

Maxillofacial Trauma in a Resource-limited Tertiary Center in Nepal: Etiologic Profiles, Fracture Patterns, and Associated Systemic Injuries

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ABSTRACT:

Introduction: Maxillofacial trauma patterns vary by region and terrain. In Nepal, most studies come from urban or highway-adjacent centers. Data from hilly, rural districts are limited. **Methods:** We conducted a prospective observational study at Lumbini Medical College and Teaching Hospital in western Nepal from June 2024 to May 2025. All patients with oral and maxillofacial injuries were included. Data on demographics, injury cause, fracture type, and associated injuries were recorded and analyzed using descriptive statistics. **Results:** A total of 123 patients were enrolled. Males predominated (67.48%), with a male-to-female ratio of 2.08:1. The peak age group was 21–30 years (22.76%). Falls were the leading cause of injury (51.22%), followed by road traffic accidents (33.33%) and physical assault (8.94%). Skeletal fractures occurred in 41.46% of patients. Midface fractures were more common (50.98%) than mandibular fractures (31.37%). Among midface injuries, zygomaticomaxillary complex fractures were the most frequent (76.92%). The parasymphysis was the predominant mandibular fracture site (68.75%). Concomitant extrafacial injuries were seen in 30.08% of patients, most commonly head injury (17.89%) and orthopedic injuries (16.26%). **Conclusions:** In the hilly districts of western Nepal, falls are the primary cause of maxillofacial trauma, and midface fractures outnumber mandibular fractures. These findings reflect local geography and occupational risks. Region-specific prevention and multidisciplinary triage protocols are needed.

Keywords: Etiology; Falls; Fractures; Maxillofacial trauma; Zygomaticomaxillary complex.

INTRODUCTION

Oral and maxillofacial trauma is a major health problem worldwide and a common emergency room case.¹ The face sits out in the open, has a complex bone structure, and lies close to the brain, eyes, and

airway. That is why these injuries often become serious. They can be minor—like cuts and bruises—or severe, including shattered jawbones, cheekbone fractures, Le Fort injuries, orbital wall breaks, and damage around the nose and eye sockets. Road traffic accidents, falls, assaults, animal bites, blasts, and workplace injuries are the usual causes.^{2,3}

But the main cause changes depending on where you are. In low- and middle-income countries like Nepal and India, road traffic accidents account for 50–70% of cases.^{4–7} Rapid urbanization, poor roads, and weak traffic enforcement drive these numbers. In high-income countries with better safety laws, interpersonal violence and falls are more common.^{2–4,8,9}

Most victims are young adults between their 20s and 40s.^{6,10,11} Men are affected far more often, largely because they have more outdoor jobs and tend to take more risks.^{6,12,13} These injuries frequently come with head trauma, neck spine injuries, or eye problems. So, a team of different specialists is often needed to manage them.^{9,14–17}

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Injury patterns vary between countries. They also differ across states, and even between rural and city areas within the same country.^{1,10} In Nepal, regional studies from various centers have reported differing etiological and clinical trends based on local topography and traffic density.¹⁸⁻²¹

Our study looks at the clinical patterns, patient backgrounds, causes, and accompanying injuries from maxillofacial trauma cases at Lumbini Medical College and Teaching Hospital. We hope this will help our team triage patients better and design more effective prevention efforts.

METHODS

We carried out a regional, observational, prospective study at Lumbini Medical College and Teaching Hospital in Palpa, Nepal. This hospital is the main tertiary referral center for five hilly districts in Lumbini Province: Palpa, Gulmi, Arghakhanchi, Baglung, and Syangja.

We included all patients who came to the emergency department, the dental department, or the wards with oral and maxillofacial injuries between June 2024 and May 2025. The institutional review committee of LMC gave ethical approval (Reference no: IRC-LMC-50/N-24).

We calculated the sample size using the standard formula: $n = (z^2 \times p(1-p)) / e^2$. We took the proportion of pan-facial fractures from a study by Jaisani MR et al., which reported 6.67% in an eastern Nepal tertiary hospital. With a 95% confidence level and a 5% margin of error, the minimum sample size was calculated as 96.

We used convenient sampling where we included all the cases that fits inclusion criteria during our study period. After getting written informed consent from each patient or their relatives, we recorded data on a standardized proforma. For every patient, we noted the following details:

- A. Demographics – age, sex, and address (geographic location of residence).
- B. Cause of injury – road traffic accident, fall, physical assault, sports injury, animal bite, or industrial/occupational injury.
- C. Site and type of injury – we split this into:
 - I. Soft tissue injury – bruising, contusions, abrasions, lacerations, incised wounds, avulsions, or penetrating wounds.
 - II. Hard tissue injury – this included:
 - a. Dental injuries – luxation, subluxation, intrusion, extrusion, or avulsion.
 - b. Facial bone injuries – these were further

divided into:

- c. Mandible fractures – symphysis, parasymphysis, body, angle, subcondyle, coronoid, or ramus.
- d. Midface fractures – Le Fort I, II, and III; zygomaticomaxillary complex (ZMC) and zygomatic arch; orbital floor/walls; and nasal bones.
- e. Dentoalveolar fractures.

- D. Associated or concomitant injuries – we looked for traumatic brain injury (head injury), cervical spine injury, eye injuries, chest or abdominal trauma, and orthopedic fractures.

We entered the data into Microsoft Excel and then imported it to PSPP 2.1.1 for analysis. We used descriptive statistics. For continuous variables like age, we reported the mean, standard deviation (SD), and range. For categorical variables like sex, cause of injury, and fracture site, we used frequencies and percentages.

RESULTS

A total of 123 patients with maxillofacial trauma met our inclusion criteria during the study period. There were 83 (67.48%) males versus 40 (32.52%) females, giving a male-to-female ratio of 2.08:1. The mean age of the participants was 31.7 ± 19.8 years. The patients' ages ranged widely, from a 6-month-old infant to an 83-year-old geriatric patient (**Table 1**). The most commonly affected group was 21–30 years, followed by 31–40 years. Patients under 20 years accounted for 30.08% of cases, which shows that children and teenagers make up a substantial portion of this population.

Table 2 shows the etiological profile of maxillofacial trauma. Falls were the most common

Table 1: Age distribution of patients with maxillofacial trauma (n=123)

Age group	Total, n (%)
<1 year	2 (1.63)
1–10 years	20 (16.26)
11–20 years	15 (12.20)
21–30 years	28 (22.76)
31–40 years	21 (17.07)
41–50 years	12 (9.76)
51–60 years	13 (10.57)
61–70 years	8 (6.50)
>70 years	4 (3.25)
Total	123 (100)

Table 2: Etiological profile of maxillofacial trauma (n=123)

Cause of injury	Total, n (%)	Patients with fracture	Fracture rate (%)
Fall injury	63 (51.22)	21	33.3%
Road traffic accident	41 (33.33)	23	56.1%
Physical assault	11 (8.94)	6	54.5%
Sports injury	5 (4.07)	1	20.0%
Industrial injury	2 (1.63)	0	0.0%
Animal bite	1 (0.81)	0	0.0%
Total	123 (100)	51	41.5%

cause of facial injury, accounting for more than half of all cases. Road traffic accidents were the second most common cause, accounting for one-third of cases. Together, falls and RTAs made up 84.55% of all cases. Physical assault accounted for 11 cases (8.94%). Almost all were male (10 out of 11), and this group had a high fracture rate of 54.5%. However, RTAs were the leading cause of fractures overall, causing 23 out of 51 (45.10%) fractures and had the highest per-cause fracture rate at 56.10%.

Among the 123 patients, 51 (41.46%) had fractures of the facial skeleton, while the remaining 72 (58.54%) had only soft tissue injuries or swelling without bony involvement. Lacerations were the most common soft tissue injury across all causes. Of the 92 patients with lacerations, 42 (45.65%) came from falls and 39 (42.39%) from RTAs — together, these two causes accounted for 88.04% of all lacerations. A similar pattern was seen for abrasions. Twelve patients (9.76%) had no soft tissue injury at all; they presented with isolated facial fractures.

Because high-energy impacts often results in fractures of multiple bones in one person, we identified 53 fracture subsites among the 51 fracture patients. Midface fractures were the most common, occurring in 26 patients (50.98% of all fracture cases). **Table 3** shows the details of midface fractures. Mandibular fractures came next, with 16 patients (31.37%). **Table 4** shows the details. Dentoalveolar fractures made up the remaining 12 cases (23.53%).

Falls caused most midface fractures (13/26, 50%), while RTAs caused most mandibular fractures (7/16, 43.75%). Within the mandible, the parasymphysis was the single most vulnerable site, accounting for 68.75% of all mandibular fractures. Dentoalveolar fractures alone made up 23.53% of hard tissue injuries, suggesting that low-to-moderate frontal forces often get absorbed by the teeth and

Table 3: Midface fracture subtype distribution (n=26)

Midface subtype	n	% of midface fractures
Zygomaticomaxillary complex (ZMC)	20	76.92 %
Maxillary (Le Fort), n=8	Le Fort I	3 11.54 %
	Le Fort II	3 11.54 %
	Le Fort III	2 7.69 %
Orbital fracture, n=3	Orbital floor	2 7.69 %
	Orbital roof	1 3.85 %
Total subsite instances	29	119.23 %*

*Total is more than 100% as multiple fractures were present in some patients.

Table 4: Mandibular fracture subtype distribution (n=16 mandibular fracture patients)

Mandibular subsite	n	% of mandibular fractures
Parasymphysis	11	68.75 %
Angle	5	31.25 %
Subcondylar/condylar	4	25 %
Body	1	6.25 %
Total subsite instances	21	131.25%*

*Total is more than 100% as multiple fractures were present in some patients.

alveolar bone before they cause full-thickness fractures of the mandible or upper face.

Of the 123 patients, 86 (69.92%) had isolated facial trauma with no other body region involved. The remaining 37 patients (30.08%) had at least one concomitant injury outside the face. The most common associated injury was head trauma, seen in 22 patients (17.89% of the whole cohort), followed by orthopedic injuries in 20 (16.26%) patients and ophthalmic trauma in seven (5.69%) patients. Abdominal injuries were rare, with only two (1.63%) cases. These significant injuries outside the face, especially to the head and limbs, highlight the need for a full trauma survey in these patients, rather than just looking at the face alone.

DISCUSSION

This study looked at maxillofacial trauma cases in a tertiary hospital in the hilly region of western Nepal. We found some clear patterns. Our results differ from what is commonly reported in global studies, and they also bring out some local public health problems that are specific to this area.

We found more men than women in our

study. The male-to-female ratio was 2.08:1 (**Table 1**). This matches global patterns,^{6,10} but it is lower than what is usually seen in big city hospitals.^{12,13,19,22} The lower ratio may be explained by the fact that in rural Nepal, women often work outdoors, in farming and with livestock. Also, many men have gone overseas for work leaving women at home. This exposes them to the same risks as men, which may explain why the gap is not as wide as in urban areas.

Most patients (28, 22.76%) were young adults between 21 and 30 years old. This age group is the most affected because they are more active, mobile, and often work in jobs that put them at risk.^{10,19}

In most studies, whether from rich or poor countries, road traffic accidents are the number one cause of facial trauma.^{9,20,23,24} But in our study, that was not the case. Falls were the most common cause, making up 51.22% of all cases (**Table 2**). Road traffic accidents came second, at 33.33%. This is a striking finding when compared to other studies conducted in Nepal. In urban and centers adjacent to major highways such as Kathmandu, Dharan, Dhulikhel, road traffic accidents are reported as the primary cause of maxillofacial trauma, often accounting for 50-70% of all cases.^{7,19-21} In contrast, this study at Palpa, Nepal shows the opposite trend where accidental falls outnumber road traffic accidents.

This may be explained by the fact that our hospital is situated in a hilly region. The districts around our hospital, Palpa, Gulmi, Arghakhanchi, Baglung, and Syangja, are hilly and mountainous. The roads are narrow, the slopes are steep, and cliffs are everywhere. Most people here are farmers. They often have to climb tall trees to collect green leaves and grass for their animals. Falling from a tree or slipping down a slope is a regular risk. These falls can be just as violent as a car crash. Another study from rural Nepal has reported the same finding.²⁵

Out of all 123 patients, 51 (41.46%) had facial bone fractures. The other 72 (58.54%) only had soft tissue injuries like cuts or bruises. This means that in this region, oral and maxillofacial surgeons are often the first doctors to see and treat these minor injuries.

When we studied facial fractures only, midface fractures were the most common (26, 50.98%). Mandibular fractures were fewer, at 16 cases (31.37%). Most published studies have reported the mandible as the most frequently fractured facial bone.^{6,7,12} This difference may be explained by the fact that cheekbones stick out more than other facial bones. That makes them easier to get injured. In our

study, zygomaticomaxillary complex fractures were the most common midface injury (20/26, 76.92%). This likely happens because falls often strike the face from the side.^{19,26} When someone falls from a tree or a slope, their cheek and midface often hit the ground or rocks directly. There is nothing to protect them. The energy of the fall goes straight into the zygoma and its connecting joints, which is why it gets fractured so often.²⁶ The mandible is one of the toughest bones in the face. But in our study, it was fractured in only 16 (31.37%) patients out of all fracture cases and just 13.01% of the whole group. Many other studies report that mandibular fractures are two to three times more common than midface fractures.^{7,19} Where the mandible breaks depends on where the blow lands. Different studies report different patterns.^{4,7,27} But in our patients, the parasymphysis (11/16, 68.75%) was the most common site. This matches what other studies from Nepal and elsewhere have reported.^{6,19} We also found 21 fracture subsites in 16 patients. This happens because the mandible is shaped like a horseshoe. Upon impact, the force travels around the curve and breaks another spot. In our patients, the primary break was usually at the parasymphysis, and the secondary break was often at the subcondyle or angle.

Most patients (92/123, 74.80%) had soft tissue injuries. Falls and RTAs caused nearly all of these injuries. Together, they were responsible for 88.04% of all lacerations. Another study from Nepal has reported similar numbers.⁷

More than 30% of our patients had injuries outside the face as well. Head injuries were the most common of these, seen in 22 patients (17.89%). This makes sense because the midface sits right next to the skull base. Another study from Nepal has reported similar rates.²⁵ High-energy falls and RTAs often hit the head and face directly. Limb fractures were also common (20, 16.26%). This matches the pattern of falling from a height. People land on their arms or legs first, then their face hits the ground. These findings are a reminder that when we come across a patient with facial trauma, we should always check for head injury and neck injury. We also found eye injuries in seven patients, mostly linked to cheekbone and orbital fractures. These need a specialist's attention.

Facial trauma is often part of a bigger injury picture. These patients need more than just a surgeon who manages the facial injury. They need a team of emergency doctors, neurosurgeons, orthopedists, and ophthalmologists. In our center, triage should start with the brain and the airway status. Only after

those are stable should we think about managing facial bones fractures.

Nepal is a developing country, and most of its land is hilly. In these hilly districts, falls are the main reason people get facial injuries. Our study describes the causes and patterns of these injuries in this region. Looking at all our data together, it appears that the type of injury - fall, RTA, or assault - matters more than age or sex. It determines whether a patient will have a fracture and what kind of fracture it will be. Falls are the most common cause, but they often cause only cuts and bruises. In young children and older adults, falls can cause more serious fractures. But RTAs and physical assaults are more serious. They cause more fractures and more severe injuries. Our study has some limitations. It was done at a single center. We may have missed some patients who visited other hospitals in the area. Also, our results may not apply to all parts of Nepal. To get a clearer picture in the future, we need a multi-center study to collect data together, using the same definitions and categories.

CONCLUSIONS

This study shows that falls are the main cause of maxillofacial trauma in the hilly districts of western Nepal. Road traffic accidents come second. Young adult males are the most affected group. Among the fractures we found, midface injuries - especially zygomaticomaxillary complex fractures - were the most common, followed by mandibular fractures.

These findings point to several practical notes. Community programs should teach safer farming practices, especially for climbing trees to collect fodder for livestock. Fall prevention efforts should target young adults, and road safety measures need continued support. Mountain roads and slippery pavements require better barriers, and people should be encouraged to walk carefully, particularly at night and during the rainy season. Helmet laws for motorcyclists must also be strictly enforced. Hospitals in this region need to be equipped to manage zygomaticomaxillary and mandibular fractures, since these two types make up the vast majority of surgical cases. Finally, emergency departments should follow standardized, multidisciplinary triage protocols to ensure that head and limb injuries are addressed alongside facial trauma.

Conflict of Interest:

The authors declare that no competing interests exist

Source of Funding:

None

Ethics Statement:

Ethical approval was obtained from the Institutional Review Committee of Lumbini Medical College and Teaching Hospital (Reference no: IRC-LMC-101/J-022). Written informed consent was obtained from legal guardian of all participants prior to enrolment.

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