

Total avulsion of mandible in maxillofacial trauma

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ABSTRACT

Mandibular trauma are a frequent injury of maxillofacial skeleton due to the mandible's prominence and relative lack of support. Maxillofacial injuries can be complex and can involve the skin and soft-tissues as well as bones resulting in fractures. Although, several cases of severe crush injury of the lower jaw have already been presented but total avulsion of mandible has rarely been reported. As with any facial fracture, consideration must be given for the need of emergency treatment to secure the airway or to obtain hemostasis if necessary before initiating definitive treatment. We presents a case report of completely avulsed mandible along with soft-tissue of midface region in pediatric patient following trauma, which was attempted to manage or repaired by successful microvascular surgical technique. Unfortunately, we lost the patient in next postoperative day due to cardiac complication. Avulsion of the lower jaw may further complicate the obstructive nature of the upper airway. Multi-specialty involvement in their management may be needed for management of such type of avulsion injury.

Keywords: Airway obstruction, difficult airway, difficult intubation, mandibular avulsion, microvascular anastomosis

INTRODUCTION

The maxillofacial trauma can involves the three divisions of face individually or combined. The upper face — the frontal bone and frontal sinus. The mid face — the nasal, ethmoid, zygomatic and maxillary bones. The lower face — the mandible. Maxillofacial trauma is usually caused by^[1] assault (most common); domestic violence is an important cause^[2] (alcohol may be involved), road traffic accidents (midface fractures), falls and sports injuries. The fracture ratio mandibular: zygoma:maxillary is 6:2:1.^[1]

Fracture of mandible can be classified according to location (alveolar, condyle, coronoid, ramus, angle, body, parasymphysis and symphysis), type (simple, compound, comminuted, green stick, pathologic, impacted), involvement of dentition, displacement (undisplaced/displaced) and favorability of treatment (favorable/unfavorable) but complete avulsion of mandible does not fall in any category of classification.

Maxillofacial injuries range from simple to complex and can involve the skin, soft-tissues as well as bone, resulting in fractures. Although, several cases of severe crush injury of the lower jaw have already been presented in literature^[3,4] but total avulsion of mandible has been reported very rarely. The case reported was of totally avulsed lower jaw in 34 year old patient.^[5] We present a case report of complete avulsion injury of mandible in pediatric patient.

CASE REPORT

The present case report is about a 8-year-old male patient reported to emergency maxillofacial unit, King George's Medical University, Lucknow, Uttar Pradesh with history of trauma due to road traffic accident with motor bike, which resulted in total avulsion of his mandible [Figures 1 and 2], with the avulsed bone wrapped in a piece of wet cloth for almost 2 h [Figures 3-5]. Patient was immediately examined for airway and hemostasis. Patient was shifted to operation theater and tracheostomy was done to secure the airway [Figure 6]. Microvascular surgical intervention was planned.

Surgical procedure

Avulsed mandible along with soft-tissue was cleaned and intermaxillary fixation was carried out to secure the mandible in its position. Binocular surgical loupes with 2.5 and 4× were used. Vessel preparation: Facial arteries and veins were visualized on both sides. Vessels were dissected from surrounding tissues to achieve sufficient length. The vessels were manipulated carefully by holding the adventitial tissue on the outermost aspect of the vessel wall to avoid significant traction on vessel. Vascular approximating clamps were applied and to aid visualization, a small sheet of plastic polymer of a contrasting color was placed under the vessels. The orientation of the avulsed part was checked to ensure that the anastomosis is not under excessive tension. Once a satisfactory vessel segment is attained, adventitial cleaning was carried out with sharp curved microsurgical scissors. Heparinized lactated Ringer’s solution at 20,000 units/L was used for irrigation. Vessel dilators were used to mechanically dilate and opening up the cut end of vessel.

After adequate preparation, the vessels were aligned for suture placement. Under continuous irrigation with heparinized lactated Ringer’s solution, end to end anastomosis was done with fine, non-absorbable sutures 9-0 nylon using firstly three oriental

suture and then remaining equal numbers of suture [Figure 7]. Primary nerve repair of facial nerve of both side was tried to attempt but no sufficient length of nerve tissues were available after immobilization in avulsed distal segment.

After microvascular anastomosis, vascular clamps were removed and closure was done in layers with 4-0 vicryl and finally skin was sutured with nylon [Figure 8]. Finally, patient was shifted in post-operative intensive care unit after extubation. There was no sign of flap failure in immediate postoperative period. Unfortunately, patient was died in postoperative period due to cardiac arrest as suggested by anesthetist and pediatric experts. Hence, final outcome of flap survival and facial function could not be assessed.

DISCUSSION

Mandible fracture causes vary by the time period and the region. In other parts of world blunt force trauma (assault) is the leading cause of mandible fracture^[6] whereas in India, motor vehicle collisions are now a leading cause.^[7] Mandibular injury play a significant role in craniofacial trauma and accounts for nearly 30-70% of the maxillofacial facial fractures^[8-10] with a higher frequency in males aged 21-30 years.^[11]



Figure 1: Front profile preoperatively



Figure 2: Lateral profile preoperatively



Figure 3: Avulsed mandible along with attached skin in front view



Figure 4: Avulsed mandible along with attached skin from superior view

The basic principal in this type of severe maxillofacial trauma is priority management of A, B, C, D, E. i.e., Airway: Avoid nasotracheal intubation. If an airway is needed, consider orotracheal intubation with in-line stabilization if possible. Cricothyrotomy/tracheostomy should be considered with severe mouth and mandible trauma. Breathing: Be aware of the possibility of aspirated blood. Any suggestion of aspiration would indicate the immediate need for a secured airway. Circulation: Bleeding from facial trauma can be significant and sometimes very occult. Any hypotension should indicate the need for a vigorous resuscitation. Disability: Perform a good neuro exam. Exposure: Make sure that the back of the scalp is examined for any lacerations that might result in severe bleeding. Control obvious vigorous bleeding before proceeding.

The vascular anatomy of the human face is well-known. The subcutaneous tissue contains rich vascular plexuses. The face is bilaterally supplied by the branches of the external carotid arteries, mainly the facial and superficial temporal arteries and it is drained by the external jugular and facial veins. Accordingly, an entire facial skin flap based on the external carotid arteries could be transplanted.

Principles and techniques of microvascular surgery

Microvascular surgery refers to the surgical coaptation of small vessels usually less than 3 mm in diameter. This technique has evolved significantly over the last four decades, starting from replantations and revascularizations to free flap surgery. The operating microscope and the development of loupes, microinstruments and microsutures have greatly aided its widespread use. Various techniques have been developed for the handling of small vessels. There are several ways in which the anastomosis can be performed after careful vessel preparation. The most commonly used techniques are the end-to-end, end-to-side and the use of the anastomotic coupling devices. Difficult situations such as vessel diameter discrepancy and poor vessel quality with atherosclerotic plaques and loose intima can usually be overcome with special techniques. Inadequate vessel length can be managed with microvascular surgery.

Monitoring of flap: Color (normal — pink, arterial fail — pale, venous fail cyanotic). Capillary refill (normal 1-2 s, arterial fail — slow, venous fail — fast). Tissue turgor (normal — full, arterial fail — hollow prunk like, venous — tense, distended and blisters). Temperature (normal — 30-37°C, arterial/venous thrombosis — fall below 30°C).



Figure 5: Avulsed mandible along with attached skin from inferior view



Figure 6: Patient tracheostomized and intubated



Figure 7: Intraoperative view of microvascular anastomosis



Figure 8: Immediate postoperative after closure of skin

Pin prick: (normal — bright red blood, slow to start bleed, short duration), arterial occlusion — no bleeding, venous occlusion — bleed briskly.

Nerve injury and repair

After significant injury, the facial nerve undergoes degeneration of the distal segment, as described by WallerSunderland classified such injuries into 5 types or degrees. First-degree injury (neurapraxia) in which a physiologic block is produced by increased intraneural pressure (such as may be produced by external compression). The covering layers of the nerve (i.e., endoneurium, perineurium and epineurium) are not disrupted and the nerve is capable of stimulation. Full return of function without synkinesis is observed. Second-degree injury (axonotmesis) involves a similar mechanism, but the compression is unrelieved and results in degeneration of the nerve axons and again, excellent return is expected, though recovery may take several months. Because nerve stimulation is compromised, distinguishing axonotmesis is difficult. Third-through fifth-degree injuries involve loss of endoneurial, perineurial and epineurial tubes, respectively. Fourth- and fifth-degree injuries imply partial or complete transection of the nerve. Regeneration is incomplete and synkinesis is inevitable. Primary anastomosis gives best overall results of any surgical intervention. It is done if defect is less than 2 cm. Mobilization of the nerve can give nearly 2 cm of length but with more mobilization there is risk of devascularization.

Total face and scalp replantations

Although, many cases of scalp and face segment replantation have been reported world-wide, only two successful cases of total face and scalp replantation have been reported.^[12,13] In the first, replantation was performed in two pieces, based on the medial canthal vein and the facial vein and artery on the right side and the labial artery with its vein and superficial temporal artery and two concomitant veins on the left side. At 3 years after replantation, the patient recovered satisfactory animation of the oral musculature and profound growth of hair on the scalp.^[12] In the second case, the face was avulsed as one piece, including the entire scalp, right ear, forehead, eyebrows, right cheek, nose and upper lip. This replantation was based only on a single superficial temporal artery and two veins. Four months postoperatively, the patient had hair growth and normal mimetic function.^[13]

Avulsion of the lower jaw if also accompanied by loss of hyoid bone may further complicate the obstructive nature of the upper airway due to dropping the unsupported epiglottis over the glottic inlet. Multi-specialty involvement in their management may be needed which includes anesthetist, ENT, plastic and oral and maxillofacial surgeon.

CONCLUSION

Airway establishment and hemorrhage control may be difficult to achieve in patients with massive maxillofacial and avulsed injuries. Initial airway control was achieved by cricothyrotomy or tracheostomy and then definitive management of maxillofacial injuries. Microsurgery/microvascular surgery which is a set of surgical techniques performed on very small structure such as blood vessel and nerves beyond the limits of normal human eyesight is done to repair the completely avulsed part. Treatment of these types of rare avulsion injuries is important to maintain proper speech, swallowing and masticatory function associated with the lower jaw and is multi-specialty in approach.

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