

FACIAL FRACTURES AND BLOOD PARAMETERS AMONG THE RESIDENTS OF PESHAWAR

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ABSTRACT

Objective: *The aim of this research was to examine the occurrence of facial fractures, their main causes, and the concentrations of calcium and vitamin D in the population of Peshawar.*

Methodology: *This Prospective analytical study was conducted from April 2024 to March 2025 by the Oral and Maxillofacial Surgery (OMFS) department of Peshawar Dental College (PDC), Peshawar. A total of 90 participants were selected for the study based on the established inclusion and exclusion criteria.*

Patients' data were collected using a pre-designed and pre-tested Performa. Blood samples of six milliliters were obtained from each patient. The concentrations of calcium and vitamin D were assessed utilizing established laboratory methods. Fundamental statistical techniques were utilized to analyze the data.

Results: *The gender ratio in the current study was 2:1. Individuals under 40 had a higher frequency of facial fractures (63%). Among fractures, single-bone fractures were the most common, found in 68.9% of subjects, followed by multiple fractures (20%) and associated fractures (11.1%).*

The nasal bone sustained the highest number of fractures (48.3 %), followed by the mandible (46.7 %), zygoma (30.0%), frontal bone (21.7 %), and maxilla (18.3 %). The primary cause of facial fractures was road traffic accidents, accounting for 58 cases, followed by falls, which resulted in 43 cases. Animal attacks were the least frequent cause, with 09 cases reported.

A calcium level ranging from 7.7 mg/dl to 10.6 mg/dl was identified. The vitamin D level was below the normal range in 64% of females and 42% of males. The occupations, academic credentials, and body mass indices did not affect the outcomes ($p > 0.05$).

Conclusion: *Blood calcium and vitamin D levels should be monitored regularly. Enforcing stringent safety regulations while driving and providing safer workplace facilities could help reduce the issue. Further investigation with larger groups from diverse communities is essential to confirm the results.*

Keywords: *Facial bone fractures, Blood Biochemical analysis, and Peshawar*

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INTRODUCTION

Facial fractures refer to the fractured bones found in the facial area, which include the nose, cheeks, eye region, and both the upper and lower jaws. The occurrence of facial fractures represents a major global health issue, with its prevalence differing from one area to another as a result of distinct lifestyles, occupations, environments, stress levels, population density, and socioeconomic factors.¹

In certain regions, bicycles are often used for recreation and transportation, which increases the risk of accidents and leads to fractures.² The primary reasons for facial fractures in young individuals up to the age

of forty include motor vehicle accidents, physical alterations, and sports injuries.² The risk of facial fractures is higher among individuals who consume alcohol or drugs while driving.³ Research has shown that 27.2% of traffic accident victims had a blood alcohol content above the legal limit of 0.6 g/Lt.²

Calcium and vitamin D are essential for maintaining strong bones, teeth, muscles, and overall health. Skeletal development persists until approximately age 20; however, bone mineralization may continue until age 35.⁴ Ninety percent of vitamin D is synthesized by the skin upon exposure to direct sunlight; the remaining ten percent is obtained from food, particularly dairy products, eggs, and fish.⁵ Improving vitamin D levels led to a greater absorption of calcium from dietary sources and its incorporation into the skeletal system.⁴

Low calcium levels are associated not only with osteoporosis but also with increased risk of bone fractures, even from minor falls or impacts.⁶ Another research indicated that insufficient levels of vitamin D increase the risk of bone fractures and reduce bone mineral density (BMD).⁷ The vitamin D precursor 25-hydroxyvitamin D (calcidiol) is usually measured in the serum. Calcidiol < 20 ng/mL indicates a vitamin D deficiency; while < 30 ng/mL indicates an insufficiency.⁸

A prior study discovered that reduced blood concentrations of 25 [OH]D (Vitamin D) impair muscle strength and may consequently elevate the risk of falls and fractures.⁸ However, conflicting evidence from other randomized clinical trials has implied that there is no link between vitamin D and the occurrence of fractures.⁹ Extensive research has been conducted on the connection between vitamin D, calcium levels, and the occurrence of hip and vertebral fractures.¹⁰

However, there is a lack of published information on the mentioned blood parameters and the types of facial fractures, particularly for the population of this specific area, which has a different lifestyle. The current research intends to explore patterns of facial fractures, their main causes, and the concentrations of calcium and vitamin D in patients who received treatment and were admitted to PDC, Peshawar.

METHODOLOGY

This Prospective analytical study was carried out by the Department of Oral and Maxillofacial Surgery (OMFS), at Peshawar Dental College, Peshawar. The duration of study was from April 2024 until March 2025.

The research involved participants who consented to take part, had verified radiological fractures, and resided in District Peshawar. Individuals who exhibited poor general health, had a smoking history, were consum-

ing calcium or vitamin D supplements, suffered from gastrointestinal or renal issues, or had any hormonal disorders were excluded from the study.

The sample size was calculated using a calculator.net. The prevalence was assumed to be 50% due to the lack of a reference, with a 90% confidence level and a 10% margin of error. The calculated sample size was 69. A twenty percent rate was considered as a lack of response. Consequently, the sample size was raised to 83, which was then rounded to 90.

Hence, the study included a total of 90 subjects, comprising 60 males and 30 females, from the middle socioeconomic group. The age range of the participants was from 10 to 55 years. The local ethics research committee approved the study. The goals of the project were conveyed to the participants, who were assured of confidentiality. They were then asked to provide their written consent.

A pre-structured and pre-tested Performa was completed for every patient. The Performa contained information about the participants' age, height, weight, gender, occupation, medical history, and medication. Information on the causes of fractures, along with their types and characteristics, was also collected from the participants.

The causes for injuries were categorized into road traffic accidents (RTA), falls, acts of physical violence, workplace injuries, sports-related injuries, and animal attacks. Facial fractures were classified as: nasal, mandibular, zygomatic, fronto-orbital, maxillary, and unspecified. A fracture is categorized as single if it pertains to just one bone, as multiple if it affects two or more bones, and as associated if it involves additional bones in the body.

A total of 6 mL of blood samples was collected from each patient. Following clotting, the serum was extracted from all the specimens. Calcium levels were assessed using the automated device Cobas-C 311 from Roche, whereas vitamin D was estimated using the Architect Plus I 1000 SR device from Abbott.

For the statistical analysis of the data, version 17 of the Statistical Package for Social Sciences (SPSS) was used. The significance level was set at 0.05, and frequency distribution tables were generated, including means, percentages, and standard deviations.

RESULTS

In the current study, the gender ratio was 2:1, with 66.7% of participants male and 33.3% female. Male patients were more frequently observed in the 20 to 39 age group, whereas female patients were predominantly found in the 10 to 29 age range (Table 1). Sixty-three percent of fractures were observed in

individuals younger than 40 years, whereas 36.7% of fractures were noted in those older than 40 years.

In this study, 62 (68.9%) subjects reported a single bone fracture, 18 (20.0%) reported multiple bone fractures, and 10 (11.1%) had an associated fracture. Among the total cases of facial fractures, 65 (72.2%) were discharged after receiving basic treatment at their request, 22 (24.5%) were hospitalized, and 3 (3.3%) had serious associated fractures and requested a referral to a specialized trauma center for a second opinion.

The most frequently occurring fractures were of the nasal bone, followed by the mandible, zygoma, frontal bone, and maxilla (Table 2). Road traffic accidents (RTA) accounted for the highest number of cases at 58, followed by falls with 43 cases, while animal attacks, with 09 cases, were the least frequent cause of facial fractures (Table 3).

Compared to males, females showed lower levels of Calcium and Vitamin D (Table-04). Vitamin D levels were reported to range from 17 to 45 ng/dl. Concentrations of Vitamin D less than 30 ng/ml and less than 20 ng/ml were detected in 65.3% and 34.7% of the individuals,

respectively. While 58% of males and 36% of females with different types of facial fractures exhibited normal vitamin D levels.

The calcium concentration ranged from 7.7 mg/dl to 10.6 mg/dl. Mandibular fracture patients showed lower levels of calcium and vitamin D, whereas nasal fracture patients showed adequate levels in both sexes (Table 4). However, no significant differences ($p>0.05$) in the two blood parameters were observed among patients having different occupations, educational levels, and body mass indices.

DISCUSSION

The results of the current research indicate that the highest incidence of facial fractures occurs in individuals aged 10 to 29 years. This could be explained by the era of hard work, training for competitive sports, and irresponsible driving. Similar findings were documented previously.¹¹ Other researchers found that the most common age range for facial fractures was 61 to 70 years old.¹² Some scientists demonstrated that facial fractures occurred most frequently in the age group of 21–30 years, whereas the lowest incidence was found

TABLE 1: DISTRIBUTION OF SUBJECTS BY AGE AND SEX

Age range (Years)	Male (Number)	Percentage	Female (Number)	Percentage
10-19	09	15.0	09	30.0
20-29	16	26.7	06	20.0
30-39	13	21.7	04	13.3
40-49	10	16.6	05	16.7
50+	12	20.0	06	20.0

TABLE 2: OVERALL FACIAL FRACTURES AMONG PARTICIPANTS BY GENDER

Fracture's Types	Male	Percentage	Female	Percentage
Nasal	29	48.3	21	70.0
Mandibular	28	46.7	19	63.3
Zygomatic	18	30.0	13	43.3
Frontal	13	21.7	11	36.7
Maxillary	11	18.3	12	40.0
Unspecified	21	35.0	14	46.7

TABLE 3: FRACTURE' TYPES VERSUS FRACTURE' CAUSES AMONG TOTALS

Fracture's Types	Road accident	Fall injury	Physical Violence	Work Injury	Sport injury	Animal's Attack
Nasal	13	10	09	08	06	03
Mandibular	12	09	07	08	07	02
Zygomatic	07	06	06	06	04	00
Frontal	07	05	06	04	02	01
Maxillary	08	05	05	02	03	01
Unspecified	11	08	06	07	03	02
Total	58	43	39	35	25	09

TABLE 4: FRACTURE' TYPES AND THE BLOOD PARAMETERS (MEAN $\pm$ SD)

Fracture's Types	Calcium (mg/dl) In Male	Calcium (mg/dl) In Female	p-Value	Vitamin D (ng/ml) In Male	Vitamin D (ng/ml) In Female	p-value
Nasal	9.9 + 0.7	9.6 + 0.6	= 0.0479	39 + 6.0	34 + 5.0	= 0.0002
Mandibular	8.3 + 0.3	8.0 + 0.3	< 0.0001	22 + 3.0	19 + 2.0	< 0.0001
Zygomatic	8.6 + 0.4	8.2 + 0.4	< 0.0001	29 + 4.0	24 + 3.0	< 0.0001
Frontal	8.5 + 0.5	8.3 + 0.5	= 0.0771	34 + 5.0	31 + 4.0	= 0.0053
Maxillary	8.6 + 0.6	8.4 + 0.5	= 0.1195	33 + 5.0	30 + 5.0	= 0.0087
Unspecified	8.4 + 0.5	8.1 + 0.3	< 0.0001	31 + 4.0	28 + 4.0	= 0.0012

in the 50+ age group.¹³

The present study indicated that males experienced a greater impact of the injuries than females. This agrees with previous research findings on the subject, where male patients sustained a higher proportion of facial injuries compared to female patients.¹⁴ The possible explanation for the disparity between the two genders could be that males tend to participate in riskier behaviors without taking preventive precautions, in contrast to females.

The present study showed an adequate proportion of multiple and associated fractures. This is consistent with the findings of other studies.¹⁵ The results concerning multiple mandibular fractures provide crucial information for surgeons, who must consistently take into account other indirect fractures. Three individuals suffering from severe associated fractures were referred to the trauma center. Consequently, this situation underscores the need for a trauma center with multiple specialties to improve patient care.

In the current research, we discovered that nasal bone fractures were the most prevalent, followed by fractures of the mandible, unspecified areas, zygoma, frontal bone, and maxilla. Another study indicated that the zygomatic complex fractures were the most common (44.5%), followed by mandible fractures (42.5%), maxillary bone fractures (5.2%), nasal bone fractures (4.5%), and zygomatic arch fractures (3.3%).¹¹ Despite being the strongest bone in the facial skeleton, the mandible may be impacted due to its prominent chin and unique positioning.

In Saudi Arabia, the mandibular angle was identified as the second most commonly fractured site, following the condyle.¹⁶ In Switzerland, a lower frequency of fractures in the mandible angle was noted when compared to other locations.¹⁷ The zygoma was identified as the third most frequently injured facial bone in the current study. Some researchers conducted a comprehensive review of 20 articles and 17,055 patients, and they concluded that after mandibular fractures, zygoma fractures had the second-highest incidence.¹⁸

Concerning the etiology of fractures, the predominant cause was road traffic accidents (RTA) in this study, which resulted in 58 cases. A preliminary study also found a significant proportion of road traffic accidents attributable to other causative factors.¹⁹ There is a report that motorcycle accidents were the main etiological factor among RTAs.¹¹ The possible reason for the high number of RTAs is socioeconomic factors, which include substandard road conditions, careless driving behavior, inadequate vehicle maintenance, insufficient enforcement of traffic laws, speed regulations, and seat belt requirements.

Falls from heights are noted as the second most prevalent reason for facial fractures. This result contradicts a prior report indicating that falls from height were the least prevalent etiological factor contributing to facial injuries.¹³ People fall from trees when they climb to find tropical fruits and to cut wood for domestic use.¹⁹ Falling is the primary cause of trauma for individuals over the age of 40, often linked to the presence of various health conditions.¹¹

Physical violence and job injuries were identified among 39 and 29 participants, respectively. Job injuries varied in different geographical locations, influenced by distinct working environments and conditions.¹¹ A study showed that construction workers exhibited the highest rate of maxillofacial injuries, followed by craftsmen and office workers.²⁰

A total of twenty-five fractures resulted from sports activities, including cricket, football, hockey, baseball, and wrestling. Certain researchers have suggested that sports-related injuries are a major predictor of isolated fractures in the upper midface.²⁰

This investigation found that calcium levels were generally low, except in road accident patients. Vitamin D deficiency was found in 35.7% of cases and insufficiency in 65.3% of cases. Furthermore, males exhibited relatively high levels of the two blood parameters compared with females. This is largely driven by lower dietary intake and limited sun exposure due to lifestyle, clothing, and cultural.⁵ Individuals deficient in calcium and vitamin D are at a higher risk of getting

fractures.⁶ Another study also highlighted that elevated blood concentrations of these parameters were linked to a lower risk of fracture.⁸

Several patients in the present study sustained facial fractures despite sufficient vitamin D levels. These fractures may be attributable to the severity of etiological events. Other researchers also observed no beneficial association between calcium and vitamin D levels and fracture occurrence.⁹ However, a prior research indicated that daily intake of vitamin D and calcium considerably lowers the risk of any fracture.¹¹ Combined treatment with both vitamin D and calcium was found to be associated with a 16% reduction in the risk of hip fracture.²¹

The constraints of this research were noted in the budgeting area. The insufficient budget limited the study to a small sample size. Further research is required to elucidate the aforementioned findings with larger populations across diverse communities globally.

CONCLUSION

Regular assessments of blood calcium and vitamin D levels are essential for the effective management of bone health. Besides, a secure work environment, sports, and driving are measures to reduce the number of facial fractures within any community.

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