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Airway Management In Patients With Traumatic Cervical Spine Injury For Emergency Surgery: A Case Series

Deepak Chandrakant Koli [1*], Sandip S. Katkade[2], Prajakta D. Latkar[3], Hemant H Mehta[4]

1.Consultant, Dept. of Anaesthesia and Pain Management, Sir H. N. Reliance Foundation Hospital and Research Centre, Mumbai, Maharashtra, India

2.Consultant, Dept. of Anaesthesia and Pain Management, Sir H. N. Reliance Foundation Hospital and Research Centre, Mumbai, Maharashtra, India

3.Consultant, Dept. of Anaesthesia and Pain Management, Sir H. N. Reliance Foundation Hospital and Research Centre, Mumbai, Maharashtra, India

4.Director and Head of Department, Dept. of Anaesthesia and Pain Management, Sir H. N. Reliance Foundation Hospital and Research Centre, Mumbai, Maharashtra, India

ABSTRACT

Patients with traumatic cervical spine injuries who require surgical intervention pose a significant challenge to anaesthesiologists. Airway management inherently involves cervical spine movements that may aggravate pre-existing injury. There is currently no agreement on the technique for intubating these patients. We present three patients with cervical spine traumatic injuries and neurological symptoms posted for emergency cervical spine fixation surgery. All intubations were done by direct laryngoscopy with video laryngoscope and endotracheal tube then railroaded over Boogie with manual in-line Immobilization.

We can conclude that the video laryngoscope assisted intubation has several advantages in the care of patients posted for emergency cervical spine fracture fixation.

Keywords: Trauma, cervical spine injury, emergency surgery, videolaryngoscope, difficult intubation.

*Corresponding Author Email: deepak.c.koli@gmail.com
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INTRODUCTION

Traumatic cervical spine injuries are a major public health concern because of the possible ramifications for patients as well as society.

Cervical spine injury occurs in 0.9% to 3% of all blunt trauma patients, with a weighted average of 1.8%. [1, 2] Acute cervical spinal cord injury can have serious consequences in terms of morbidity and mortality. Because patients with cervical spinal cord injury frequently require emergency intubation to secure the airway and emergency surgery to avoid any further neurological damage hence the majority of these patients will be seen by an anesthesiologist.

Patients with traumatic cervical spine injuries who require surgical intervention pose a significant challenge to an anaesthesiologist, as manipulation during securing the airway inherently leads to cervical spine movements that may exasperate the pre-existing injury.

Anesthesiologists may be able to prevent or reduce secondary nervous system injury and improve patient end result by understanding the pathophysiology of acute cervical spinal cord injury (ACSCI) and developing a precise plan for every patient during the perioperative period.

We present three patients with cervical spine traumatic injuries and the associated neurological symptoms. In this review, we highlight critical factors for anesthesiologists to consider when treating ACSCI patients during preoperative interviews, airway management, induction administration, management during general anaesthesia, and recovery phases. We hope that this information will provide anesthesiologists with useful information about ACSCI, allowing them to provide the best possible care.

CASE 1

A 45 years old female (152cm, 61kg) patient came in the emergency department with history of road traffic accident about 7-8 hours back with injury to neck and left hand. She had no comorbidities. Her MRI cervical spine showed C6-7 subluxation with facet fracture, C7 spinous process and transverse process fracture. annular tear with posterior and right posterolateral C6-C7 disc extrusion with cranial migration, large extruded disc lying behind the subluxated C6 vertebral body (FIGURE 1). On examination, her power for right shoulder abduction was grade 4/5, rest was normal. Cervical immobilization was done with a rigid cervical collar. She was posted for emergency anterior cervical discectomy and fixation surgery. We had planned awake fibre optic bronchoscope guided intubation and same was explained to the patient, but as patient was very anxious and would not have cooperated for same, after discussing with orthopaedic surgeon, we changed our plan to video laryngoscope guided intubation with manual inline stabilization and cervical collar in-situ. After IV

induction patient was then intubated with 7 no flexometalic tube with help of CMAC video laryngoscope and bougie.C6-7 discectomy with removal of part of C6 inferior body was done. After adequate decompression, cage was filled with iliac crest auto graft and placed in C6-7 space.

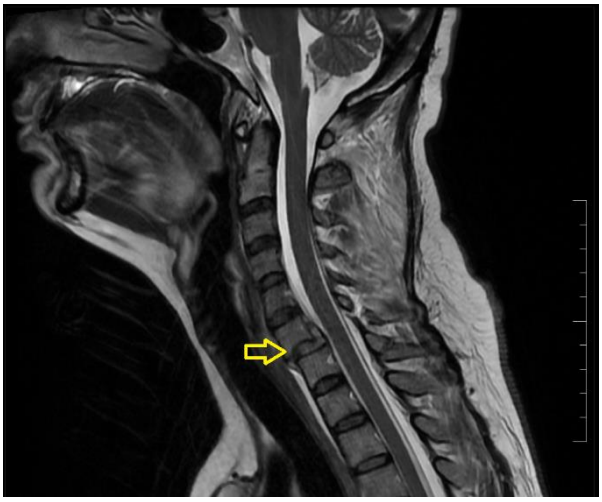

Figure 1 Sagittal MRI cervival spine of case 1, C6-7 subluxation with facet fracture (arrow)

Surgical team wanted to do neurological examination in immediate post-operative period to rule out any new neurological deficit, so post-surgical closure once patient met all extubation criteria, leak test was performed which showed significant leak excluding significant laryngeal edema patient was then extubated over a ventilating bougie so that in case of a postoperative airway emergency, it can be used as an access to railroad the endotracheal tube during laryngoscopy., patient was moving all four limbs without any neurological deficit in immediate post-operative period. Rest of the postoperative course was uneventful.

CASE 2

39/yrs. male without any known comorbid condition admitted to ER with c/o acute onset bilateral lower limb weakness and loss of sensation and diagnosed to have acute cord compression sec to acute disc rupture at C5 - C6 level on MRI cervical spine (FIGURE 2) hence was planned for emergency anterior cervical discectomy and fusion, patient was in acute spinal shock with distinct sensory level at C8-T1 and unstable hemodynamics, inside OT under local anaesthesia left radial artery was cannulated and titrated induction done with intermittent phenylephrine 50mcg boluses to maintain MAP >70mmhg, considering emergency situation video laryngoscope and bougie guided intubation done with manual in line stabilisation by surgical team, intraoperative noradrenalin (4mg/50ml NS) infusion started and titrated, C6 corpectomy and cage fusion done. post-surgery noradrenalin infusion tapered and on request of surgical team extubation trial given once all extubation criteria were met for immediate neurological examination in postoperative period to rule out any

further neurological damage, considering long surgical duration of 6hrs, patient extubated over airway exchange catheter(AEC) after doing leak test to exclude significant airway edema and AEC kept insitu to secure airway post extubation in case of reintubation required in immediate postoperative period, patient shifted to ICU for observation. Patient improved neurologically over the time in postoperative period, post physiotherapy with power in both lower limbs improved without any further neurological deterioration, and discharged on POD8.

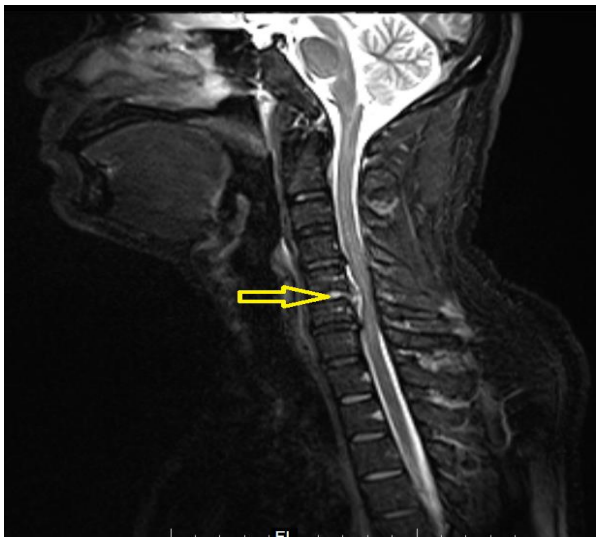

Figure 2 Sagittal MRI cervical spine of case 2, acute disc rupture at C5 - C6 (arrow)

CASE 3

57 yrs. male admitted to ER post traffic accident with bilateral weakness and numbness in both upper limbs with severe pain over fingers of both hands, patient was operated for cerebellar hemangioblastoma 8 months back no other significant medical history, on CT brain diagnosed to have C6-C7 undisplaced spine fracture emergency MRI was done for further evaluation which showed Flexion distraction injury-Injury to the posterior ligament complex (PLC) at C6/7 and Cervical disc protrusion at C6-C7 with spinal cord compression (FIGURE 3), hence posted for emergency anterior cervical discectomy and fusion.

Patient was very anxious post-accident and refused to cooperate for awake fiber optic (FOB) guided intubation hence similar to our previous patients after general anesthesia with manual in line stabilization video laryngoscope and bougie guided intubation done, patient was hemodynamically stable throughout the procedure, hence post-surgery extubated on OT table, patient improved neurologically post-surgery with significant reduction in pain and improved power in both upper limbs in postoperative period over 7 days ,so discharged with stable neurological findings on POD8.

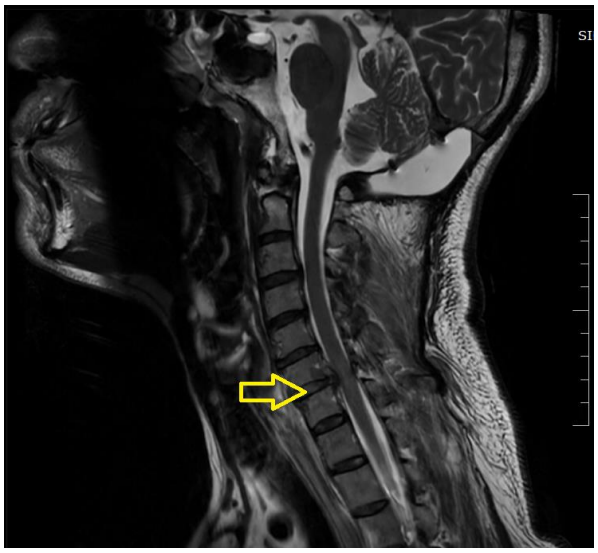

Figure 3 Sagittal MRI cervival spine of case 3, Cervical disc protrusion at C6-C7 (arrow)

DISCUSSION

Adult trauma centers frequently see patients with actual or potential spinal cord insult (SCI), and a large number of these patients require surgical intervention. Until proven otherwise, all polytrauma patients should be assumed to have a SCI. Pre-hospital provider should take appropriate steps to immobilize all trauma patients at the scene of the accident. Spinal stabilization aids in the treatment of other major injuries both in and out of the hospital. The primary aim of perioperative management is to avoid iatrogenic worsening of existing injury and to reduce the risk of secondary injury while providing overall organ support that may be undermined by the injury.

Despite the lack of clear evidence of its benefit, cervical spine immobilisation has become standard practice in the treatment of these patients.[3] The professionals involved are extremely sensitive because they are afraid of causing further neurological damage during the endotracheal intubation of these patients. As a result, protocols have been developed that include manual in-line immobilisation of the cervical spine during airway manipulation. [4] The safety of this technique in terms of the integrity of the injured spine has been called into question in recent years. [5,6] Furthermore, we have known for years that this practice complicates intubation by obscuring the view from the direct laryngoscope. [7]

Several devices have emerged in recent years that enable intubation with minimal cervical movement via indirect laryngoscopy. Despite this, a significant percentage of failed intubations occur when compared to direct laryngoscopy, particularly in the out-of-hospital setting. [9] When it comes to cervical spine movement, all of the devices studied mobilize it, though the majority of these studies show that video laryngoscopes outperform direct laryngoscopy. [8] When compared to flexible fibreoptic bronchoscopes, this technique is shown

to mobilize the affected spinal area to a lesser extent. [10,11] The use of the fibreoptic bronchoscope, without a doubt, necessitates overcoming a learning curve; thus, its use is limited to seasoned professionals, and its recommendation cannot be generalized.

When developing an intubation plan, it is critical to consider the extent of the neurologic injury, the patient's mental status, the airway exam, the adequacy of ventilation, and the urgency of the surgery. There are several techniques for intubating the patient, but none is perfect for every situation. It is critical to consider the benefits and drawbacks of each technique, as well as how each technique leads to cervical spine movement, when developing the plan. Some consider awake fibreoptic intubation to be the gold standard for securing an airway in an acute spine injury. One of the advantages is the ability to perform a post-intubation neurologic exam. Another advantage of the fibreoptic scope is the minimal pressure placed on the cervical spine.

The time required for airway topicalization and intubation is one of the difficulties in performing an awake fibreoptic intubation. An awake fibreoptic intubation typically takes 20-30 minutes. A second issue is that, despite adequate airway topicalization, the patient tends to cough or move during airway intubation. This movement can be quite violent at times, endangering the spinal cord. In addition, while performing fibreoptic guided intubation, a patient who is awake and willing to cooperate with the intubation is required, instead of performing the fibreoptic intubation while the patient is awake, it can also be performed while the patient is under general anaesthesia. If this is done, a short-acting muscle relaxant can be given to the patient to make sure that no movement or coughing occurs during the intubation. For this to happen safely, the anaesthesiologist must be confident that the patient can be mask ventilated to ensure adequate ventilation prior to intubation. The benefit of performing the intubation under general anaesthesia is that it is usually faster and does not necessitate a cooperative patient. The main disadvantage of this technique is that a neuro exam cannot be performed after intubation. While the fibreoptic scope only causes minor spinal cord movement, mask ventilation causes significant spinal movement.

In a cadaver study, after giving a jaw thrust to enable mask ventilation caused a 5mm movement of the cervical spine at the site of injury [12]. To minimize cervical spine movement, it is common practice to maintain "manual in-line immobilization" (MILI) during intubation. Despite the fact that this prevents gross cervical spine extension, subluxation can still occur.[13]

In 45% of patients, keeping the cervical spine in neutral rather than the traditional sniffing position exacerbates the view of the vocal cords. Furthermore, in 22% of patients with a neutral spine, the vocal cords were not visible. Only 1% of the patient's vocal cords were not visible while in the "sniffing position" [14]. Given the anticipated difficulty in intubating a patient with MILI, it has become standard practice to use a video laryngoscope instead of

direct laryngoscopy, which has been shown to vastly improve intubation ease [15]. During intubation, the movement at the cervical spine is comparable to a 3-4 mm widening of the disc space [16]. Because the patient is under general anaesthesia and is not required to be awake or cooperative, direct laryngoscopy or video laryngoscopy is significantly faster than fibreoptic intubation. Direct laryngoscopy or video laryngoscopy is also less technically difficult than fibreoptic intubation, especially in patients with blood in the pharynx as a result of trauma. However, when MILI is combined with cricoid pressure, successful LMA placement becomes significantly more difficult. Moreover, when they tried a fibreoptic intubation with the LMA in place, they noticed vocal cords in considerably fewer patients who were kept in MILI compared to the sniffing position (38 percent vs 83 percent) [17].

There are no recommendations for the best way to manage the airway in patients with cervical spine disease at the moment. There are no outcome studies that show one technique is superior to another [18]. The final decision will be based on the provider's expertise in airway management, the urgency with which the airway must be secured, and the patient's willingness to comply with the intubation. Furthermore, understanding the extent of the cervical injury as well as how the various airway management techniques will affect the cervical spine is critical.

After confirming bag and mask ventilation, we decided to proceed with videolaryngoscopic and bougie guided intubation. As a backup plan, a fibreoptic scope was kept on standby in case of any difficulty in securing airway via direct laryngoscopy, fibreoptic intubation under general anaesthesia was our plan B. All three patients were successfully intubated with a video laryngoscope and bougie in a single attempt. Cervical spine surgery is typically performed in the same anatomical region as the larynx; additionally, most spine surgeries are performed in the prone position, and manipulation around the larynx during surgery can cause airway edema, which can result in postoperative airway compromise.

During an anterior approach for cervical spine surgery, medial retraction of the upper airway structures and oesophagus is frequently used to gain access to the vertebral column [19]. The following are some of the potential drawbacks of this approach include airway edema, sore throat, and hoarseness of voice. recurrent laryngeal nerve palsy, dysphonia, dysphagia, and oesophageal perforation [20]. As demonstrated in these cases, edema can impair patients' respiratory tracks and distort airway anatomy, making it exponentially more difficult to establish a secure airway.

If a patient's respiratory status deteriorates, the initial method of intubation may not be efficient anymore due to difficulty in visualizing anatomical landmarks or inability to pass the endotracheal tube into the trachea. Given all of these risk factors, the anaesthesiologist and surgical team must be extremely cautious for extubation, immediately after cervical spine

surgery. An endotracheal tube cuff leak test should be performed prior to extubation to identify patients with significant airway edema. A cuff test compares expiratory tidal volumes with and without the cuff, with a 15% reduction in tidal volume indicating an appropriate leak when the cuff is deflated [21].

It is absolutely essential that the medical team have a rescue plan for airway management in these cases in case of airway compromise requiring reintubation. This plan should include immediate access to advanced airway devices, staff trained to identify at-risk patients, and a standby surgeon who can secure a surgical airway. In our case, we performed a leak test, which revealed a significant leak, and then extubated our patient over ventilating bougie (airway exchange catheter) so that it could be used as an access to railroad the endotracheal tube during laryngoscopy in the event of a postoperative airway emergency.

CONCLUSION:

High index of suspicion for early detection and prevention of secondary injury through adequate oxygenation, blood pressure support through volume replacement, and immobilization are the most important anaesthetic management principles in the treatment of spine trauma. Anesthesiologists managing patients with acute cervical spinal cord injury should make themselves aware of the relevant pathophysiology and provide specialized care to improve patient outcomes. It's advisable to communicate effectively with surgeons, plan well in advance, and execute their plan at each step of the preoperative evaluation, airway management, induction, maintenance of anesthesia and postoperative intensive care.

ABBREVIATIONS:

ACSCI: Acute cervical spinal cord injury

AEC: Airway exchange catheter

CMAC: Karl storz videolaryngoscope

CT scan: Computed tomography scan

ICU: Intensive care unit

FOB: Fiberoptic bronchoscope

IV: Intravenous

LMA: Laryngeal mask airway

MAP: Mean arterial pressure

MILI: Manual in-line immobilization

MRI: Magnetic resonance imaging

NS: Normal saline

OT: operation theatre

PLC: Posterior ligament complex

POD: Post operative day

SCI: Spinal cord insult

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