Editorial

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Airway Management in Trauma

The primary goal in the early treatment of the trauma patient is to provide sufficient tissue oxygen delivery to avoid organ failure and secondary tissue damage. The first priority is to establish and maintain a patent airway, followed by oxygen supplementation.

Trauma patients with inadequate airway include

1. Altered consciousness (head injury, drugs or alcohol)
2. Airway trauma (faciomaxillary, neck, larynx and throat)
3. Profound bleeding
4. Blast or inhalational injury

Steps to identify the obstructed airway:

1. *Look:* for obtundation, agitation, cyanosis, retraction, use of accessory muscles of respiration, and chest movement.
2. *Listen:* to patient attempting to talk, breath sounds, snoring, gurgling, stridor and crackles..
3. *Feel:* Feel for deviated trachea, subcutaneous emphysema.

Causes of difficult airway in trauma may be due to:

1. Oropharyngeal/pulmonary haemorrhage
2. Facial trauma obscuring airway
3. Immobilised cervical spine
4. Possible full stomach
5. Faulty cricoid pressure (Sellick's maneuver)
6. Uncertain volume status
7. Hypoxaemia
8. Convulsions
9. Coma
10. Uncooperative patient

2–12% of major trauma victims have cervical spine injury and 7–14% of these are unstable. About 10% of comatose trauma patients have cervical spine injury. Hence, neck movement must be minimized to avoid secondary harm to the spinal cord.

Quick history (Mnemoic: SAMPLE) incudes:

S	Signs /Symptoms
A	Allergies if any
M	Medications
P	Past medical history
L	Last meal
E	Events prior to injury

Prehospital airway management

The initial approach to trauma victim begins with the assessment of the patency of the airway. Manual in-line stabilization (MILS) is advised to maintain the head and neck in neutral alignment to cause minimal movement to the cervical spine. A correctly sized firm cervical collar, lateral blocks and straps across the forehead and chin piece of the collar may also be used. Opening the obstructed airway by jaw thrust is preferred to chin lift as it causes lesser movement of cervical spine.

If the patient tolerates, an oropharyngeal airway may maintain airway patency exerting less force on the cervical vertebrae. Otherwise, a nasopharyngeal airway may be the option, if basal skull fracture is not suspected and there is no nasal bleeding.

Supraglottic airway devices like classic laryngeal mask airway (cLMA), Combitube

and Laryngeal Tube are also useful in maintaining the airway.

If oxygenation is achieved with airway adjuncts and bag-valve-mask, quick transferof the victim to the hospital is more important than tracheal intubation. Assisted ventilation is more effective if separate rescuers apply the jaw thrust, hold the facemask with both hands, and squeeze the reservoir bag. Blind nasal intubation in the field is unreliable and not advised; complications include oesophageal intubation, epistaxis, laryngospasm, and vomiting.

Surgical cricothyroidotomy, can be life-saving in severe hypoxaemia due to airway obstruction or if supraglottic airway device has failed and intubation is not possible.

Airway management in the hospital

In the resuscitation room, availability of expertise and 'difficult airway' equipment enable optimal airway management. Assess rapidly for difficulties with mask ventilation, laryngoscopy, airway techniques and surgical airway.

Facial beard, trauma and burns interfere with face mask application. Trismus can prevent supraglottic airway device and laryngoscope insertion. Laryngoscopy is difficult with airway oedema, blood or burns. MILS and cricoid pressure may decrease the laryngeal visibility. Blood, secretions and regurgitation make fibreoptic intubation impossible. Surgical airway is difficult with restricted neck extension, laryngotracheal disruption, subcutaneous emphysema or anatomical distortion by penetrating injury or haematoma. An emergency tracheostomy by an experienced operator is preferable to cricothyroidotomy in situations like laryngotracheal disruption or impending airway obstruction.

BONES: for difficult mask ventilation (2 or > of the following)	
B	Beard
O	Obesity : BMI>26kg/m2
N	No teeth
E	Elderly (Age >55)
S	Snorer

LEMON: for assessing difficult intubation		
L	Look Externally	Facial/neck trauma, receding mandible, short neck(<3 finger breadth from sternal notch to thyroid cartilage)
E	Evaluate 3-3-2 rule	Mouth opening, submandibular space & distance between thyroid notch & chin < 3,3 &2 finger bredth
M	Mallampatti grade	= 2 indicate difficult laryngoscopy & intubation
O	Obstruction	Obstruction to airway- fixed or changing: inhalation injury / faciomaxillary trauma
N	Neck mobility	Fixed as in cervical collar or Halo frame

Airway strategy in inadequate airway

First of all clear any blood, clot or mucous from the oral cavity and nose. Remove foreign bodies such as broken dentures or avulsed teeth. Control the tongue position in case of symphyseal bilateral fracture of the mandible. While suctioning the oral cavity, do not suck beyond visibility, suck on the way out and not longer than 15 seconds. Oxygenate before and after suctioning.

1. Simple airway strategy
2. Definitive airway strategy (Endotracheal intubation/surgical airway)
3. Semi-definitive airway strategy (to make the airway patent)

Simple airway strategy

Include Head tilt, Chin lift (avoid in patients with cervical trauma) and Jaw thrust or the use of basic adjuncts like oropharyngeal / nasopharyngeal airway.

Definitive airway strategy

Endotracheal intubation/Surgical airway

Indications include:

1. Apnoea.
2. Airway protection form aspiration (vomitus, bleeding)
3. Unconsciousness (Glasgow Coma Scale <8)
4. Severe faciomaxillary fracture
5. Risk for obstruction (neck haematoma, laryngeal/tracheal injury)
6. Impending / potential airway compromise (Burns, inhalation injury)
7. SpO2> 90% with Oxygen by facemask

Options for Endotracheal intubation depend upon the situation, device availability and operator expertise. This includes,

1. Direct laryngoscopy intubation
2. Video laryngoscopy
3. Fibreoptic intubation
4. Lightwand-guided intubation
5. Gum elastic bougie
6. Intubating LMA/C-Trach intubation
7. Bullard aided intubation
8. Retrograde tracheal intubation
9. Blind nasal intubation

Direct rigid laryngoscopy by straight or curved blade is the most successful in experienced hands. Gentle direct laryngoscopy with MILS by is usually not associated with significant movement of the cervical spine.

Tracheal intubation has to be confirmed by clinical methods like visualising the tube passing through the vocal cords, chest movement and 5 points auscultation. CO_2 detector and capnography are now a routine. Chest X-ray may be required in certain cases to confirm the tracheal tube position.

Video laryngoscope (GlideScope, Truview) view the images on a monitor and provides an assistant to apply external laryngeal manipulation. In presence of blood and secretions the visibility is poor, besides being expensive.

Fibre optic tracheal intubation is preferred in patient with unstable cervical spine. However, in presence of blood, secretion and vomitus or in uncooperative patient this can fail.

Lightwand (Trachlight) is a safe, effective, rapid and inexpensive. It can be used with minimal head extension and even in the presence of blood and secretions in the oral cavity. However, since this is a blind technique, should be avoided in patients with expanding neck masses or laryngopharyngeal trauma.

Gum elastic bougie is useful when only a portion of laryngeal inlet or epiglottis alone is visualised. It is not affected by the presence of blood and secretion. One should be satisfied with Cormack and Lehane's class 2 or 3 view and use a bougie to aid intubation, rather than use force to obtain class 1 view and aggravate cervical injury.

Intubating LMA / C-Trach requires minimal head and neck movement while placing in the oropharynx and facilitate intubation. However, it may be associated with displacement of the unstable cervical vertebra.

Bullard laryngoscope, due to its anatomically curved shape, no head and neck movement is necessary and is suited for patients with cervical spine injury. Cricoid pressure and inline stabilisation of the head and neck does not interfere with its use. Presence of blood, vomitus or secretions makes its use difficult.

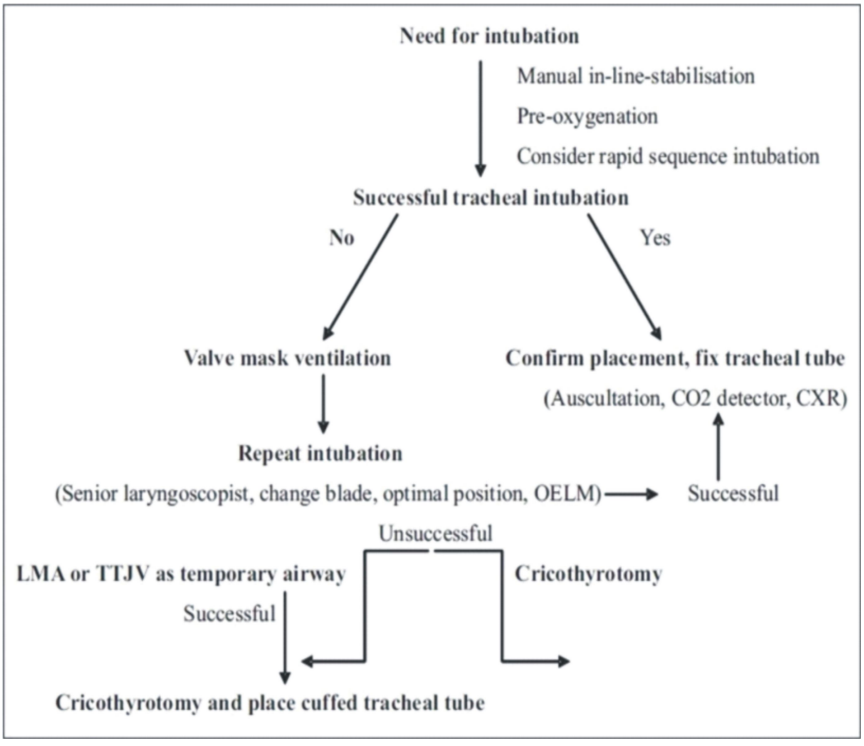
Blind nasotracheal intubation, has very few indications in trauma (eg. limited mouth opening), as most devices above require mouth opening of at least 2 cm. In such situation, this may be attempted if surgical airway is not possible. Contraindications include significant midface trauma and coagulopathy.

Surgical airway: 1% of trauma patients requiring intubation require surgical airway. Cricothyrotomy may be resorted in severe glottis oedema and/or oropharyngeal haemorrhage, fracture of the larynx and failed tracheal intubation.

Percutaneous tracheostomy (PCT) is not recommended in the trauma setting as it requires hyperextension of the neck, which can be disastrous in cervical injury. Further, the procedure needs expertise and can be time-consuming.

Semi definitive airway strategy: Three devices recommended by ATLS are LMA, Combitube and laryngeal tube (LT).

Laryngeal Mask Airway (LMA) is useful a where definitive airway could not be established. ATLS recommends that a definitive airway should be achieved



shortly in these patients.

Combitube is used in trauma patients where facilities for definitive airway do not exist or have failed. Ventilation is possible whether the device enters in the esophagus (usual) or in the trachea (unusual). Attempt should be made to switch over to a definitive airway device at the earliest.

Laryngeal tube (LT) is a supraglottic airway device which is placed without direct visualisation of the glottis and does not require significant manipulation of the head and neck. Though not a definitive airway device, improved success rate with quick placement makes it a good choice.

Approach to definitive airway management in trauma patients

Cricoid pressure (Sellick's maneuver), used to prevent regurgitation of gastric contents can distort the laryngeal view and displace unstable cervical spine. Cricoid pressure should be reduced or abandoned, if it is hampering tracheal intubation or placement of supraglottic device.

Rapid sequence induction and tracheal intubation though hazardous, may be the choice with skilled personnel. While carrying out rapid sequence intubation:

1. Ensure a person with skill to perform surgical airway in the event of failed intubation.
2. Ensure that suction and device to ventilate is available.
3. Pre-oxygenate with 100% oxygen and apply cricoid pressure (Sellick's maneuver).
4. Avoid succinylcholine in severe crush injuries, major thermal and electrical burns, chronic renal failure, chronic paralysis and chronic neuromuscular disease, due to risk of severe hyperkalaemia.
5. Avoid Thiopental in patients with hypovolaemia.

Failed intubation: Failed intubation drill by waking the patient after spontaneous breathing for an alternative plan, is rarely appropriate in trauma patients. If RSI is done with inadequate airway, it is unlikely that waking will be advantageous.

If oxygenation is adequate, further attempts may be tried to intubate by a more experienced person with optimal external laryngeal manipulation. Not more than four attempts are advised, as multiple attempts cause further trauma and hypoxaemia. Cricoid pressure cannot be maintained for more than 5 min and airway reflexes return after the effect of succinylcholine.

If there is hypoxaemia intubation attempt must be abandoned and ventilation re-established. The priority is to maintain adequate oxygenation with basic airway manoeuvres and adjuncts. Poorly-applied cricoid pressure may aggravate airway obstruction.

If oxygenation cannot be restored, 'cannot intubate—cannot ventilate' back-up plan must be initiated. A trained practitioner may insert a supraglottic airway device depending on availability and familiarity. Release cricoid pressure temporarily may help inserting LMA. Replacement of cricoid pressure will be unnecessary if a ProSeal LMA, Combitube, or Laryngeal Tube has been positioned correctly, which has oesophageal drainage tubes.

These devices will protect the larynx and the flexible fibreoptic bronchoscope from bleeding, and also act as a conduit for blind or fibreoptic-aided tracheal intubation. Fibreoptic-guided tracheal insertion of a bougie or Aintree intubation catheter to railroad the tracheal tube after removal of LMA is easier.

The Intubating LMA (ILMA) facilitates

blind and fibreoptic-guided tracheal intubation. However, cervical flexion and posterior vertebral displacement by pressure on the cervical spine may occur with it. This pressure may also produce pharyngeal oedema if left *in situ*; therefore, once intubation is accomplished, ILMA has to be removed.

Surgical airway must be created rapidly if oxygenation cannot be maintained using simple manoeuvres, basic airway adjuncts or a supraglottic airway device. Accepted methods of emergency surgical access to the trachea are cannula and surgical cricothyroidotomy.

Cannula cricothyroidotomy: A kink-resistant device to enable exhalation (e”4.0 mm ID) is desirable. Confirm intra-tracheal placement by aspiration and secure the cannula before connecting a high-pressure ventilation system.

Surgical cricothyroidotomy consists of a horizontal stab incision through the skin and cricothyroid membrane to pass a 6.0–7.0 mm ID cuffed tracheal tube. Retraction of the wound edges facilitates intubation or insertion of a bougie to railroad the tube. Surgical cricothyroidotomy should produce little vertebral displacement.

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