EVALUATION OF CLINICAL AND RADIOGRAPHIC CHARACTERISTICS OF COMBINED MAXILLARY AND MANDIBULAR FRACTURES AT MILITARY HOSPITAL 103

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Abstract

Objectives: To evaluate the clinical characteristics, radiographic features, and fracture patterns of combined maxillary and mandibular fractures. ***Methods:*** A cross-sectional descriptive study was conducted on 30 patients diagnosed with confirmed combined maxillary and mandibular fractures. These patients were treated at the Maxillofacial and Reconstructive Surgery Department, Military Hospital 103, from January 2018 to May 2020. ***Results:*** The mean age of patients was 29.16 ± 11.24 years with a male-to-female ratio of 14:1. The primary cause this fracture type was traffic accidents (90.0%). Common clinical presentations included swelling and ecchymosis, and bone discontinuity (100.0%); abnormal jaw mobility (96.7%); malocclusion (93.3%); restricted mouth opening/trismus (90.0%); and maxillofacial deformities (80.0%). 56.7% of cases involved zygomatic complex (ZMC) or unilateral maxillary fractures, while 30.0% were combined with Le Fort I, II, or I + II maxillary fractures. 3.3% exhibited injuries involving Le Fort I + II + III fractures and the remaining 10.0% presented with other varied forms of maxillary fractures. Computed tomography (CT) scans facilitated more accurate and comprehensive detection of maxillofacial injuries compared to conventional radiography. ***Conclusion:*** CT provides superior accuracy and comprehensiveness in detecting maxillofacial lesions compared to conventional radiography.

Keywords: Panfacial fractures; Maxillofacial trauma; Mandibular fractures, Computed tomography; Malocclusion.

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INTRODUCTION

Maxillofacial trauma accounts for approximately 5% of all total body fractures, with traffic accidents being the predominant etiology. Maxillofacial injuries are increasing in both frequency and complexity; they may involve a single bone or a combination of multiple bones, affecting either a single facial zone or multiple facial zones (pan-facial fractures), thereby impacting both function and aesthetics.

Combined fractures of the maxilla and mandible represent highly complex injuries. They are frequently associated with traumatic brain injury (TBI), and fractures of the naso-ethmoid complex, orbital floor, and zygoma. These injuries significantly compromise functional integrity and facial aesthetics [1, 2]. Notably, failure to provide an early, comprehensive, and accurate diagnosis, followed by appropriate and timely intervention, can lead to severe sequelae, such as malocclusion, trismus (limited mouth opening), and facial deformity.

To enhance the quality of diagnosis and ensure the precise identification of lesions for maxillofacial surgeons, thereby facilitating timely therapeutic interventions and optimizing functional and aesthetic outcomes for patients, we conducted this study. The objective of this study was to: *Describe the clinical and radiographic characteristics of combined maxillary and mandibular fractures at Military Hospital 103.*

MATERIALS AND METHODS

1. Subjects.

A total of 30 eligible patients were enrolled in the study.

* *Inclusion criteria:* Patients diagnosed with concomitant maxillary and mandibular fractures confirmed by both clinical examination and CT; individuals underwent surgical treatment at the Maxillofacial and Reconstructive Surgery Department, Military Hospital 103 between January 2018 and May 2020.

** Exclusion criteria:* Patients with a history of prior maxillofacial trauma; individuals with pre-existing pathology or congenital deformities affecting the zygoma, maxilla, or mandible; those who received initial surgical intervention at other medical facilities before referral; patients who refused to consent to participate in the study.

2. Method

** Study design:* A cross-sectional descriptive study.

** Study protocol:*

Sampling method: Convenience sampling was used including all patients who met the inclusion and exclusion criteria during the study period.

Clinical examination: All patients underwent clinical assessment to identify symptoms of maxillary and mandibular fractures including pain, edema and ecchymosis (bruising), paresthesia of

the cheek, nose, and upper lip regions; facial asymmetry/deformity, bone discontinuity (step-off deformity), fixed localized tenderness, trismus (restricted mouth opening), and malocclusion.

Laboratory tests: Complete blood count (CBC), blood biochemistry, and coagulation profile (bleeding time and clotting time).

Radiographic Imaging: Patients underwent conventional radiography, including Posteroanterior (PA) view, Water's view (Blondeau), Submentovertex view (Hirtz), and Panoramic radiography. Additionally, craniofacial Multislice Computed Tomography (MSCT) was performed with axial, coronal, and sagittal planes, along with 3D reconstruction. While conventional radiography (PA, Blondeau, Hirtz, Panorama) was part of the initial protocol, MSCT with 3D reconstruction was performed on all 30 patients. All radiographic and CT images were independently interpreted by experienced radiologists specializing in diagnostic imaging.

** Data collection:* All obtained data were recorded in the study case report forms.

** Data analysis*: Categorical variables were described using frequencies and percentages. The difference in fracture site detection between X-ray and CT imaging was evaluated on a per-patient basis. Data were analyzed using standard medical statistical methods with Microsoft Excel.

3. Ethics

The study protocol was approved by the Ethics Committee of Military Hospital 103. The data were authorized for use and publication by Military Hospital 103. The authors declare no conflicts of interest associated with this study. All patient data were kept confidential and utilized solely for research purposes.

RESULTS AND DISCUSSION

Table 1. Distribution of patients by age and gender.

Age group (years)	Male (n, %)	Female (n, %)	Total (n, %)
6 - 18	4 (13.3)	1 (3.3)	5 (16.7)
19 - 39	20 (66.7)	3 (10.0)	23 (76.7)
40 - 59	4 (13.3)	0 (0.0)	4 (13.3)
≥ 60	0 (0.0)	0 (0.0)	0 (0.0)
Total	28 (93.3)	2 (6.7)	30 (100.0)

Patient age ranged from 15 to 49 years, with a mean age of 29.16 ± 11.24 years. The 19 - 39 age group accounted for the majority (70%). The male-to-female ratio was 14:1. This gender distribution is consistent with Ngo Thi Thu Ha's finding (male-to-female ratio of 12:1) [3], but higher than the study by Dao Bich Thuy (male/female ratio 5:1) [4]. The higher incidence of trauma in males compared to females may be attributed to the tendency of males to participate in higher risk activities, especially traffic-related incidents. Notably, our study recorded no patients in the ≥ 60 age group. This could be explained by the fact that individuals in this age bracket are typically retired, have reduced exposure to labor-related risks, and are less involved in operating motor vehicles. Furthermore, elderly individuals often exhibit higher traffic safety awareness and more cautious behavior, significantly reducing their risk of sustaining high-energy maxillofacial trauma from traffic accidents.

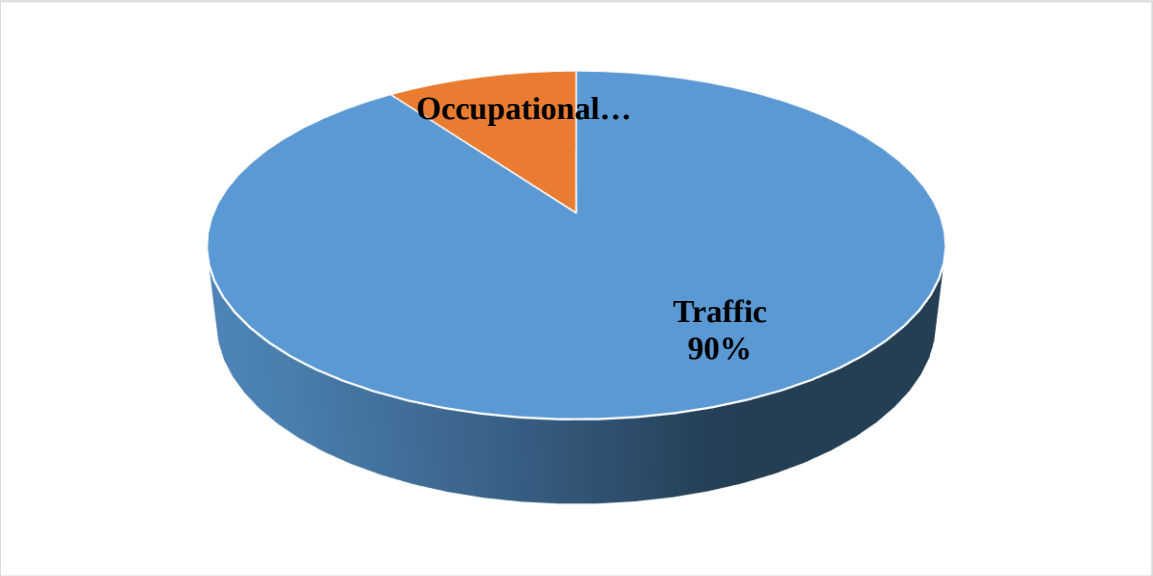

Figure 1. Etiology of trauma (n = 30).

Ninety percent (90.0%) of patients sustained trauma due to traffic accidents. This result aligns with Dao Bich Thuy's study (90.0%) [4], but is higher than those reported by Tran Van Truong (81.8%) [5] and Phillipo LC (57.0%) [6]. In Vietnam, the predominance of the traffic-related trauma may be attributed to the disproportionate development of the transportation system relative to vehicle density, coupled with poor adherence to traffic laws (e.g., driving under the influence of alcohol, failure to obey traffic signals).

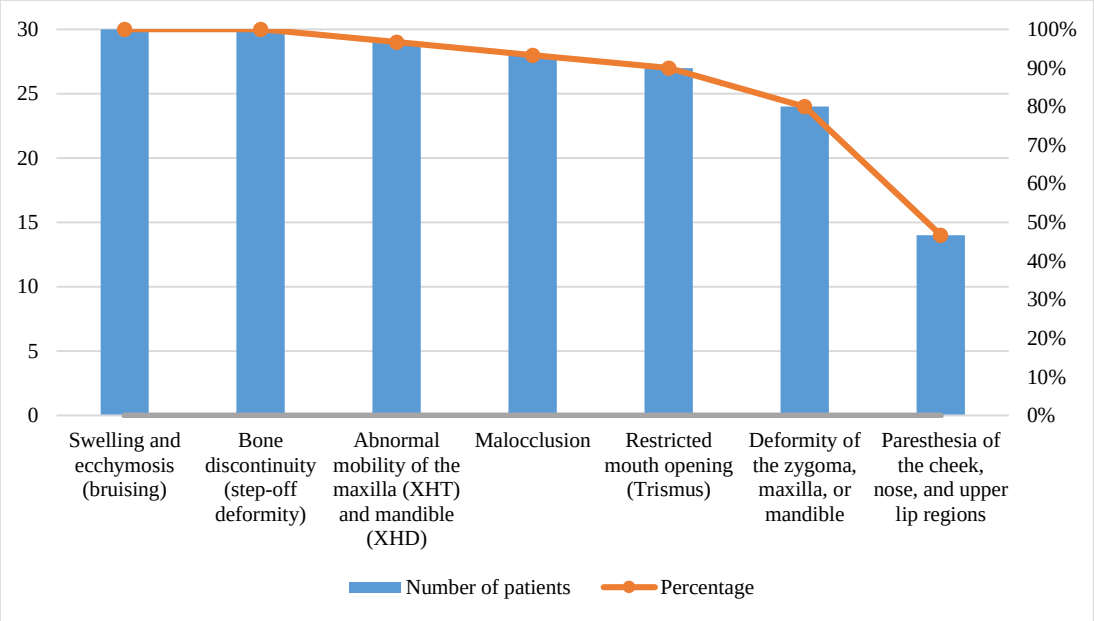

Figure 2. Clinical characteristics of study patients.

One hundred percent (100%) of patients presented with clinical symptoms of swelling, ecchymosis, and bone discontinuity, which is consistent with the results of Dao Bich Thuy (100% bone discontinuity) [4], but higher than Nguyen Cong Suat's finding (85.7% swelling and ecchymosis) [7]. The symptom of abnormal jaw mobility of the maxilla and mandible was observed in 96.7% of patients while deformity of the zygoma, maxilla, or mandible occurred in 80.0%. These rates are higher than those reported by Nguyen Quoc Duc (87.5% abnormal jaw mobility) [8], but lower than Pham Duong Chau's report (92.8% bone deformity/asymmetry) [9].

Table 2. Correlation of mandibular fracture sites with maxillary fracture patterns.

Mandibular fracture pattern	n (%)	Zygomatic/ unilateral	Le Fort I	Le Fort II	Le Fort I + II	Le Fort I + II + III	Other
Symphyseal/parasymphyseal	14 (46.7)	5	3	1	2	1	2
Body/horizontal ramus	2 (6.7)	1	0	0	1	0	0
Angle	3 (10)	2	0	0	0	0	1
Multiple fractures (total)	11 (36.7)	9	0	2	0	0	0
Symphyseal + condylar neck	4 (13.3%)						
Symphyseal + body	2 (6.7%)						
Symphyseal + angle	2 (6.7%)						
Angle + vertical ramus	1 (3.3%)						
Symphyseal + angle + vertical	1 (3.3%)						
Symphyseal + body + condylar	1 (3.3%)						
Total (n = 30)	30 (100)	17	3	3	3	1	3

Isolated symphyseal/parasymphyseal fractures were the most frequent mandibular pattern (46.7%). When combined with the maxilla, the most common association was the mandible paired with zygomatic complex (ZMC) or unilateral maxillary fractures wwith 17/30 cases (56.67%). The high prevalence and complexity of these combined injury patterns can be attributed to the specific etiology and biomechanical factors observed in the study. Since 90.0% of patients sustained trauma from high-energy traffic accidents, primarily involving motorcycles, the resulting injuries were caused by direct impacts to the face. Anatomically, the mandibular symphysis is the most prominent anterior structure of the lower face, making it the primary target for direct force; this explains the prevalence of these isolated fractures (46.67%). Furthermore, the mechanism of combined injury is driven by the fact that the mandible is connected to the midface via the occlusion and the temporomandibular joint. Consequently, severe force is often transmitted upward, or the facial planes are struck simultaneously during high-impact collisons, leading to the panfacial or combined patterns identified in the results - such as the mandible paired with the zygomatic complex or Le Fort patterns - rather than isolated bone breaks.

Table 3. Comparison of fracture site detection: Conventional radiography vs. MSCT (n = 30).

Anatomical region	Conventional X-ray	CT scanner/MSCT	Detection difference
Zygomatic arch	21	21	0
Zygomaticomaxillary	19	19	0
Piriform aperture rim	16	16	0
Orbital floor	0	14	+ 14
Lateral orbital wall	0	6	6
Medial orbital wall	0	4	+ 4
Posterolateral maxillary wall	0	27	+ 27
Mandibular symphysis	24	24	0
Condylar neck	5	5	0
Total fracture sites detected	163	214	+ 51

CT scans proved more effective in identifying fractures, detecting 214 sites, whereas conventional radiography only captured 163. The most frequently missed injuries on conventional X-ray were fractures of the posterolateral maxillary wall (n = 27), followed by the orbital floor (n = 14), the lateral orbital wall (n = 6), and the medial orbital wall (n = 4) While X-rays were limited to superficial areas, CT provided essential 3D visualization of deep structures - such as the orbital floor and posterior maxillary walls - which were entirely missed by standard films. This comprehensive accuracy is vital for effective surgical planning and preventing long-term functional or aesthetic deformities.

This study has several limitations. Firstly, the relatively small sample size (n = 30) and the single - center design conducted at Military Hospital 103 may limit the generalizability of the findings to broader populations. Secondly, as a descriptive study without a control group, causal inferences were unable to be established, and comparisons between treatment strategies or diagnostic approaches are inherently limited. Thirdly, selection bias may have occurred due to the use of convenience and consecutive sampling. Only patients presenting during the study period and meeting the inclusion criteria were enrolled. Furthermore, as the research primarily prioritized the diagnostic value of MSCT in evaluating maxillofacial trauma, the study did not explore specific symptoms in detail. Observation bias may have arisen from the subjective assessment of aesthetic and functional outcomes categorized as good, fair, or poor. In accordance with the STROBE guidelines, potential sources of bias and methodological limitations have been explicitly discussed. To mitigate these limitations, standardized diagnostic criteria were applied, and all diagnoses were supported by confirmed radiographic evidence from both conventional X-ray and multislice computed tomography (MSCT).

CONCLUSION

Based on the study of 30 inpatients at Military Hospital 103 from January 2018 to May 2020, it is concluded that combined maxillary and mandibular fractures primarily affect young males, with a mean age of 29, and are predominantly caused by traffic accidents. Clinical presentation is characterized by swelling and bone discontinuity in all cases, with over 90% of patients experiencing malocclusion and restricted mouth opening. While the mandibular symphysis is the most frequent individual fracture site, the most common combination involves the mandible paired with the zygomatic complex or unilateral maxillary fractures. Crucially, MSCT provides superior diagnostic accuracy compared to conventional radiography, as it identifies significantly more fracture

sites - particularly deep - seated injuries in the posterolateral maxillary and orbital regions, providing the 3D precision necessary for effective surgical planning and the prevention of long - term functional or aesthetic deformities.

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