Review Article

ANAESTHESIA MODALITIES FOR MAXILLOFACIAL TRAUMA PATIENTS UNDERGOING SURGICAL INTERVENTION

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Abstract :

Maxillofacial Injuries present with a unique problem of compromised airway which is always a challenge for anaesthesiologists regardless of advances in the medical field. Maxillofacial trauma patients present with other life threatening injuries as massive haemorrhages, cervical spine injury, head injury and fracture fixation which may require urgent surgical intervention and hence securing the airway assumes prime importance for administration of anaesthesia^{1,2}. Morbidity and mortality of such patients often increases because of errors in judging difficult airway and subsequent management. Anaesthetic challenges in such cases include difficult mask ventilation, anatomic distortion, residual swelling in airway, cervical spine injury, limited mouth opening and finally the most dreadful outcome – failure to intubate. In this review we will discuss various approaches of airway management according to patient's injuries, airway status, urgency of surgery and anesthesiologist's expertise.

Key words: Maxillofacial Injuries, Anaesthesia, surgical intervention

INTRODUCTION

Maxillofacial injury is very common in developing countries like India with ever increasing vehicular traffic on the highways and expressways in recent times leading to deaths and financial burden on the country. Road traffic accidents and sports related injuries constitute the major part of etiology of maxillofacial injuries^{3,4,5}.Fracture mandible accounts for more than half of the cases followed by fracture maxilla and fracture of zygoma in one-fifth cases each. A very small percent accounts for pan-facial fractures. Isolated maxillofacial trauma patients usually do not require surgery unless significant hemorrhage or airway compromise is present.

These injuries are of prime concern to the anaesthesiologists due to close association with the airway. Maxillofacial airway usually accompanies upper airway injury which if unrecognised may lead to dyspnoea in unintubated patients due to laryngotracheal edema. The management should be directed so as to achieve good outcome with minimal risks and maximum success achieved which is often attained with the help of skilfull and experienced anaesthesiologist and surgeon.

The first priority is cervical spine stability and Advanced Trauma Life Support (ATLS) protocol is followed in patients suffering from maxillofacial trauma with life-threatening injuries⁶. According to that concept loss of an airway directly kills the patient more rapidly than the inability to breath or circulatory failure. Gruen et al found in their studies that failure to intubate, secure or protect the airway was responsible for 16 % of the deaths.

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MAXILLOFACIAL TRAUMA AND AIRWAY INJURIES

Immediate management of maxillofacial trauma patients is warranted when there is existing or impending airway compromise and/or severe hemorrhage requiring exploration².

Hutchinson et al mentioned six specific situations associated with maxillofacial trauma which may adversely affect the airway⁷.

1. Postero-inferior displacement of fractured maxilla parallel to the inclined plane of the skull base.

- 2. Bilateral fracture of anterior mandible.
- 3. Hemorrhage from vessels in open wounds or from nasal blood vessels.
- 4. Soft tissue swelling and edema.
- 5. Trauma to the larynx and trachea.
- 6. Foreign bodies as dentures, debris, shrapnel, exfoliated teeth and bone fragments.

Once airway has been secured and bleeding from all identified sites controlled, definite management of maxillofacial trauma may be delayed until life or organ threatening injuries have been attended to.

MECHANISM OF INJURY

A knowledge of mechanism of injury and extent helps to assess the airway and degree of damage which helps in preparation. Majority of the injuries are caused by blunt trauma due to direct blows and severe flexion and extension injuries, other causes include penetrating trauma such as stab wounds which usually damage trachea, inhalation of noxious or hot gases which injure trachea and larynx ,aspiration of foreign bodies and iatrogenic injuries.^{8,9,10}

Low –force injuries occuring due to sport mishaps or interpersonal altercations mainly affect the bones without compromising the airway. High-force injuries as motor accidents or due to heavy weapons cause mandible and maxilla fractures and airway compromise

.PRE OPERATIVE EVALUATION - DIAGNOSIS AND COMPLICATIONS ASSOCIATED WITH MAXILLOFACIAL INJURIES

Maxillofacial injuries produce a constellation of signs and symptoms like local tenderness, voice change, hemoptysis, subcutaneous emphysema, airway obstruction. Extent of injury, the composition and anatomy of injury along with Mallampatti classification, atlanto-axial mobility and thyromental distance provides a fair idea about the airway¹¹.

Likely complications associated with maxillofacial injuries are

a) Compromised airway due to anatomic distortion of airway structures, blood clots, loose tooth , dentures and foreign body. Intoxicated patients due to alcohol or drug abuse pose additional problems¹².

b) Hemorrhage due to soft tissue injury , mouth and nose are common along with vascular injuries in penetrating trauma¹⁰.

c) Cervical spine injury are said to be present in all maxillofacial trauma patients until ruled out¹.

d) Cerebrospinal fluid rhinorrhea is suspected with fracture of base of cranium¹¹.

e) Oesophageal injuries with subcutaneous emphysema and trismus¹³.

APPROACH TO THE PATIENT AND THE COMPLEXITY OF THE SITUATION

Approach to the maxillofacial trauma patients should be chosen according to patient's injuries, airway status and anaesthesist's familiarity with such conditions and equipments with a valid back up plan in case of a failed intubation. More than 2/3rds of the perioperative complications arise during induction and rest during surgery, extubation¹⁴.

Patients with severe injuries are evaluated with the ABCs of primary survey of Advanced Trauma Life Support protocol^{15,16,17}. Primary aim is to prevent aspiration and protect the airway. Patient is put in lateral position with pulling the mandible or maxilla forward to allow

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external drainage of secretions/blood. Bleeding is controlled through nasal packs or a balloon tipped catheter placement^{11,18}, direct pressure and acute reduction of fractures. Significant injuries with anatomical disruption and hemorrhage may require endotracheal intubation.

Definite care of maxillofacial injury should be done after proper evaluation consisting of airway examination, blood loss calculation and central nervous system manifestation after the swelling has subsided^{8,10,11}.

Cervical spine injuries are present in almost every patients which has to be dealt with caution such as avoiding all neck movements and stabilising the neck with a collar for the time being¹⁹.

According to the American Society of Anesthesiologists guidelines, spontaneous breathing must be preserved in patients where intubation is presumed to be difficult²⁰.

In patients with extensive facial injury resulting in damage to bony structures mask ventilation is difficult.

Almost every patient of maxillofacial trauma is considered full stomach. Blood is often swallowed and the risk of regurgitation and aspiration is high. Therefore naso-gastric suction is advised before intubation. Another method used is the Sellick's manoeuvre²¹ during rapid sequence induction where pressure is applied over the cricoids cartilage resulting in compression of oesophagus over vertebral body. However in some cases the cricoid pressure can worsen the laryngeal view making intubation troublesome^{22,23}.

MANAGEMENT OF THE AIRWAY

Securing the airway is of utmost importance. The challenge lies here is the visualisation of the vocal cords. Numerous instruments and techniques have been developed to overcome this problem. A difficult airway trolley consisting of Laryngeal Mask Airway (LMA), Combitube, Fibre-optic bronchoscope ,cricothyroidotomy kit²⁴ etc. should be kept ready for emergency purpose.

Factors which determine the possible methods of securing airway are -

a) Mouth opening of the patient.

b) Cervical spine fracture chances.

c) Difficult airway anticipation.

d) Chances of skull base fractures.

Various techniques used for securing the airway are as follows -

1) **Awake intubation** – For anticipated difficult airway in patients, an overview of the laryngeal inlet visibility through direct laryngoscopy is done. But it has risks involved so mostly reserved for slim patients with minimal disruption in the facial anatomy and where urgent tracheostomy is feasible.

Local anaesthesia of the upper airway is must for awake nasal or oral intubation which is usually done with 2% or 4 % lignocaine. Adrenaline is added in some cases as it causes vasoconstriction and increases the size of the airway. Superior laryngeal block on both sides of hyoid cornu with 2ml of 2 % lignocaine on each side and translaryngeal block through cricothyroid membrane with 4 ml of 2 % lignocaine are also administered in some cases²⁵.

BLIND NASOTRACHEAL INTUBATION- It is done where the patient has anticipated difficult airway and has no mouth opening but contraindicated in patients with basilar skull fractures and nasal bone fractures due to risk of contamination spreading to subarachnoid space. This method requires skill of the anaesthesist and assisted by pulse oximeter and EtCO2 which confirms the presence of tube in the larynx. This technique has drawbacks of failures in first passage and increased trauma with repeated attempts leading to complete airway obstruction requiring emergent cricothyrotomy.

FIBRE-OPTIC INTUBATION – done under local anaesthesia with/without sedation for difficult mask ventilation cases and for anticipated difficult airway patients posted for

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elective surgeries^{26,27}. Blood , vomitus or secretions preclude vision by the fibre-optic instruments along with the problem of achieving local anaesthesia in traumatised regions Above all patient's cooperation is very essential. In cases of children or uncooperative patients the procedure is to be done under general anaesthesia. It is an excellent alternative in cases of failed direct laryngoscopy.

GLIDESCOPE – It is a video laryngoscope which allows direct visualization of epiglottis. It is usually used as an alternative to direct laryngoscopy in difficult intubating conditions²⁸.

2) **Intubation after general anaesthesia** - In patients with spontaneous breathing and unobstructed airway, intubation after general anaesthesia is performed using a potent volatile agent²⁹ while avoiding neuromuscular agents until the airway is secured. After the patient is anesthetized airway is secured using a rigid bronchoscope or tracheal tube.

ORAL INTUBATION - It is done in cases of isolated midline fractures. Usually achieved using aspiration prophylaxis with anti-emetics as ondansetron 4 mg ,anti-cholinergics as glycopyrrolate 0.2 mg and proton pump inhibitors as ranitidine 50 mg. Oral intubation is preferred with south pole tube and nondepolarizing muscle relaxants given after confirmation of tube in the larynx by auscultation and capnography.

NASAL INTUBATION – It is done usually in maxillofacial fracture correction²⁴ with north pole tube preferably. It is contraindicated in patients with basilar skull fractures and nasal bone fractures due to risk of infection spreading to subarachnoid space³⁰. It is usually preferred by maxillofacial surgeons as it gives them an idea about dental occlusion and field is also clear.

The patency of the nostrils is checked by breath test and more patent one is chosen for intubation after using vasoconstrictors and a local anaesthetic in the air passage³¹. The tracheal tube is inserted through nose after general anaesthesia is administered and direct laryngoscopy done to push the tube into trachea using magill forceps³².

LARYNGEAL MASK AIRWAY (LMA) can be used in difficult airway conditions to ventilate the patients till the airway is secured. It is an important tool in management of airway and inserted blindly and requires less experience comparatively. But it has limitations that it a supra-glottic airway device which can be displaced during movements of patients and can cause stomach inflation.

SUBMENTAL INTUBATION – It is done when oral or nasal intubation fails^{33,34,35} and done using an armoured tube by a 1.5 cm skin incision medial to lower border of mandible using an artery forceps through the incision directed towards floor of the mouth where again an incision is taken and the tube with deflated cuff is taken out through the submental incision. The connector is attached and ventilation is achieved³⁶.

Dutta et al showed in a study that retromolar positioning of the tracheal tube³⁷ along the angle of mouth in the retromolar trigone during intermaxillary fixation helps in adequate control of dental occlusion³⁸. Extubation is done in awake state with a wire cutter placed in case of an emergency.

3) **Surgical methods** - Tracheostomy¹² or cricothyroidotomy^{11,16} under local anaesthesia is safe option and used in emergency or elective situations or cases where prolonged mechanical ventilation is required. The procedure can be painful and uncomfortable along with the risk of hemorrhage and pnuemothorax.

POST OPERATIVE MANAGEMENT -

Patients are at high risk of complications in the post-operative period. Following surgery neck movements are restricted, edema of mucous membranes is present and chances of hemorrhage are still high. Extubation is advised when the patient is fully conscious and until

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the edema has subsided or normal anatomy is restored with preparation for re-intubation. Head end can be elevated to improve venous drainage and reduce soft tissue swelling²⁹. **DISCUSSION** –

The study suggests considerable change in the airway management methods and single technique may not be favourable in all circumstances. In the era of rigid fixation of fractures and possibility of leaving the mouth open and using alternate techniques like fibre-optic intubation and glidescope and surgically securing by cricothyrotomy or tracheostomy should be the last resort after failure of all techniques. Airway management depends on the years of experience in dealing with such situations, skill in using the equipments with sound judgement to have an outcome with minimal risks involved.

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