

Transverse Fracture of the Mandible: Report of a Rare Case of Domestic Violence and its Management

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Abstract

Domestic violence, a grave violation of basic human rights, remains one of the most challenging problems of our society. Though commonly involving the facial region, these injuries are difficult to characterize and treat due to varied and unique presentations. Cases of violent weapon injuries can often be a challenge for the treating surgeon due to nonbiomechanical pattern of the presentation. The purpose of this report is to discuss the presentation and management of a brutal case of domestic violence with a rare “chop” injury pattern caused by an “axe.” Only two previous reports of sharp weapon injury resulting in horizontal fracture of mandible have been found in literature, of which only one was caused by an axe. The important social issue of significance of health care personnel, who are in a unique position and can contribute toward raising the awareness to the plight of silent sufferers of domestic violence for whom home is often the most dangerous place, is also raised.

Keywords

- ▶ domestic violence
- ▶ mandibular fractures

The United Nations recognizes violence against women to be “severe and pervasive throughout the world” and report physical violence, inflicted by an intimate partner, as the most common form of violence experienced by women globally.¹

Domestic violence (DV) broadly includes the physical and psychological abuse of children, elders, and spouses or other intimate partners.² DV currently accounts for 16% of all violent crimes in the west.³ In India, these figures are significantly higher but still largely underreported. Over a period of 11 years, from 50,703 in 2003, the number of reported cases have increased to 1,22,877 in 2014.⁴ The problem of DV, though not unique to India, is profound and attributable to the culture of silence deep rooted in fear, social stigma, and patriarchal framework of society.

The face, head, and neck have been reported as common sites of injury in an assault.^{5–7} These injuries are hence considered to be a good sensitive marker for cases of DV in

women.⁸ It is reported that in attempted homicide and assault cases, women are most likely to be victimized at home and by a known assailant.⁹

In spite of the knowledge that DV commonly involves the face, little is known or documented regarding the injury patterns in these kinds of trauma patients. The variability in the patterns of maxillofacial injury observed in the cases of DV can be attributed to the fact that these vary in the mode and pattern of injury and different kinds of biomechanics come into play, which has not been clearly comprehended.

Here, we report a case of a rare pattern of transverse fracture of mandible associated with the right body region and alveolar fracture attained in a brutal case of DV. Besides highlighting the need for a more systematic study of violence, especially against women, the purpose of reporting this case is to discuss how less commonly encountered clinical presentations may pose a challenge to the treatment and rehabilitation of such patients.

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Fig. 1 Preoperative clinical picture.

Case Report

A 50-year-old woman presented to the outpatient department with a history of assault. Wielding an axe, the victim's husband had attacked her multiple times over a minor household argument in a state of alcohol intoxication (► **Fig. 1**).

The patient had received primary care at the emergency department where suturing had been performed. At the time of examination, she had a 10 × 1 cm sutured laceration over her chin. The skin over the submental and submandibular regions appeared tense and tender; also, a splint wire was presented around the lower right anterior teeth. Minimal mobility was elicited in the right body region anterior to the last molar. Mouth opening was adequate and there was no occlusal derangement.

She also had a plaster cast over her left forearm for fracture of both bones of forearm, which was planned for open reduction and internal fixation by the orthopaedic department.

She underwent conventional posteroanterior mandible view and reverse Towne's view radiographs, which revealed a fracture line running horizontally through the chin and body of the mandible.

Cone beam computed tomography (CBCT) with three-dimensional (3D) reconstruction scan revealed the fracture line extension and a significant interfragment gap of around 10 mm between the superior and basal/inferior segments of the mandible. Also, fracture of right body region of the mandible was noted anterior to the last mandibular molar with an additional radiolucent line between the right incisors, suggestive of an alveolar fracture that was splinted (► **Figs. 2, 3**).

On clinical and radiographic correlation, a diagnosis of transverse fracture of mandible with right body region and right side alveolar fracture of mandible was made.

The fracture in the body region was minimally displaced and in an edentulous area. The anterior alveolar fracture was stable after splinting. The horizontal fracture through the mandible was below the roots of the teeth. None of these

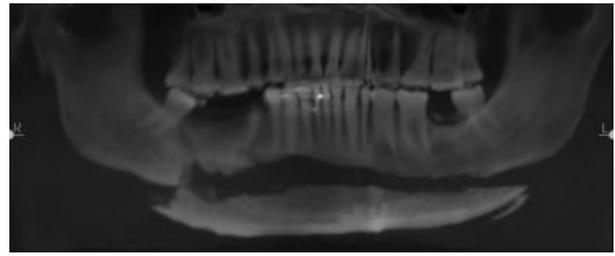


Fig. 2 Preoperative CBCT: transverse fracture through mandible body. CBCT, cone beam computed tomography.

fractures contributed to any malocclusion. It was hence planned to manage the case by open treatment after administration of antibiotics and surgery for fractures of forearm. It was planned to fix the horizontal basal fracture segment with semi rigid fixation through the existing laceration. Fearing contamination and compromised vitality of the dentate segment, we decided not to expose intraorally.

Under local anesthesia, upper and lower Erich arch bars were placed. Intermaxillary fixation was achieved. The fracture site was exposed through the existing laceration on the chin, exposing the entire chin and lower border of the mandible. The inferior basal part of the mandible was stabilized with a bone clamp. A hole was drilled through the symphysis region and through this, a 26-g wire was passed to provide traction and pull the segment upward (► **Fig. 4**). After removal of the granulation tissue, the segment including the lower border of mandible was pulled upward and reduced into position. The segment was stabilized using three mini plates and two positional screws. On the right side, after reduction, a positional screw was drilled into through the basal segment, upward and posteriorly behind the mental foramen. A four-hole miniplate was placed vertically in between the roots of mandibular canine and premolar; a second four-hole plate was placed horizontally near the lower border bridging the body fracture and basal segment. On the left side, a two-hole plate and a positional screw were placed to stabilize the reduced mandible. Closure was performed in layers and a pressure dressing was applied (► **Fig. 5**).



Fig. 3 Preoperative CBCT: large interfragment gap. CBCT, cone beam computed tomography.

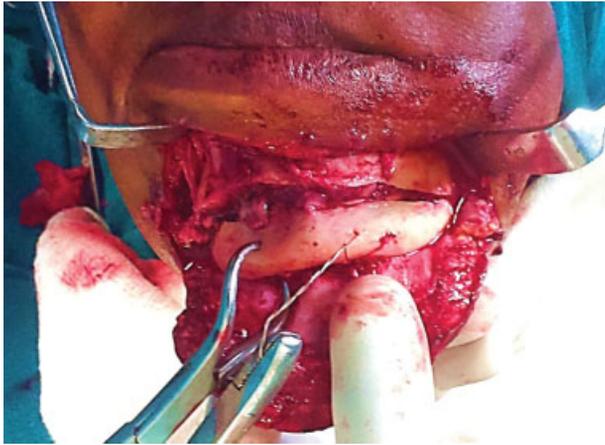


Fig. 4 Intraoperative reduction with bone holding forceps and traction wire.



Fig. 5 No derangement of occlusion.

Addressing the alveolar fracture, Erich arch bar was left in situ for 4 weeks, and the patient was kept on a strict soft diet.

At early follow-up and review, the patient had no further complaints; facial height and aesthetics were restored; and no occlusal discrepancy was noted (→**Fig. 6**, →**Fig. 7A**, **7B**).



Fig. 6 Improved aesthetics at 1-week follow-up.

The patient was also counseled and referred to a psychotherapist for recovery from the agony of the ordeal and years of physical and psychological abuse.

At a later follow-up of 9 months, the patient reported with localized infection and the implant was removed (→**Fig. 8**), after which a follow-up CBCT was performed and satisfactory healing was noted (→**Figs. 9, 10**).

Discussion

Injuries in the maxillofacial region, due to direct external trauma, are frequently encountered, more so in the mandible that constitutes a prominent lower third of the face.¹⁰ The spectrum of etiologies of mandibular fractures is diverse. Different mechanisms of injury account for the plethora of patterns and presentations of injuries that are encountered in the accident and emergency units. This pattern and presentation is nowhere more varied than in patients of physical and domestic assault and violence, especially where weapons are involved. Exemplifying this variegation, this study presents the case of DV with its rare clinical picture of a horizontal fracture of mandible associated with multiple other fractures caused by an axe hit.

Meer et al¹¹ stated that “violence is a complex phenomenon; its causes are multidimensional and its consequences have ramifications far beyond the immediate perpetrators and victims.”

A 2004 study by the World Health Organization (WHO) reported that one third of violent husbands were alcoholics, and substantial incidences of DV occurred under the effect of alcohol intoxication.¹² And yet, alcohol-related abuse and violence against women constitute a disturbingly under-reported occurrence, with as much as three quarter cases of violent crimes requiring medical intervention not being intimated to the police.¹³ In our case too, the victim was assaulted by her husband under a heavy state of inebriation.

Sharp and penetrating weapons, such as knives, farming and gardening tools, chopping axe, and machete are often used to inflict injuries in the victims of conflict, social strife, banditry, terrorism, and war.¹⁴ Penetrating knife blade injuries to the face are quite rare, mainly as a result of attempts to protect the face by the hands in self-defense.

Hand and forearm are common sites of defense injuries in sharp force trauma.¹⁵

Maxillofacial literature confirms the low incidence of knife injuries in the facial complex.¹¹ In our case, the victimized woman in trying to protect herself from the stroke of axe aimed at her throat, received the first hit on her right forearm, which led to a compound fracture of both bones of her forearm. In a second attempt, again missing the throat, her husband struck at her lower jaw resulting in multiple fractures of the jaw.

Fracture of the mandible depends on the point of application of force, direction, severity of forces, and impact. The fracture will occur either at the site of application of the force (direct) or at some other distant site(s) (indirect), or if the force is severe, fracture may occur at both the site of application and some distant site(s) (multiple fractures).¹⁶ Fractures occur when the local stresses exceed the ultimate strength of the

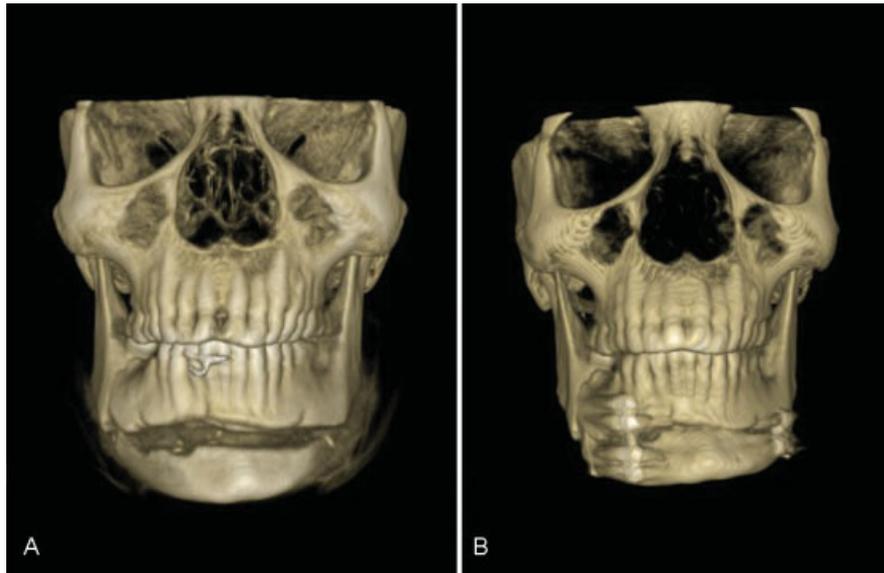


Fig. 7 (A) Preoperative CBCT 3D reconstruction views. (B) Postoperative CBCT 3D reconstruction views. CBCT, cone beam computed tomography.

bone in that region.¹⁷ Most often, mandibular fractures are vertical to the longitudinal axis of the mandible. Traumatic impact leads to mandibular fractures with vertically-orientated deformation patterns at points of weakness in the body, such as angle of mandible, symphysis, ramus, condyle, and coronoid process regions by direct or indirect impact.¹⁸ In sharp weapon and blast injury, the bone may often fracture in a “nonbiomechanical” pattern.¹⁷

Transverse fractures of the mandible have been described clinically by Shuker, as being parallel to the angle of the mandible in blast injuries.¹⁸ Shuker also suggested that the classifying of wounds caused by weaponry should be labeled as blast, penetration, perforation, avulsions, and “chop off” injuries (BPPAC).¹⁹

Although extensive research and publications have been written regarding the biomechanics of mandibular fractures, little is documented in maxillofacial literature regarding penetrating/chopping bony injury of mandible caused by assault with sharp instruments and weapons. In forensic

science, studies of autopsy specimens have attempted to describe such wounds as “chopping” type. Heavy weapons with a sharp or relatively sharp edge, such as axes, machetes, propellers, or shovels cause chop wounds. Chop wound injuries have both sharp force and blunt force components.²⁰

In injuries with axe and similar sharp-edged hand chopping weapons, the object with a horizontal orientation striking the mandible with an acute loading action would act like a high-powered osteotome.¹⁷ In our case too, we observed that the horizontal fracture resembled an osteotomy cut. The patient sustained a transverse fracture of the mandible at the site of direct hit associated with indirect or radiating fractures in the right body region with additional fracture line in the right anterior alveolar region.

In an extensive search of literature, we could find only two reported cases of horizontal fractures of mandible caused by sharp weapon injury.^{10,21}

In an in-vitro study on the lower limb long bones to characterize chopping wounds, the authors reported that



Fig. 8 (A) Clinical picture at 9 months. (B) Intraoral occlusion.



Fig. 9 Follow-up CBCT at 9 months: Reduced interfragment gap. CBCT, cone beam computed tomography.

sharp force trauma entailed a combination of compression or shearing force, applied dynamically with a narrow focus. It could include actions of puncturing, cutting, chopping, sawing, or crushing. Also, the study states that “axe” as a weapon has the ability to split bone to a greater degree than other sharp weapons.²²

The principles of management of mandibular fractures are correct anatomical reduction, functionally stable fixation, atraumatic surgical technique, immediate active function, which we strived to achieve. However, no defined guidelines exist regarding the management of such horizontal fractures of mandible. To stabilize the mandible in the transverse fractures during healing, Shuker found that the application of multiple circumferential wires provided favorable conditions for bony healing by decreasing the interfragmental space,



Fig. 10 Follow-up CBCT 3D reconstruction view after implant removal. CBCT, cone beam computed tomography.

reducing the risk of infection in the region of the impaired blood supply as a result of crushed and shredded soft tissue.¹⁸ Mitsukawa and Ladiende in their case reports also used circummandibular wiring for such transverse fractures.^{10,21} Ladiende²¹ noted a shifting of the fractured mandible posteriorly during healing. Both these authors recommended the need for more stable and rigid fixation.

The main goal of treatment in this case was anatomical reduction of the mandibular segments by decreasing the interfragment gap for restoring the anterior facial height and aesthetics and a stable fixation, counteracting the posteriorly directed muscle forces on the lower mandibular segment.

The forces exerted by the active and strong suprahyoid muscles attached to the mandible play a role in determining its location. A horizontal fracture through the body of the mandible causes a backward and downward pull on the lower segment of the mandible. The intent was to stabilize the mandible in the reduced position, counteracting the posteriorly directed muscle pull.

To achieve our treatment goals, we applied load sharing fixation with miniplates and positional screws similar to what is provided after osteotomizing the chin in genioplasty. However, admittedly in focusing on the dramatic and rare nature of injury, we overlooked the need for stronger rigid fixation, and erred in our choice and placement of the implant. The usage of a load bearing reconstruction plate for the long span horizontal fracture in continuation with the right body region would have optimized the treatment and provided better stability. The failure of hardware may well be attributed to this less than optimum fixation. However, radiographs after implant removal demonstrated that the fractures were satisfactorily healed.

In harmony with the 67th World Health Assembly historic resolution of addressing violence, entitled as “Strengthening the role of the health system in addressing violence, in particular against women and girls, and against children,”²³ we emphasize the role of the medical profession in prevention of community violence. Awareness needs to be generated regarding reporting of all such cases so as to recognize patterns of injury and optimize patient care.

Oral and maxillofacial surgeons who typically treat these patients with facial injuries in the acute and convalescent phase are in a good position to institute the necessary rehabilitation process, as well as instigate the preventive programs.²⁴

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