Chapter 56
Approach to Maxillofacial Trauma in the ICU

56.1 Introduction and Importance

Maxillofacial trauma presents significant challenges in airway management due to its close proximity to vital structures such as the airway and cervical spine. Injuries in this region can lead to altered pharyngeal reflexes, increasing the risk of aspiration and airway obstruction. The physiological impacts include compromised airway patency due to tissue swelling, bleeding, and displacement of anatomical structures. The potential for airway compromise is further heightened when cranial and spinal structures are involved, necessitating careful assessment and management.

Common complications such as trismus (inability to open the mouth fully) can hinder airway access, while pneumoencephalus (presence of air within the cranial cavity) may indicate severe cranial injury and necessitate careful neurological monitoring. Prompt and coordinated management is crucial to prevent airway compromise, control hemorrhage, and stabilize the cervical spine, especially in patients with multiple traumas. A multidisciplinary approach involving anesthesiologists, surgeons, emergency physicians, and critical care specialists is essential to address the complex needs of these patients effectively [1–3] [Ref: Algorithm 56.1].

56.2 Etiology and Mechanism of Injury

Maxillofacial injuries commonly result from road traffic accidents, assaults, falls, sports injuries, and industrial accidents. Alcohol and drug intoxication play a significant role in the etiology of these injuries, both as contributing factors to the incidents and as complicating factors in airway management. Intoxicated patients may have impaired consciousness and airway reflexes, increasing the risk of aspiration and making airway control more challenging.

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The mechanism of injury can be classified based on the impact force:

- High-Impact Trauma: Such as car accidents or falls from height, often result in complex fractures involving multiple facial bones.
- Low-Impact Trauma: Incidents like sports injuries or minor falls typically cause soft tissue damage without significant bony involvement.

Understanding the etiology and mechanism aids in anticipating the severity of injuries and potential complications.

56.3 Anatomy and Classification of Maxillofacial Injuries

56.3.1 Anatomy

The facial skeleton is structurally complex and can be divided into three regions:

- Upper Face: Frontal bone and sinus.
- Midface: Maxilla, zygomatic bones, nasal bones, ethmoid, lacrimal bones, and orbital structures.
- Lower Face: Mandible and temporomandibular joint.

56.3.2 Fracture Classification

56.3.2.1 Le Fort Fractures

These are classic patterns of midfacial fractures that help in assessing the extent of injury and planning management:

- Le Fort I: Horizontal fracture of the maxilla above the teeth (floating palate), separating the maxillary alveolar process from the rest of the midface.
- Le Fort II: Pyramidal fracture involving the maxilla and nasal bones, extending into the orbital floor (floating maxilla).
- Le Fort III: Craniofacial dissociation, where the entire midface is separated from the cranial base, involving the orbital walls and zygomatic arches (floating face).
- Le Fort IV: An extension of Le Fort III fractures into the frontal bone, involving both midface and cranial structures. This type includes frontal sinus involvement and may be associated with cranial injuries.

56.3.2.2 Other Fractures

- Mandibular Fractures: Can lead to airway obstruction due to posterior displacement of the tongue and soft tissues.

- Zygomaticomaxillary Complex Fractures: Affect the prominence of the cheek and the orbital floor, potentially impacting ocular function.

56.3.2.3 Associated Injuries

Certain fracture patterns, particularly Le Fort II, III, and IV, are associated with increased risk of cerebrospinal fluid (CSF) leaks, dural tears, and injuries to cranial nerves or the cervical spine. CSF leaks may present as rhinorrhea or otorrhea and indicate a breach in the cranial base, increasing the risk of meningitis. Understanding the correlation between fracture types and potential intracranial or spinal injuries is crucial for developing an effective management strategy and preventing complications.

56.4 Airway Management in Maxillofacial Trauma

56.4.1 Primary Concerns

Airway obstruction due to displaced fractures, bleeding, foreign bodies, soft tissue swelling, and impaired protective reflexes is the foremost concern. The potential for rapid airway compromise necessitates immediate assessment and intervention.

56.4.1.1 Airway Assessment

1. Assess the Ability to Speak and Protect Airway: Note any signs of airway compromise such as stridor, gurgling, or silence.
2. Visual Examination: Inspect the oral and nasal cavities for bleeding, foreign bodies, loose teeth, fractures, and soft tissue injuries.
3. Evaluate for Cervical Spine Injury: Cervical spine stabilization is mandatory to prevent additional injury.

56.4.1.2 Management Techniques

- Positioning: Position the patient to optimize airway patency and facilitate drainage of blood and secretions. Elevating the head or lateral positioning can be beneficial if cervical spine injury is ruled out.
- Suctioning: High-volume suction devices are essential for clearing the airway of blood, vomitus, and secretions. The suction-assisted laryngoscopy and airway decontamination (SALAD) technique can be employed to maintain a clear view during airway instrumentation in the presence of active bleeding.

- Adjuncts: Use of oropharyngeal and nasopharyngeal airways can assist in maintaining airway patency but must be used with caution or avoided in cases of suspected or confirmed skull base fractures due to the risk of intracranial placement.
- Advanced Airway Techniques: In situations where standard intubation is challenging due to anatomical distortion or profuse bleeding, consider alternate strategies such as video laryngoscopy with suction assistance or awake fiberoptic intubation if the patient's condition allows.

56.4.2 Surgical Airway Management

56.4.2.1 Timing

Early consideration for a surgical airway is crucial when airway obstruction is imminent or intubation attempts have failed.

56.4.2.2 Indications for Transition

- Inability to secure the airway through nonsurgical means after limited attempts.
- Significant facial trauma obstructing visualization of landmarks.
- Profuse bleeding or severe edema impeding intubation.

56.4.2.3 Early Tracheostomy

In the ICU setting, early tracheostomy may be indicated for patients who are expected to require prolonged ventilatory support, have severe maxillofacial injuries precluding oral or nasal intubation, or are at high risk of airway compromise due to progressive swelling.

56.5 Techniques for Airway Control

56.5.1 Nonsurgical Airway Options

- Orotracheal Intubation: Preferred method for securing the airway in most emergency situations. May be challenging due to facial deformities, bleeding, edema, or trismus.
- Nasotracheal Intubation: Considered when oral access is compromised but contraindicated in patients with suspected or confirmed skull base fractures due to the risk of intracranial tube placement and exacerbation of CSF leaks.

- Video Laryngoscopy: Provides improved visualization of the glottis in patients with difficult airways and distorted anatomy. Suction readiness is crucial to manage blood and secretions.
- Fiberoptic Intubation: Ideal for anticipated difficult airways and can be performed while the patient is awake, maintaining spontaneous ventilation. Limited by blood or secretions obstructing the scope.

56.5.2 Adjunctive Devices

- Oropharyngeal Airways (OPA): Help maintain airway patency in unconscious patients without a gag reflex. Care must be taken to avoid causing additional trauma.
- Nasopharyngeal Airways (NPA): Useful in maintaining airway patency in patients with trismus or limited mouth opening. Should be avoided in midface or skull base fractures.

56.5.3 Preoxygenation Strategies

- High-Flow Nasal Cannula (HFNC): Provides apneic oxygenation during airway management, prolonging safe apnea time.
- Non-rebreather Masks or Bag-Valve-Mask Devices: Adjuncts like two-person bag-valve-mask technique may improve efficacy when sealing is challenging.

56.5.4 Supraglottic Airway Devices

- Laryngeal Mask Airway (LMA), i-gel: Useful as rescue airways when intubation is unsuccessful. May not provide adequate protection against aspiration and can be difficult to insert in facial trauma.

56.5.5 Surgical Airway Options

- Cricothyrotomy: Recommended in “cannot intubate, cannot ventilate” scenarios due to speed and simplicity.
- Tracheostomy: Performed in a controlled setting, considered for prolonged mechanical ventilation or when other methods are contraindicated.

56.6 Hemorrhage and Circulatory Management

56.6.1 Hemorrhage Control

Maxillofacial injuries can result in significant hemorrhage due to the rich vascular supply, including branches of the external carotid artery.

56.6.2 Techniques for Hemorrhage Control

- Direct Pressure: Immediate application to bleeding sites.
- Nasal Packing and Tamponade: Effective for epistaxis from nasal or midface fractures.
- Hemostatic Agents: Topical agents like tranexamic acid, fibrin sealants, or absorbable hemostats promote clotting.
- Vascular Control Measures: Ligation or clamping of bleeding vessels during surgery.
- Embolization: Interventional radiology can perform embolization of bleeding vessels in intractable cases.

56.6.3 Circulation Management

- Monitoring for Hemorrhagic Shock: Assess vital signs, urine output, mental status, and skin perfusion.
- Fluid Resuscitation: Administer crystalloids and blood products as needed.

56.6.4 Monitoring for Coagulopathy

- Regular Monitoring: Check platelet count, PT/INR, aPTT, fibrinogen levels, and thromboelastography (TEG) when available.
- Correction of Coagulopathy: Early identification and management prevent exacerbation of bleeding.

56.6.5 ICU Preparedness

- Massive Transfusion Protocols: Be prepared to implement as needed.

- Maintain Normothermia and Correct Acidosis: Vital for managing coagulopathy.
- Collaboration with Hematology and Transfusion Services: Ensures optimal patient management.

56.7 Considerations for Cervical Spine Stability

56.7.1 Cervical Spine Immobilization

Patients with maxillofacial trauma have a high suspicion of cervical spine injuries.

56.7.2 Challenges with Rigid Collars

- May interfere with airway management by limiting mouth opening.
- Can increase intracranial pressure (ICP) due to jugular venous compression.
- May cause pressure ulcers with prolonged use.

56.7.3 Alternatives to Rigid Collars

- Manual In-Line Stabilization (MILS): Minimizes cervical spine movement during airway management.
- Vacuum Mattresses or Sandbags: Immobilize the patient without neck pressure.

56.7.4 Imaging for Cervical Spine Evaluation

- Computed Tomography (CT) Scan: Preferred for its rapid and detailed assessment of bony structures.
- Magnetic Resonance Imaging (MRI): Indicated for ligamentous injury, spinal cord injury, or unexplained neurological deficits.

56.7.5 Imaging Guidelines

- Follow protocols like the Canadian C-Spine Rule or NEXUS criteria.
- In unconscious or intubated patients, CT scanning of the entire cervical spine is recommended.

56.7.6 Implications for Management

- Early Identification: Prevents secondary spinal cord injury.
- Team Coordination: Involvement of trauma, radiology, and spine specialists is vital.

56.8 Secondary Survey and Comprehensive Assessment

56.8.1 Secondary Survey

Conduct a thorough head-to-toe examination to identify all injuries.

56.8.2 Ongoing Reassessment

- Monitor for Delayed Complications: Evolving hematomas, swelling, or infections.
- Regular Reassessment: Allows for early detection and intervention.

56.8.3 Neurological Monitoring

- Glasgow Coma Scale (GCS): Assess and monitor the level of consciousness.
- Serial Assessments: Detect deterioration indicating intracranial pathology.

56.8.4 Diagnostic Imaging

- Initial Imaging: CT scans of the head, face, and cervical spine.
- Repeat Imaging: Necessary to monitor known injuries or detect new developments.
- MRI: For detailed assessment of soft tissue injuries or unexplained deficits.

56.8.5 Monitoring Practices

- Vital Signs: Continuous monitoring of heart rate, blood pressure, respiratory rate, and oxygen saturation.

- Laboratory Assessments: Complete blood count, electrolytes, coagulation profile, arterial blood gases.
- Invasive Monitoring: Arterial lines, central venous catheters as needed.

56.8.6 Airway Vigilance

- Risk of Obstruction: Remain high due to swelling or hematoma expansion.
- Close Monitoring: Of airway patency and ventilatory parameters.

56.9 Conclusion and Key Takeaways

Maxillofacial trauma presents complex challenges that require a nuanced and adaptable approach to airway management and overall patient care.

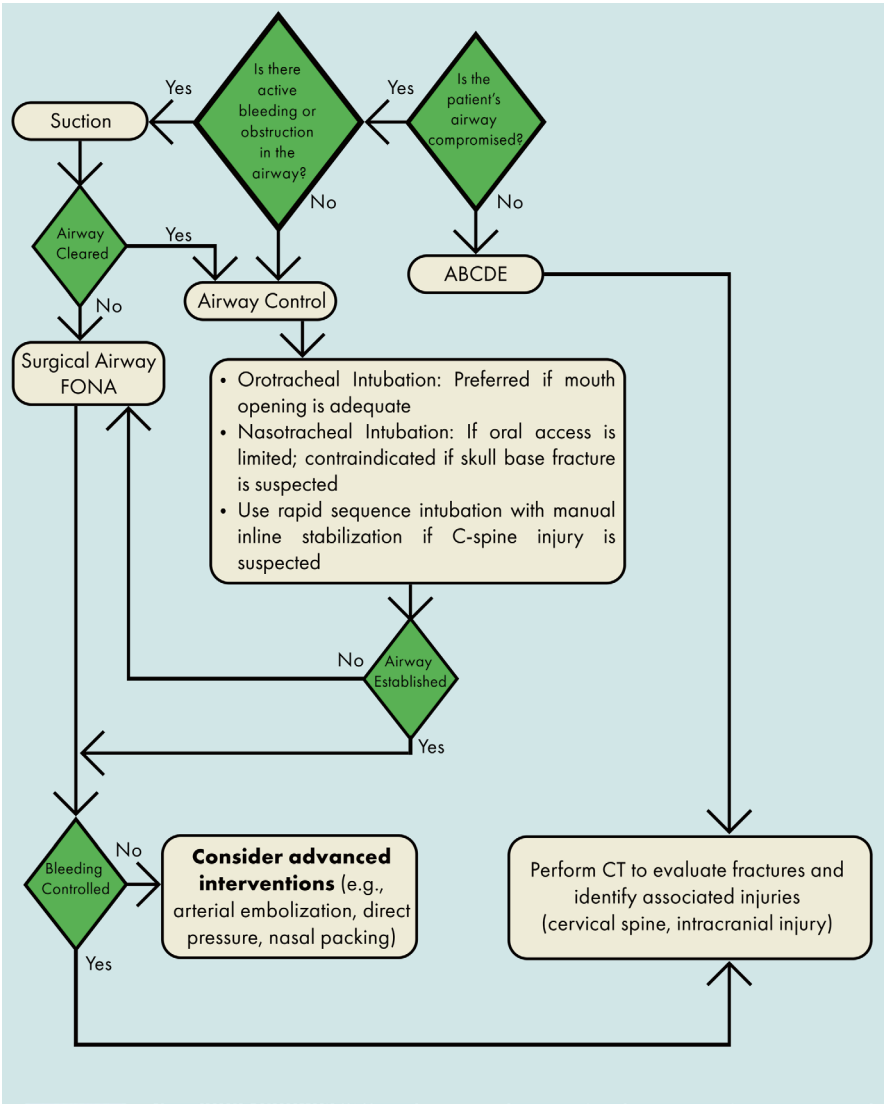
56.9.1 Interdisciplinary Coordination

Effective management necessitates a coordinated, multidisciplinary effort involving anesthesiology, trauma surgery, maxillofacial surgery, otolaryngology, critical care, radiology, and nursing teams. Collaborative planning and communication are essential to address the evolving airway, hemodynamic, and neurological needs of these patients, ensuring timely interventions and optimizing outcomes.

56.9.2 Importance of Training and Protocols

Continuous education and training in advanced airway management techniques are critical for ICU providers. Simulation training in procedures such as cricothyrotomy, video-assisted laryngoscopy, and fiberoptic intubation enhances provider readiness for high-risk scenarios. Implementation of standardized protocols and checklists can improve team performance, reduce errors, and ensure that best practices are followed in the management of maxillofacial trauma.

Algorithm 56.1: Approach to maxillofacial trauma in the ICU



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