

## Facial Trauma

Cases involving facial trauma may potentially involve difficult airway and risk of life threatening airway obstruction from edema, hematoma, foreign body & mobile bony fragments; there is also a high risk of concomitant closed head injury & C-spine injury requiring ICP & C-spine precautions

### ANESTHETIC CONSIDERATIONS:

- Potential for **difficult airway & airway obstruction** from mobile bony fragments (foreign body), flail mandible, edema, blood, broken teeth, trismus, and cranio-facial dislocation
  - May be unable to mask ventilate
  - May require emergency tracheostomy
  - Dynamic obstruction requires continuous evaluation
- Concomitant traumatic injury:
  - **C-spine**
  - Head injury (traumatic brain injury, basal skull fracture, open eye injury, pneumocephalus)
  - Laryngeal, hypopharynx, or tracheal injury
  - Major thoracic or great vessel injury
- Considerations of the **trauma patient** (full stomach, hypothermia, toxic ingestion, concealed hemorrhage / hemorrhagic shock, associated injuries)
- Surgical Considerations:
  - Shared airway
  - Potential for bleeding (mandibular fracture)
  - Postoperatively mouth may be wired, N&V may be lethal

### ANESTHETIC GOALS:

- To safely secure the airway without inducing secondary trauma or airway obstruction
- To avoid exacerbation of coexisting injuries (C-spine, brain injury, open eye injury, hemodynamic instability)

### HISTORY, PHYSICAL & INVESTIGATIONS – ATLS APPROACH

- Simultaneous assessment & resuscitation with ATLS approach maintaining C-spine precautions throughout
- At start of 1<sup>o</sup> survey delegate administration of 100% O<sub>2</sub>, CAS monitors, full VS q3min and 2 large bore IVs
- **Airway** – examine for patency / foreign body / secretions / impending obstruction / injury / protective reflexes
  - Ability to phonate / stridor / hoarseness, clear AW of foreign body, blood & vomitus
  - ? impending obstruction from hematoma / edema / displaced bony or cartilage segments
  - External trauma, crepitus / SC emphysema indicating AW injury
  - Ease of intubation including mouth opening & examine anterior neck for ease of surgical AW
- **Breathing** – RR, depth & respiratory effort; bilateral air entry, midline trachea, distended neck veins, SC emphysema, respiratory distress, asymmetrical movements with flail segment (R/O tension pneumothorax, open pneumothorax, flail chest, massive hemothorax)
- **Circulation** – presence and quality of pulse; ? perfusing rhythm; adequacy of peripheral perfusion; volume status; neck veins (↑ - consider tamponade; ↓ - hypovolemia); control of external bleeding
- **Disability** – GCS < 8 – ↑ urgency for secure airway for protection, ? ↑ ICP
- **Expose** and R/O other life / limb threatening injuries and environmental control (prevent hypothermia)
- **Essential Investigations** – X-match, CBC, lytes Bun Cr, Glu, ABG, +/- INR / PTT,
  - CXR - tubes, lines, pneumothorax / mediastinum / pericardium, SC emphysema, hemothorax, effusion, contusion, aspiration, cardiac silhouette, mediastinum, foreign body
  - C-spine, +/- ECG, +/- pelvic, +/- FAST, CT head / neck / facial bones
- **Secondary survey**
  - **Focused Hx** – AMPLE + mechanism of injury, GCS & VS @ scene, interventions (previous intubation attempts / drugs / fluids), toxic ingestions or medical condition leading to accident (stroke, MI)
  - More detailed **head to toe examination** including:
    - Head & neck - evidence of basal skull # (Battle's sign, raccoon eyes, CSF rhinorrhea / otorrhea), focal neurological deficits, ?↑ICP
    - Chest – R/O simple pneumothorax, hemothorax, pulmonary contusion, diaphragm rupture & myocardial contusion
    - Abdominal / GU / MSK exam and ensure Foley +/- NG or OG (see re nasotracheal intubation)

### OPTIMIZATION

- Consider taking to **OR** for airway management
- Surgeon in room for **potential surgical airway** with cricothyroidotomy and tracheostomy set open and ready
- **Difficult airway equipment** checked & ready including flexible FOB, Glidescope, rigid FO scope (e.g. Bullard or Glidescope), variety of laryngoscopes (including McCoy), various ETT sizes styletted, intubating & classic / Proseal LMA available
- CAS monitors and others as indicated, 100% O<sub>2</sub>, sitting up if able
- Optimize volume status, give aspiration prophylaxis & antisialogogue (dictated by patient status)
- Discussion with surgeon RE: airway management based on patient and surgical indications; if patient is compromised the easiest route for securing AW should be favored regardless of surgical preferences
  - Basal skull # - avoid nasal ETT
  - Mandibular and jaw wiring – prefer nasal ETT
  - Middle and upper 1/3 facial # and nasal # - oral RAE preferred

### ANESTHETIC OPTIONS

- **Airway Options**
  - **Key concepts** for managing the airways of trauma patients are:
    - Protect the airway from the full stomach
    - Do not create a situation from which retreat is impossible
    - Have a valid backup plan
  - ? difficult BMV and intubation or difficult intubation / ventilation alone

- ? uncooperative patient; ? difficult surgical airway; ? degree of aspiration risk
- ? oral or nasal (see basal skull # and surgical preferences above)
- If difficult BMV and intubation (e.g. mechanical ↓ mouth opening) should do awake technique
  - “Awake look” was not advised in a couple of sources b/c potential for previously recognizable structures to become unrecognizable with induction – but can intubate awake and then immediately induce
  - Awake FOI – esp. if there may also be laryngotracheobronchial injury; ++ blood may make FOI useless
  - Awake tracheostomy – laryngoscopy or FOI not feasible, jaw wiring or tracheostomy indicated anyway e.g. laryngeal injury
- Asleep technique if BMV seems possible – decide whether to ablate spontaneous breathing or not:
  - May be necessary in uncooperative or pediatric patient to allow airway management; risk of aspiration
  - Can do direct laryngoscopy or use LMA as guide to intubation
- Prior to any technique always ID cricothyroid membrane and be ready to urgently convert to surgical airway
- Potential contraindications to cricothyroidotomy – age < 12 (laryngeal damage), suspected laryngeal trauma (acute uncorrectable airway obstruction)
- Cricothyroidotomy should be converted to formal tracheostomy if in place > 2-3 days to prevent laryngeal damage
- **Technique of cricothyroidotomy:**
  - Locate the cricothyroid membrane
  - Affix the skin over the cricoid membrane with thumb and index finger of non-operative hand
  - Make vertical skin incision, then a horizontal incision through the cricothyroid membrane
  - Avoid perforating the posterior wall of the trachea
  - Have an assistant hold the trachea with a hook / hemostat
  - Intubate with #6 ETT or device in kit, avoid endobronchial intubation
- **TTJV may be lifesaving:**
  - Have oral / nasal airway in place (obstructed upper airways leads to significant barotraumas)
  - Confirm positioning of needle in trachea by aspiration through a fluid-filled syringe
  - Once in place maintain catheter manually (misplacement leads to barotrauma and sc emphysema)
  - Watch chest rising with each inspiration, listen for expiration
  - After each second of inspiration allow for 2-3 sec of expiration

#### ANESTHETIC SETUP

- **Drugs**
  - Emergency drugs
- **Equipment**
  - **Difficult airway equipment** checked & ready including flexible FOB, Glidescope, rigid FO scope (e.g. Bullard or Glidescope), variety of laryngoscopes (including McCoy), various ETT sizes stylet, intubating & classic / Proseal LMA available
  - CAS monitors and others as indicated, 100% O<sub>2</sub>, sitting up if able

#### MANAGEMENT OF ANESTHESIA

- **Induction**
  - Dictated by airway management technique and coexisting injuries (e.g. avoid ketamine if ↑ ICP)
- **Maintenance**
  - Balanced technique; avoid N<sub>2</sub>O (risk expanding abnormal air spaces - pneumothorax, air emboli, pneumocephalus)
  - Fluid balance to keep U/O = 1 cc/kg/h but limit fluids to avoid edema
  - Hypotensive technique in hemodynamically stable patients to minimize blood loss in extensive maxillofacial injuries
  - PONV prophylaxis (especially if intermaxillary wires)
- **Emergence**
  - Smooth emergence
  - If there is no tracheostomy and no need for PPV postoperatively (i.e. ICU / high acuity care), must make a decision regarding extubation with possible difficult airway / re-intubation (will still require monitored setting postoperatively)
  - Consider **usual extubation criteria** (awake, warm, comfortable, low FiO<sub>2</sub>, strong, adequate Vt & RR) and **possibility of edema** – assess submandibular edema (can push tongue upward & posteriorly), tongue edema, ETT leak (won't assess edema & potential obstruction from supraglottic structures), consider steroids to ↓ edema
  - Can consider taking back to OR to extubate
  - Extubate over ETT changer with variety of smaller ETTs, difficult airway & surgical airway equipment available

#### DISPOSITION & MONITORING

- **? Jaw wired** – **Wire cutters** at bedside at all times (or taped to patient's chest), aggressive PONV prophylaxis, consider emptying stomach prior to jaw wiring with NG / OG intraoperatively
- Postoperatively pain management

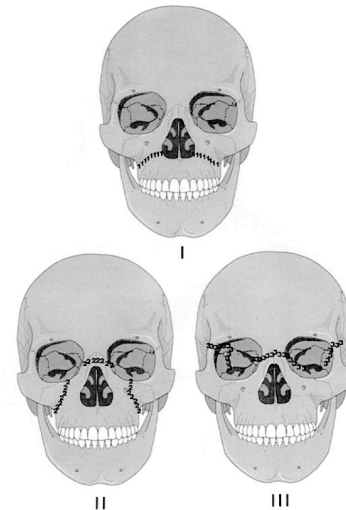
#### COMPLICATIONS

- Airway obstruction / inability to secure the airway
- C-spine instability
- Head trauma with increased ICP

#### PATHOPHYSIOLOGY

- **Lower 1/3 - Mandibular fractures:**
  - Mandible injured in 66% of cases
  - Unilateral fractures are stable
  - Bilateral fractures are unstable; the posterior fragment may be displaced upward and medially, causing the base of the tongue to obstruct the pharynx

- Bilateral condylar fractures may also cause trismus that is mechanical and unresponsive to general anesthesia and muscle relaxation
- Association between mandibular fracture and hi C-spine injuries
- **Middle 1/3 - Midface (LeFort) fractures:**
  - **LeFort I:** horizontal fracture across the lower maxilla which produces mobility of the palate – no airway difficulty expected
  - **LeFort II:** extension of the LeFort I along the malarmaxillary suture lines to the floor of the orbit and base of the tongue which produces a posterior displacement of the maxilla, dural tears may occur
  - **LeFort III:** transverse fracture through the orbits above the malar bone which produces a complete separation of the midface from the craniofacial skeleton, may involve the ethmoid bone and cribriform plate causing dural tears and communication with the subarachnoid space
- **Nasal fractures:**
  - Potential for +++ epistaxis causing significant hypovolemia, poor visualization of airway & increased aspiration risk
- **Zygomatic fractures:**
  - May cause mechanical trismus by fragments pushing down onto the coronoid process of the mandible
- **Basal Skull fracture:**
  - LeFort II & III can involve cribriform plate & ethmoid bone, creating risk of foreign material / air getting into intracranial & subarachnoid space causing pneumocephalus, meningitis & direct mechanical trauma
  - Clinical signs: Battle's sign & raccoon eyes (post-auricular & periorbital ecchymosis), CSF rhino / otorrhea
  - Nasal gastric & nasal ETT contraindicated; caution with BMV PPV b/c risk of pneumocephalus
  - Do some form of oral intubation or awake tracheostomy
  - Barash says if there is no clinical or radiological evidence of basal skull # and there is a "compelling reason", nasal intubation may be considered
    - This should be done with flexible FOB (not blindly) and there are several case reports of this in literature
- **Upper 1/3**
  - Consists of the frontal bone and the cranium
- **C-Spine Note:**
  - Assume all patients with maxillofacial injuries also have c-spine injuries
  - Incidence ranges from 10% to 15% in patients with traumatic facial injuries
  - Lewis et al found 19.3% of patients with c-spine injuries also had facial injuries
    - Also found a relationship between mandibular fractures and fractures of the upper c-spine
    - Facial soft tissue injuries related to fractures of the lower c-spine



#### REFERENCES

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- Krohner RG. Anesthetic considerations and techniques for oral and maxillofacial surgery. *International anesthesiology clinics* 2003;41(3):67-89