Review Article

*Indian Journal of Neurotrauma (IJNT)*
2005, Vol. 2, No. 2, pp. 99-101

# Airway Management: Uncleared Cervical Spine Injury

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**Abstract:** The potential for cervical spine injury makes airway management more complex in the trauma patient. Patients with injury above the clavicles are at increased risk, and this is increased 4-fold if there is a clinically significant head injury (GCS < 9). Cervical vertebrae, being highly mobile for flexion, extension and rotation in vertebral column, are the most vulnerable ones for fracture, subluxation and dislocation. Atlanto-axial dislocation may even be fatal. In patients suspected for cervical spine instability, manipulation of airway either in emergency or electively continues to figure prominently challenging in anaesthesia practice. The best outcome depends upon the patients' predicament and the practitioner's experience and expertise with technique and the skills with which it is performed

**Keywords**: airway management, cervical spine injury, endotracheal tubes, head injury

## INTRODUCTION

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 if there is a clinically significant head injury (GCS < 9)[1]. Cervical spine injury is often occult, and secondary injury to the spinal cord must be avoided. Cervical vertebrae, being highly mobile for flexion, extension and rotation in vertebral column, are the most vulnerable ones for fracture, subluxation and dislocation. Atlantoaxial or atlantooccipital dislocation may even be fatal. Immobilization of the cervical spine must be instituted until a complete clinical and radiological evaluation has excluded injury. Minimal spinal movement can be facilitated by an assistant providing manual-in-line stabilization. Trauma patients require rapid assessment and also need a quick airway control and ventilatory assistance.

## CAUSES OF UNSTABLE CERVICAL SPINE

1. Congenital unrecognized craniovertebral anomalies
2. Traumatic fracture and dislocation.
3. Pathological conditions predisposing to falls like osteoporosis, degenerative disorders, spinal tuberculosis, etc.

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## 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 must constantly be reassessed.

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

b) 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' maneuvers. The 'sniffing the morning air' position

for standard tracheal intubation flexes the lower cervical spine and extends the occiput on the atlas. However, cadeveric studies have shown that 'jaw thrust' and 'chin lift' both cause distraction of at least 5 mm in the presence of C5/C6 instability[2]. This movement was unaffected by use of a rigid collar. Manual stabilization did however reduce movement[3].

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[4,5,6,7]. Bag and mask ventilation also produces a significant degree of movement at zones of instability.

## TRACHEAL TUBE

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 recognized and reasonable care taken[3]. ATLS recommends a nasotracheal tube in a spontaneously breathing patient, and orotracheal intubation in an 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 stabilization 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 hemorrhage 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 and is the fastest and surest method of intubating the trachea.

Atlanto-occipital extension is necessary to bring the vocal cords within line-of-sight of the mouth. Thus patients with unstable $C_1$ or $C_2$ injuries might be at more risk from this technique. Direct laryngoscopy has been shown to disturb the cervical spine both in anaesthetised volunteers[4,5] and in cadavers[2]. Manual axial in-line stabilisation reduces this movement by 60%. Reports of quadriplegia exist after laryngoscopy and intubation when precautions are not taken[6].

## ANESTHESIA

Intravenous use of use of induction agents and muscle relaxants to facilitate intubation are found to be safe and effective. Patients requiring tracheal tube intubation should be anesthetised unless very cooperative. In the obtunded head injured patient, anesthesia is vital to prevent pressor responses to intubation, which can increase intracranial pressure. Carbon dioxide levels are also much better controlled in the anesthetised patient.

### Choice of Induction Agents

The ideal induction agent probably does not exist, and once again it is down to operator experience. Propofol is to be used with caution because of the potential for hypotension but its ability to provide total intravenous anaesthesia with good control over the depth of anesthesia is valuable. Thiopentone (pentothal) 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 hypovolemic 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 cautiously-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

Awake intubation is also a feasible option and is favored 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.

### Fibreoptic Intubation

Successful fibreoptic tracheal intubation requires a cooperative patient, a secretion and blood free airway, a pharynx unrestricted by edema and adequate supraglottic and infraglottic anesthesia. 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 recognized. Clinical predictors of difficult airway especially in a setting of trauma hold no good for evaluation[9]. This aspect is predominantly seen in cervical spine injuries and also in polytrauma cases with head injuries[10].

### 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 esophageal sphincter and increase reflux. Its 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 esophagus 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 recognized 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 immobilization, 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.

## CONCLUSION

In patients suspected for cervical spine instability, manipulation of airway either in emergency or electively continues to figure prominently challenging in anesthesia practice. There is no data available to suggest which method is superior to other. The best outcome depends upon the patients predicament and the practitioner's experience and expertise with technique and the skills with which it is performed rather than the particular technique chosen. In most instances, direct laryngoscope with orotracheal intubation with in-line immobilization, with or without pharmacologic adjuncts and muscle relaxants represent the most effective method.

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