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Case report

Reconstruction and rehabilitation of short-range gunshot injury to lower part of face: A systematic approach of three cases

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ABSTRACT

Gunshot injuries are always known to cause severe morbidity and mortality when head and neck are involved. They vary in morbidity, which can occur in civilian surroundings. The wound largely depends on the type of weapon, mass and velocity of the bullet, and the distance from where it has been shot. Close-range gunshot wounds in the head and neck region can result in devastating aesthetic and functional impairment. The complexity in facial skeletal anatomy cause multiple medical and surgical challenges to an operating surgeon, demanding elaborate soft and hard tissue reconstruction. Here we presented the successful management of three patients shot by short-range pistol with basic life support measures, wound management, reconstruction and rehabilitation.

Introduction

Gunshot wounds to the face present serious challenges to the oral and maxillofacial surgeons. These injuries result from assaults, accidents or suicide attempts. In contrast to blunt facial trauma, ballistic injuries result in significant bone and soft tissue loss, whose severity is not always apparent at initial presentation. Reconstruction of these defects is often complicated by tissue ischaemia, necrosis and infection.[1,2]

Ballistic injuries can be classified as low-velocity or high-velocity. Generally, low-velocity injuries are from projectiles travelling at less than 1200 feet/s. High-velocity missiles are those travelling at greater than 1200 feet/s. The degree of surrounding tissue injury from a gunshot wound is related to the mass of the projectile and the square of its velocity (kinetic energy = $1/2\ mv^2$).[3] Low-velocity injuries cause limited damage along the missile path and result in little bone and soft tissue loss. These are generally treated similarly to blunt facial trauma, with limited debridement, immediate bony reconstruction and primary soft tissue closure.[4]

High-velocity weapons, including rifles or close-range shotgun blasts, inflict considerably significant damage. In addition to the initial cavity created by the bullet path, an evolving pattern of tissue loss is observed, with resultant bone and soft tissue loss for several days or weeks.

Wounds are frequently contaminated with oral secretions and foreign materials, resulting in a complication rate as high as 39%.[5] Close-range gunshot wounds have a reported infection rate of 100%.[6] Traditional treatment of these injuries involves initial wound debridement and soft tissue closure without replacement of lost bone.[1,7]

Soft tissue injury, which could not be closed primarily, is allowed to be healed by secondary intention. Bony reconstruction is addressed secondarily, which often results in significant scar contracture and suboptimal cosmetic and functional outcome.

The past 10 years have seen a shift away from delayed treatment of these injuries towards immediate definitive reconstruction. This has been largely due to the increased use of free tissue transfer which allows importation of well vascularized bone and soft tissue into the wound.[7] Early transfer of vascularized tissue helps restore the bony and soft tissue framework while minimizing scar contracture.[8,9] Reconstruction of facial gunshot wound should proceed in a staged fashion to optimize form and function.[10] Our algorithm involves two phases, each with specific goals (Table 1). The two phases are the initial encounter and the definitive reconstruction.

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Table 1
Algorithm of reconstruction after gunshot wounds or severe avulsive trauma to the face.[10]

Phase I: the initial encounter
CABs of trauma management per ATLS protocols
Identification of life or limb-threatening injuries and stabilization of patient
Imaging once patient stabilized
CT scan head region to rule out head injury
Initial operating room management
Management of intracranial, ocular, and other life or limb-threatening injuries
Establishment of occlusal relationships
Debridement of foreign material and obviously nonviable tissue
ORIF of midface/mandibular fractures when adequate bone stock available
Phase II: the definitive reconstruction
Planning of definitive bony and soft tissue reconstruction
Importation of adequate soft tissue to allow cosmetic contouring
Reconstruction of major mandibular and maxillary defects
Free bone graft reconstruction of midface, upper face, nasal profile and peri-orbital area.
Adequate soft tissue coverage of underlying bone, internal and external defects

Note: ATLS: advanced trauma life support; ORIF: open reduction and internal fixation.

Case report

Case 1

An 18-year-old male reported to the casualty department of Guwahati Medical College & Hospital at 6:00 p.m. on December 6, 2012, referred from Bongaigaon Civil Hospital, Assam, approximately 4 h after sustaining a bullet injury on the face. The patient was shot with the hand gun at a very short distance. The bullet entrance wound was in right submandibular region. Possible exit wound for the bullet could be identified on left submandibular region. The patient was fully conscious, well oriented to time, place and person. His vital signs were within normal limits. On inspection, there were submandibular lacerating injury marks on both sides of mandible, multiple fractured segments visible in mandible on both sides. The patient was unable to close and open the mouth (Fig. 1A and B).

Provisional diagnosis was displaced right and left mandibular body fracture and middle symphysis fracture. Initial debridement of the lacerated non-vital soft tissue wound was done under local anaesthesia and soft tissue closure was done primarily where it was possible and within limits. The patient was then admitted in our ward and planned for operation under general anaesthesia and all the necessary routine investigations were advised along with orthopantomogram (OPG) (Fig. 1C), paranasal sinus X-ray (PNS) and CT scan (Fig. 2A).

In the operation room, surgical site was prepared and submandibular incisions were given bilaterally along the already lacerated wound which was connected in the midline (Fig. 2B). Facial artery and vein were identified and ligated. Fracture site was exposed and after careful exploration, bullet fragments/pellets were removed. A 4.0 cm × 1.6 cm × 1.5 cm anterior iliac crest graft was harvested and then divided into two halves, which were placed at the avulsed site on both sides of body of mandible: the left graft was stabilized with 2-hole miniplate with gap and 2 mm × 6 mm screws along with a reconstruction plate and the right graft was stabilized with reconstruction plate alone (Fig. 2C).

One week after operation, the patient had infection in surgical wound on right body region of mandible, which was managed with intravenous antibiotics for 1 week. The healing was uneventful and good bone formation was apparent radiographically 2 months later (Fig. 3).

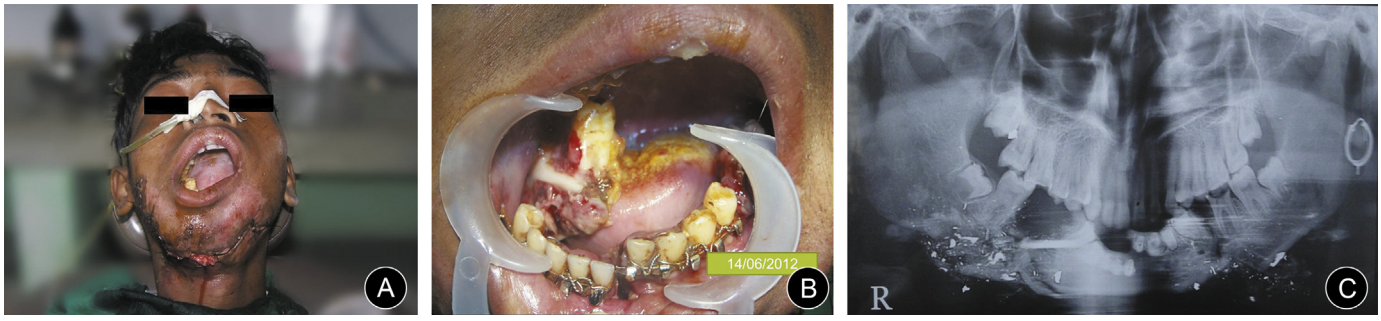

Fig. 1. A: Preoperative photograph of the patient with lacerating injury marks in the lower part of the chin. B: Multiple fractured segments visible in mandibles on both sides. C: Preoperative orthopantomogram view showing bilateral mandibular body fracture with middle symphysis fracture. Multiple radioopaque loose bony fragments and foreign pellets are seen around right side entry and left side exit wound region.

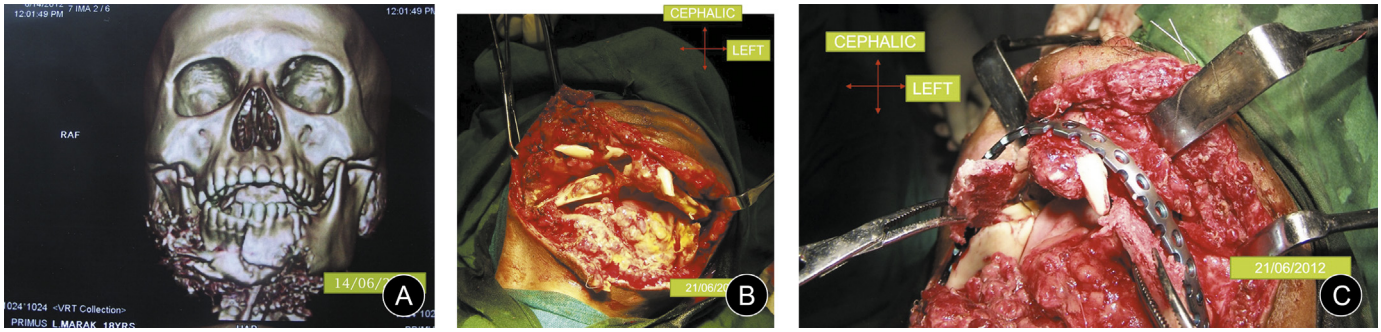

Fig. 2. A: CT scan in faciomaxillary region with three-dimensional reconstruction. B: Intraoperative exposure of the fractured mandible due to gunshot wound. C: Reconstruction plate placed from body to body of mandible.