ANALYSING THE INCIDENCE, ETIOLOGY, AND PATTERNS OF MANDIBULAR FRACTURES IN INDIAN SUB-POPULATION: A CROSS-SECTIONAL STUDY

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ABSTRACT
BACKGROUND: Mandibular fractures are common facial injuries with varying patterns influenced by demographic factors. Understanding these patterns can inform better prevention and treatment strategies. This study aimed to analyze the incidence, etiology, and patterns of mandibular fractures in patients treated at the Raichur Institute of Medical Sciences (RIMS).

METHOD: This retrospective study was conducted at the RIMS, a public health hospital in the Raichur region of Karnataka State, over a two-year period, from April 2022 to April 2024. Data were collected from medical records and radiographs of patients diagnosed with mandibular fractures. The study analysed demographic data, etiological factors, anatomical distribution, and treatment outcomes. Statistical analysis was performed using SPSS version 26.0, with chi-square tests for categorical variables ($p < 0.05$ considered significant).

RESULT: The study included 742 patients. The majority (64.2%) were in the 20-40 age group, with males representing 77.8% of cases. MVAs were the leading cause of fractures (47.0%), followed by falls (25.3%) and assaults (17.5%). Alcohol involvement was noted in 64.4% of cases. The symphysis region was most commonly fractured (59.4%), with angle para-symphysis opposite fractures being the most common pattern (40.6%). Most patients (72.9%) underwent ORIF as the treatment modality. Significant associations were found between demographic factors (age, gender, marital status, alcohol involvement) and fracture patterns and mechanisms of injury ($p < 0.05$).

CONCLUSION: This study provides a comprehensive understanding of the demographic factors, mechanisms, and patterns of mandibular fractures. The majority of cases occurred in the 20 to 40 age group, predominantly affecting males, with MVAs as the leading cause. Alcohol involvement was a significant factor. These findings underscore the need for tailored prevention and treatment strategies, particularly focusing on high-risk groups and alcohol-related incidents.

KEYWORDS: Mandibular fractures, incidence, etiology, patterns, demographic factors, motor vehicle accidents, alcohol involvement.

INTRODUCTION

Mandibular fractures are common facial injuries, reflecting the mandible's prominence and vulnerability.[1] As a crucial part of the craniofacial skeleton, the mandible is essential for functions like mastication, speech, and aesthetics. Its exposed anatomical position makes it particularly susceptible to fractures from trauma such as road traffic accidents, falls, interpersonal violence, and sports-related injuries.[2]

The incidence and patterns of mandibular fractures vary across populations, influenced by socioeconomic factors and cultural practices. Studies consistently report a higher prevalence of these fractures in males, particularly those in their third decade of life, often due to greater involvement in high-risk activities. Road traffic accidents are a leading cause, especially in regions with lax traffic regulations and inconsistent vehicle safety standards. Interpersonal violence, especially in urban areas, is another significant contributor.[3]

The anatomical distribution of mandibular fractures typically includes the symphysis, condylar region, body, and angle of the mandible. The condylar region is frequently affected due to its position and the forces transmitted during impacts. Young and middle-aged men are particularly prone to mandibular fractures, with falls and traffic accidents being the major causes.[4]

Pediatric facial fractures present unique challenges due to the ongoing growth of the facial skeleton. Falls are the leading cause of facial fractures in children, followed by road traffic accidents. The pattern of injuries in children is influenced by their age and growth stages. Beyond mandibular fractures, craniofacial trauma often includes injuries to other facial bones, with nasal bone fractures being common, especially from ground accidents and assaults.[5]

Management of mandibular fractures involves both surgical and non-surgical approaches aimed at restoring function, occlusion, and aesthetics while minimizing complications. Advances in surgical techniques, such as open reduction and internal fixation (ORIF), have significantly improved outcomes, although challenges remain in managing complex fractures.[6]

This study aims to provide a comprehensive overview of mandibular fractures in the Raichur district by analyzing their incidence, etiology, and patterns over two years at the RIMS Hospital. By understanding these patterns, the study seeks to inform preventive strategies and optimize treatment protocols, with the broader goal of enhancing patient care in maxillofacial trauma. The insights gained are expected to contribute to improving fracture management and prevention strategies in similar settings.

METHODOLOGY
Study Area
The study was conducted at the Raichur Institute of Medical Sciences (RIMS), a public health hospital located in the Raichur district of Karnataka state, India.

Study Design and Period
This was a retrospective study carried out over a two-year period, from April 2022 to April 2024.

Study Population and Sample Size

The study included all patients diagnosed with mandibular fractures at RIMS during the study period. The total sample size was 742 patients, encompassing a diverse demographic range.

Inclusion Criteria

Patients of all ages and genders with mandibular fractures who received treatment at RIMS and had complete medical records and radiographs available.

Exclusion Criteria

Patients with incomplete medical records, those treated outside the study period, and cases of pathological fractures unrelated to trauma.

Ethical Consideration

The study was conducted following the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee (IEC) of RIMS, with the IEC waiving the requirement for informed consent due to the study's retrospective nature. Patient confidentiality was maintained by anonymizing personal information.

Sample Collection and Processing

Data were retrospectively collected from the medical records department (MRD) and patient radiographs. The recorded information included demographic data, etiological factors, anatomical distribution of fractures, and treatment modalities.

Data Collection and Analysis

Data were entered into a spreadsheet and analysed using SPSS version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarize the data. Chi-square tests were employed to compare categorical variables, with a p-value of less than 0.05 considered statistically significant.

RESULTS

The study population (n=742) primarily consisted of patients aged 20 to 40 years (64.2%), with males representing 77.8% of cases. Most patients were married (86.9%). The leading causes of mandibular fractures were motor vehicle accidents (MVAs) (47.0%), followed by falls (25.3%) and assaults (17.5%). Alcohol involvement was noted in 64.4% of cases (Figure 1).
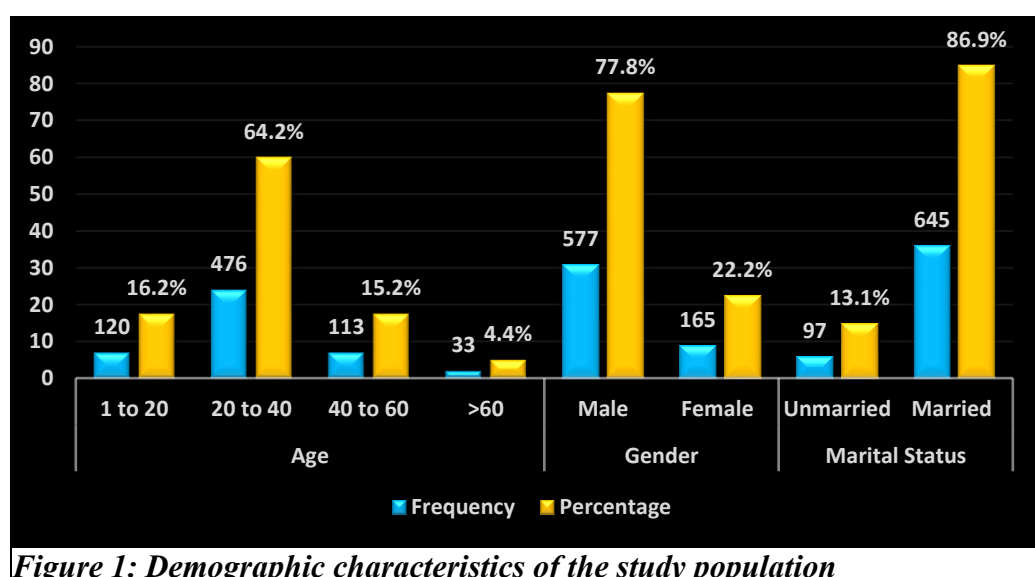

Figure 1: Demographic characteristics of the study population

The mechanisms of injury and the involvement of alcohol in the study population are summarized in Figure 2. The leading cause of mandibular fractures was MVAs, which accounted for 47.0% of the cases.
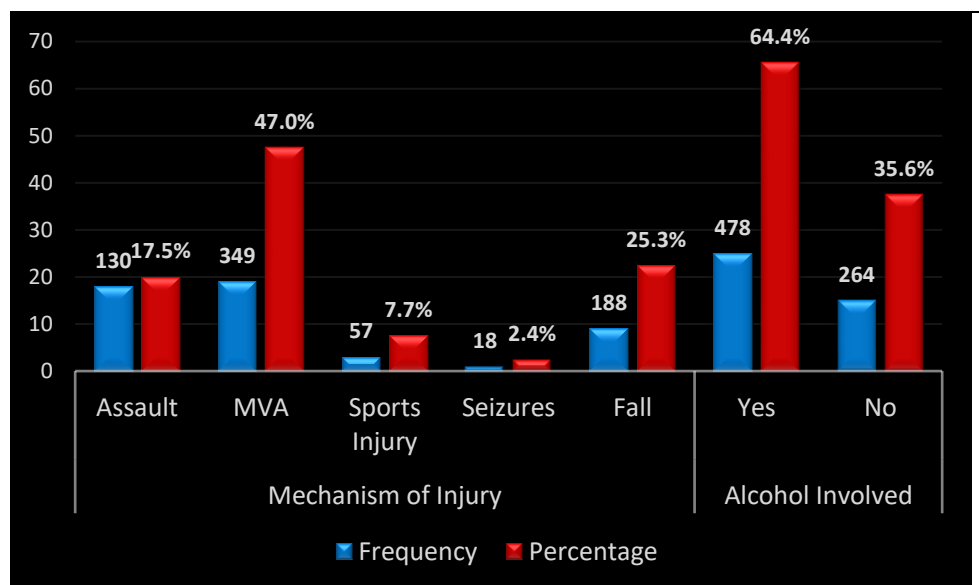

Figure 2: Distribution of mandibular fractures according to the mechanism of injury and involvement of alcohol

The distribution of mandibular fractures according to location is summarized in Figure 3. The majority of fractures were located in the symphysis region, accounting for 59.4% of the cases. The parasymphysis region on the left side was the second most common site, with 14.8% of the fractures, followed by the left body of the mandible at 8.2%.
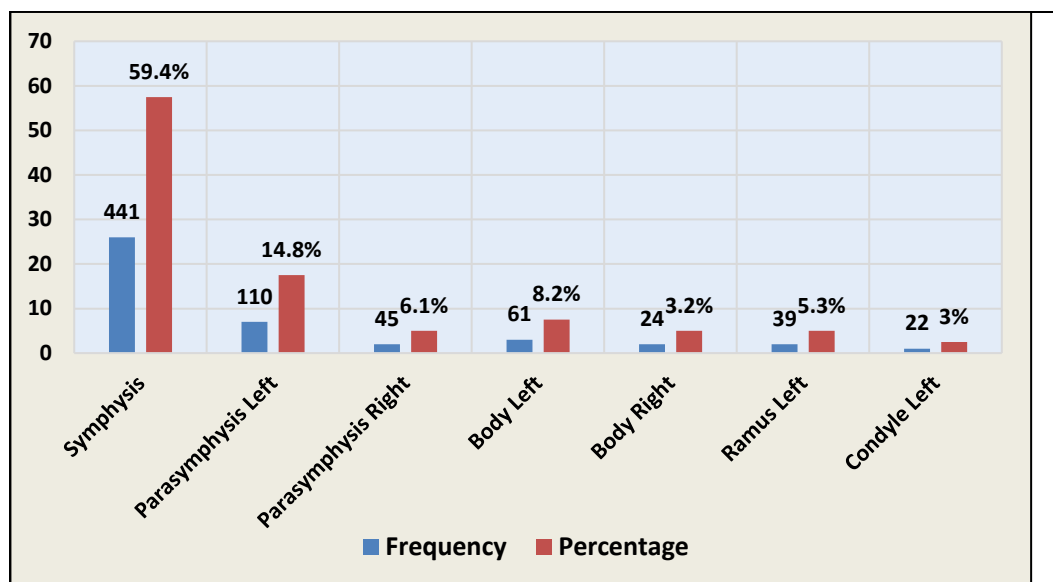

Figure 3: Distribution of mandibular fractures according to the location

The pattern of mandibular fractures in the study population is summarized in Figure 4. The most common pattern was fractures involving the angle parasymphysis opposite, accounting for 40.6% of the cases. This was followed by fractures isolated to the para-symphysis region, which comprised 35.8% of the cases.

Figure 4 Distribution of mandibular fractures according to number
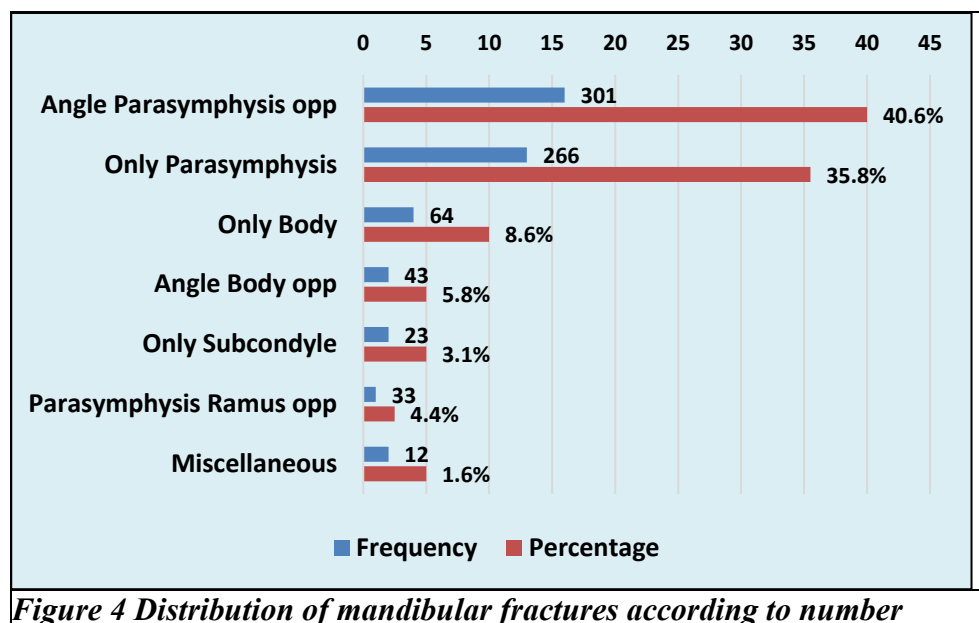
The treatment modalities for mandibular fractures in the study population are summarized in Figure 5. The majority of patients, 72.9%, underwent ORIF. A smaller proportion, 8.6%, took their leave from the hospital without formal treatment. Conservative management was applied in 6.5% of the cases, while 12.0% of the patients underwent exploration without subsequent ORIF.

Figure 5: Management strategies of mandibular fractures

Table 1 Reveals associations between demographic factors and the mechanisms of injury in mandibular fractures. Age, gender, marital status, alcohol involvement, fracture location, and fracture pattern showed a significant association with the mechanism of injury ($p < 0.05$).

Table 2 Shows associations between demographic factors and the location of mandibular fractures. Age, gender, marital status, alcohol involvement, and fracture location showed a significant association with fracture location ($p < 0.05$).
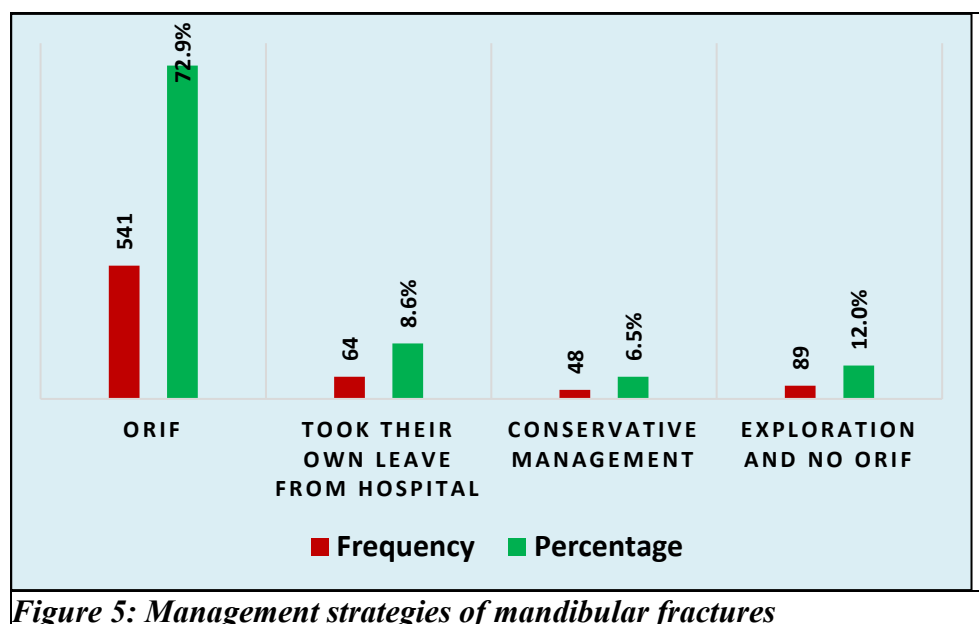
Table 3 Depicts associations between demographic factors and the pattern of mandibular fractures. Age, gender, marital status, and alcohol involvement were significantly related to fracture patterns ($p < 0.05$).

Variables	Mechanism of Injury					Chi-Square Value	p-value
	MVA	Assault	Sports Injury	Seizures	Fall		
Age							
1-20	15	48	57	0	0		
20-40	249	182	0	18	127		
40-60	52	0	0	0	67	494.377	**<0.001***
>60	33	0	0	0	0		
Gender							
Male	310	63	87	18	129	119.785	**<0.001***
Female	39	67	0	0	59		
Marital status							
Married	334	82	23	18	188	228.154	**<0.001***
Unmarried	15	48	34	0	0		
Alcohol Involved							
Yes	276	71	0	0	131	176.254	**<0.001***
No	73	59	57	18	57		
Fracture Location							
Symphysis	231	75	22	18	95		
Para-symphysis Left	23	33	23	0	31		
Para-symphysis Right	0	0	0	0	45		
Body Left	61	0	0	0	0	422.228	**<0.001***
Body Right	12	0	12	0	0		
Ramus Left	0	22	0	0	17		
Condyle Left	22	0	0	0	0		
Fracture Pattern							
Only Parasymphysis	121	68	45	0	32		
Angle Parasymphysis Opp	121	23	0	18	139		
Angle Body Opp	43	0	0	0	0		
Only Body	33	22	12	0	0		
Para-symphysis Ramus Opp	12	11	0	0	10	291.209	**<0.001***
Only Subcondyle	16	0	0	0	7		
Miscellaneous	6	6	0	0	0		

Table 1: Association of demographic factors with the mechanism of injury of mandibular fractures

*Significant value<0.05; Chi-Square Test; MVA-Motor Vehicle Accident

Variables	Location of Mandibular fractures							Chi-Square value	p-value
	Symphysis	Parasymphysis Left	Parasymphysis Right	Body Left	Body Right	Ramus Left	Condyle Left		
Age									
1-20	37	49	0	0	12	22	0		
20-40	348	50	12	54	12	0	0	857.228	**<0.001***
40-60	56	0	33	7	0	17	0		
>60	0	11	0	0	0	0	22		
Gender									
Male	300	103	45	61	24	22	22	93.949	**<0.001***
Female	141	7	0	0	0	17	0		
Marital status									
Married	404	84	45	61	12	22	22	131.817	**<0.001***
Unmarried	37	26	0	0	12	17	0		
Alcohol Involved									
Yes	291	65	45	43	12	0	22	130.730	**<0.001***
No	150	45	0	18	12	39	0		
Fracture Pattern									
Only Parasymphysis	196	57	0	0	0	7	6		
Angle Parasymphysis Opp	203	53	45	0	0	0	0		
Angle Body Opp	0	0	0	43	0	0	0		**<0.001***
Only Body	0	0	0	18	24	22	0	1486.24	
Para-symphysis Ramus Opp	23	0	0	0	0	10	0		
Only Subcondyle	7	0	0	0	0	0	16		
Miscellaneous	12	0	0	0	0	0	0		

Table 2: Association of demographic factors with the location of mandibular fractures

*Significant value<0.05; Chi-Square Test

Variables	Pattern of Mandibular fractures							Chi-Square value	p-value
	Only Parasymphysis	Angle Parasymphysis Opp	Angle Body Opp	Only Body	Parasymphysis Ramus Opp	Only Subcondyle	Miscellaneous		
Age									
1-20	75	11	0	34	0	0	0		
20-40	159	216	36	30	23	0	12		
40-60	26	63	7	0	10	7	0	412.292	**<0.001***
>60	6	11	0	0	0	16	0		
Gender									
Male	199	230	43	64	12	23	6	76.888	**<0.001***
Female	67	71	0	0	21	0	6		
Marital status									
Married	214	290	43	30	33	23	12	140.352	**<0.001***
Unmarried	52	11	0	34	0	0	0		
Alcohol Involved									
Yes	162	203	43	12	23	23	12	104.356	**<0.001***
No	104	98	0	52	10	0	0		

Table 3: Association of demographic factors with the pattern of mandibular fractures

*Significant value<0.05; Chi-Square Test

DISCUSSION

Mandibular fractures are the most prevalent type of facial fracture, accounting for between 35 and 56.9% of all facial fractures [7]. This retrospective study was conducted at the RIMS, a public health hospital located in Raichur district of Karnataka state, India. The study aims to analyze the incidence, etiology, and pattern of mandibular fractures over a period of 4 years.

The demographic characteristics of the study population provide valuable insights into the incidence, etiology, and patterns of mandibular fractures in this region. The majority of cases occurred in the 20 to 40 age group, which aligns with other studies [8, 9] highlighting the increased risk of trauma in this active and working-age demographic. Additionally, gender distribution showed a significant male predominance, consistent with the findings of Agir et al. (2005)[6] and other studies,[10,11] which can be attributed to the greater involvement of males in activities leading to trauma, such as driving and physical altercations. Moreover, the marital status data revealed that the majority of the patients were married, indicating that marital status may not be a significant protective factor against mandibular fractures.

The MVAs emerged as the leading cause of mandibular fractures. This finding is consistent with global trends,[10,12] where MVAs are a significant contributor to facial trauma due to high-speed impacts and inadequate use of protective measures. Additionally, falls were the second most common cause followed by assault, responsible for fractures, highlighting the risk of everyday activities and the potential vulnerability of the elderly and children,[13] and reflecting social and behavioural factors that influence trauma incidence.[14] However, sports injuries were a less common cause, indicating that while sports activities pose a risk, they are not the predominant cause of mandibular fractures in this population.[15] Moreover, seizures accounted for the smallest proportion, suggesting that medical conditions, while relevant, are a minor factor in the overall incidence of these injuries.[16]

A significant finding was the involvement of alcohol in most of the cases, indicating a strong correlation between alcohol consumption and the likelihood of sustaining mandibular fractures.[17] Moreover, this underscores the need for public health interventions targeting alcohol consumption and its role in trauma, particularly in reducing the risk associated with MVAs and assaults.[18]

This prevalence of mandibular fractures in the symphysis region can be attributed to the anatomical position, which is prone to direct trauma from impacts to the lower face.[19] Similarly, the

parasymphysis region on the left side was the second most common fracture site, followed by the left body of the mandible. This pattern highlights the vulnerability of the anterior and lateral regions of the mandible to fractures.[20]

The pattern of mandibular fractures in the study population indicates that the most common fracture pattern involved was angle para-symphysis opposite. Similar findings were observed in previous studies.[21,22] Regarding treatment, the majority of patients underwent ORIF, highlighting it as the preferred treatment modality. However, a smaller proportion of patients left the hospital without formal treatment, conservative management, and exploration without subsequent ORIF, indicating possible barriers to care or personal choice. These findings underscore the complexity of mandibular fractures and the importance of tailored treatment approaches to achieve optimal outcomes.

The study revealed significant associations between demographic factors and the mechanism of injury in mandibular fractures. Age was significantly linked to the mechanism of injury, with the 20-40 age group individuals more frequently involved in MVAs and falls. This finding aligns with other studies, such as those by Chrcanovic et al. (2012)[23] and Abosadegh et al. (2018),[24] which also reported higher incidences of fractures in younger adults and those engaged in active lifestyles or occupational hazards.

This study reveals significant associations between demographic factors and the location of mandibular fractures. Age, gender, marital status, and alcohol involvement all showed significant relationships with fracture location. The symphysis region was most commonly affected, particularly in the 20-40 age group, consistent with other study findings,[25] which also identified the symphysis as a frequent fracture site in young adults. Younger age groups more frequently had para-symphysis fractures, whereas fractures in the body and condyle were less common, aligning with the anatomical vulnerability highlighted in other studies.[26]

This study reveals significant associations between demographic factors and the pattern of mandibular fractures. The 20-40 age group predominantly exhibited angle and opposite para-symphysis fractures, aligning with findings by Zhou et al. (2019)[27] which also noted a higher incidence of complex fracture patterns in this active age group. Younger patients (1-20) commonly had parasymphysis fractures, indicating different trauma mechanisms or bone resilience in younger individuals. Additionally, the gender analysis showed that males more frequently had the angle and opposite para-symphysis fractures, consistent with the patterns reported by Zulfiqar et al. (2018).[28] This male predominance is often linked to greater participation in high-risk activities. Similarly, married individuals predominantly experienced angle and opposite para-symphysis fractures, suggesting lifestyle and occupational factors that increase exposure to trauma.

CONCLUSION

This study provides a comprehensive understanding of the demographic factors, mechanisms, and patterns of mandibular fractures. The majority of cases occurred in the 20 to 40 age group, predominantly affecting males, with MVAs as the leading cause. Alcohol involvement was a significant factor. These findings underscore the need for tailored prevention and treatment strategies, particularly focusing on high-risk groups and alcohol-related incidents.

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