trends in maxillofacial trauma, with the predominant presence of maxillary sinus wall and nasal fractures and a diverse range of injury patterns. However, the study's limitations, such as a small sample size, suggest that larger cohorts and multicenter studies could enhance the generalizability of the findings. Despite these limitations, the study contributes to the knowledge of maxillofacial fractures and emphasizes the importance of MDCT in diagnosis and management. Further research is essential for improving patient care and outcomes in maxillofacial trauma.

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