Airway Management of the Trauma Victim

The potential for cervical spine injury makes airway management more complex in the trauma patient. A cervical spine injury should be suspected in all injury mechanisms involving blunt trauma. Patients with injury above the clavicles are at increased risk, and this is increased 4-fold (9) if there is a clinically significant head injury (GCS < 9). Cervical spine injury is often occult, and secondary injury to the spinal cord must be avoided.

Immobilization of the cervical spine must be instituted until a complete clinical and radiological evaluation has excluded injury.

Assessment

- The fully conscious, talking patient is able to maintain his own airway and needs no further airway manipulation. However patients' status may deteriorate at any time, and ABC's must constantly be reassessed.

- The following categories of patients require a definitively secured airway :
    1. Apnoea
    2. Glasgow Coma Scale < 9 or sustained seizure activity.
    3. Unstable mid-face trauma.
    4. Airway injuries.
    5. Large flail segment or respiratory failure.
    6. High aspiration risk.
    7. Inability to otherwise maintain an airway or oxygenation.

- The urgency of airway intubation is the most important factor in planning which technique of securing the airway is the safest and most appropriate. One must evaluate and assess the risk of further cord injury given head and neck movement, the degree of cooperation from the patient, anatomy and trauma to the airway and one's own expertise in each technique.

Airway Management

Initially the airway should be cleared of debris, blood and secretions. It should be opened using the 'chin lift' or 'jaw thrust' manoeuvres. The 'sniffing the morning air' position for standard tracheal intubation flexes the lower cervical spine and extends the occiput on the atlas. However, studies (2) have shown that 'jaw thrust' and 'chin lift' both cause distraction of at least 5mm in a cadaver with C5/6 instability.

This movement was unaffected by use of a rigid collar. Manual stabilization did however reduce movement.

An oral (Guedel) or nasopharyngeal airway may be necessary to maintain patency until a definitive airway is secured. Insertion of an airway produces minimal disturbance to the cervical spine. Bag and mask ventilation also produces a significant degree of movement at zones of instability.

TrachealTube

The safest method of securing a tracheal tube remains debatable. In general, the technique used should be the one the operator is most familiar with. The method is generally unimportant as long as the (potential) cervical spine injury is recognised and reasonable care taken (4).

The ATLS recommends a nasotracheal tube in the spontaneously breathing patient, and orotracheal intubation in the apnoeic patient. MANUAL in-line axial stabilization must be maintained throughout. The hard collar may interfere with intubation efforts and the front part may be removed to facilitate intubation as long as manual stabilisation is in effect.

Blind nasal intubation is successful in 90% of patients but requires multiple attempts in up to 90% of these. Nasotracheal intubation is (relatively) contraindicated in patients with potential base of skull fracture or unstable mid-face injuries. In addition, it may produce haemorrhage in the airway, making other airway manipulations difficult or impossible. Nasotracheal intubation in non-trauma patients is often accomplished by rotating or flexing the neck to align the tube correctly. This is not possible in the trauma patient and the procedure becomes more difficult. In the spontaneously breathing patient however, one can hear movement of air at the end of the tracheal tube and thus line the tube up with the trachea.

Orotracheal intubation is generally accepted as the more usual method for securing the airway in the trauma patient. It is the fastest and surest method of intubating the trachea. At Shock Trauma in Baltimore, Maryland (5) more than 3000 patients were intubated orally with a modified rapid sequence induction technique with pre-oxygenation and cricoid pressure. Ten percent of these patients were found to have cervical spine injury and none deteriorated neurologically following intubation.

Atlanto-occipital extension is necessary to bring the vocal cords within line-of-sight of the mouth. Thus patients with unstable C1 or C2 injuries might be at more risk from this technique. Direct laryngoscopy has been shown to disturb the cervical spine both in

anaesthetised volunteers (3) and in cadavers (7). Manual axial in-line stabilisation reduces this movement by 60%. Papers showing no neurological deficit after direct laryngoscopy have small patient numbers, and there are cases in the literature of quadriplegia following laryngoscopy without manual stabilization.

Rotando et al evaluated the use of induction agents and muscle relaxants to facilitate intubation and found them to be safe and effective. If possible, patients requiring tracheal tube intubation should be anaesthetised unless very cooperative. In the obtunded head injured patient, anaesthesia is vital to prevent pressor responses to intubation increasing intracranial pressure. Carbon dioxide levels are also much better controlled in the anaesthetised patient.

The ideal induction agent probably does not exist, and once again it is down to operator experience. Propofol is not recommended for trauma because of the potential for hypotension (as with most IV agents) but has many advantages in these patients and is used in many centres. Its ability to provide total intravenous anaesthesia with good control over the depth of anaesthesia is also very valuable. Thiopentone (pentothal) requires making up to solution but otherwise is very effective and is the standard for rapid sequence induction. Etomidate has been reported to produce less cardiovascular depression than other intravenous induction agents, but this research was done on healthy individuals, and this is not the case for hypovolaemic patients. In addition, the potential adrenal and immunological suppression caused by even one bolus of etomidate puts a question mark on its use in these cases. Ketamine is a very under-used induction agent which maintains cardiovascular stability better than the other intravenous agents. As a non-competitive NMDA receptor antagonist it has neuroprotective effects. Its use is currently contraindicated in patients at risk from raised intracranial pressure as it has been shown to increase cerebral blood flow and so ICP in head injured patients. However, evidence is accumulating that this may not be the case, especially in hypotensive patients, and its effects on ICP may be modulated by agents such as propofol.

Awake intubation is also a feasible option and is favoured by some practitioners. It has been shown to be safe in the patient with cervical spine injury (8). It may be performed via the nasotracheal route, direct oral laryngoscopy or by fibreoptic technique.

Successful fibreoptic tracheal intubation requires a cooperative patient, a secretion and blood free airway, a pharynx unrestricted by oedema and adequate supraglottic and infraglottic anaesthesia. Such ideal conditions often do not exist, and local anaesthetic preparation

of the airway is time consuming and might increase the risk of aspiration.

Failed Intubation

Failed or difficult intubation is always a problem. It is important not to waste time with repeated attempts at intubation while the patient is desaturating. Alternative methods of securing the airway should be instituted as soon as a problem is recognised.

Laryngeal Mask Airway (LMA)

The LMA is gaining wider support in the management of patients with cervical spine injury. As well as maintaining the airway, a tracheal tube (size 6 or less) may be placed, either blindly or via flexible fibreoptic laryngoscopy. The LMA does not however protect the airway from aspiration, and by acting as a bolus in the pharynx, may actually relax the lower oesophageal sphincter and increase reflux. It's use should probably be limited to maintenance of the airway after a failed attempt at intubation.

Combitube

The Combitube is a double lumen tube inserted blindly into the oesophagus or trachea. The position of the tube is confirmed by the presence of breath sounds or capnography. By inflating one of the two cuffs present, the lungs may then be ventilated. Problems arise after positioning with definitive securing of a tracheal tube, and again with protection of the airway from aspiration, although stomach suctioning is possible through the gastric port.

Cricothyroidotomy

The need for a surgical airway should be recognised quickly and performed by an experienced person without delay. It may be used as a primary airway, with injuries to the pharynx for example, or after failure of orotracheal intubation. It may be a full surgical approach or via a percutaneous needle cricothyroidotomy with high flow oxygen. The potential for carbon dioxide retention with this technique must be remembered and the levels in arterial samples monitored. There are no studies regarding movement of the neck during cricothyroidotomy, ease of cricothyroidotomy with neck immobilisation, or neurological deterioration following cricothyroidotomy.

Verification of Tracheal Tube Placement

It is vital that the position of the tube is confirmed to be in the trachea. Clinical methods of verification are notoriously unreliable, and patients with chest injuries increase the likelihood of mistakes in this area. Capnography is the gold standard in the operating room to

assess tracheal tube position, and this should probably be transferred to the trauma area too.

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