

## Direct laryngoscopy and endotracheal intubation in the prone position following traumatic thoracic spine injury

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### Abstract

Perioperative airway management in trauma victims presenting with penetrating thoracic spine injury poses a major challenge to the anesthesiologist. To avoid further neurological impairment it is essential to ensure maximal cervical and thoracic spine stability at the time of airway manipulation (e.g., direct laryngoscopy and endotracheal intubation). Airway management in the prone position additionally increases the incidence of cervical/thoracic spine injury, difficult ventilation, and difficult airway instrumentation. Although awake fiberoptic intubation of the trachea is considered the gold standard for airway instrumentation in patients with posterior thoracic/cervical trauma, this technique requires the patient's cooperation, special equipment, and extensive training, all of which might be difficult to accomplish in emergency situations. We herein present the first reported case of an adult trauma patient who underwent direct laryngoscopy and endotracheal intubation under general anesthesia in the prone position. Although the prone position is not the standard position for airway instrumentation with direct laryngoscopy and endotracheal intubation under general anesthesia, our experience indicates that this technique is possible (and relatively easy to perform) and might be considered in an emergency situation.

**Key words** Anesthesia · General · Trauma · Endotracheal intubation · Prone position

### Introduction

Management of the airway in trauma patients presenting with penetrating thoracic spine injury poses a major challenge to the anesthesiologist, who must ensure maximal cervical and thoracic spine stability (to avoid further neurological impairment) at the time of airway manipulation (e.g., direct laryngoscopy and endotracheal intubation) [1–3]. Moreover, airway management in the prone position (if indicated) further increases the

incidence of difficult ventilation, difficult airway instrumentation, and cervical/thoracic spine injury [4–8]. We herein present the first reported case of an adult trauma patient who underwent direct laryngoscopy and endotracheal intubation under general anesthesia in the prone position.

### Case report

A 43-year-old, 166-cm, 65-kg, previously healthy woman (a hospital employee) was suddenly attacked by a psychiatric ward patient with a pair of scissors. One of the scissor blades was inserted 8 cm deep into the middle region of her upper back/posterior upper thorax. The patient was immediately immobilized on a “spine board” in the prone position (Fig. 1) and transferred to a neighboring trauma center for further care.

Upon arrival at the trauma center, she was conscious, and hemodynamically stable, and was breathing spontaneously. Her neurological examination was unremarkable. Thoracic radiographic studies and a computerized tomography scan (both conducted in the prone position) ruled out pneumothorax and established the exact position of the scissors' blade (between the processus spinosus, in close proximity to the spinal cord at the T7 level, with the blade's tip lodged 2 cm into the corpus of the T7 vertebra; Fig. 2). No traumatic fracture/s of the corpus of the vertebra could be demonstrated, nor was there any indication of thoracic spinal dura mater penetration.

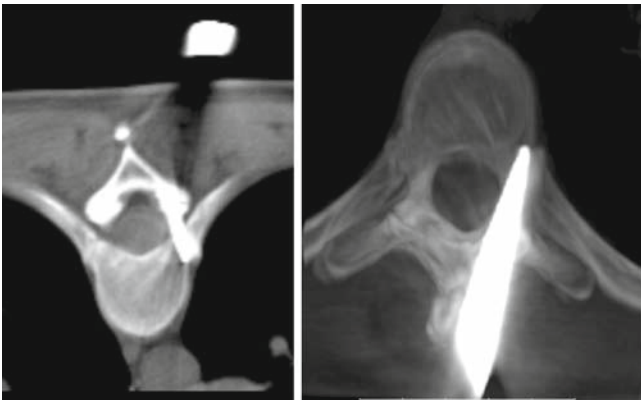
The patient was transferred to the operating theater. As the trauma surgeon did not want to move the patient (to avoid possible neurological compromise) the anesthesia team decided to establish the airway (intubate the patient's trachea) in the prone position. It was determined that the patient had had nothing per os (NPO) for more than 5 h. Her airway examination was normal (Mallampati class one), and she had a good mouth

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**Fig. 1.** Patient in the prone position, with scissor blade lodged in the thoracic spine



**Fig. 2.** Computed tomography scan reveals close proximity of the scissor blade to the spinal cord

opening. Options for airway management in the prone position, including: (1) awake fiberoptic intubation, (2) direct laryngoscopy, and (3) insertion of a laryngeal mask airway (LMA) were extensively discussed with the patient and the surgical team. Additional anesthesia personnel and equipment (portable difficult airway management cart) were promptly secured.

Following preoxygenation with oxygen (fractional inspired oxygen  $F_{I_{O_2}} = 1.0$ /facial mask) for 3 min, the patient was sedated with a continuous intravenous infusion of remifentanyl  $0.2 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$  and propofol  $150 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ . While she remained immobilized in the prone position, her head was slightly moved toward the side of the operating table, and a flexible fiberoptic bronchoscope was gently inserted into her mouth. However, secondary to the patient's lack of cooperation (under these stressful circumstances) it proved impossible to accomplish endotracheal intubation over the fiberoptic bronchoscope. The patient was preoxygenated again (as above) for an additional 3 min, and general anesthesia was induced with a standard intravenous dose of propofol ( $3 \text{ mg}\cdot\text{kg}^{-1}$ ) and suxamethonium (total



**Fig. 3.** Direct laryngoscopy and endotracheal intubation with the patient in the prone position (anesthesiologist is sitting on the floor—laryngoscope in right hand)

dose of 100 mg). With the patient's body manually immobilized by four people and her head immobilized by an additional two people (in-line stabilization), the patient was moved toward the head of the operating table (to gain direct access to the airway). The anesthesiologist performing airway instrumentation (who sat on the floor) was able to promptly visualize the patient's vocal cords with a Macintosh laryngoscope metal blade, size 3 (held in his right hand) and easily intubate the patient's trachea (with an endotracheal tube, size 7.0) positioned in his left hand (Fig. 3). Following confirmation of the proper endotracheal tube position (with standard methods) subsequent lung ventilation was easy with normal peak pressures. No intraoperative problems were encountered, and the scissor blade was carefully removed from her upper posterior thorax by the surgeon. Careful wound exploration (conducted by the surgical team) following removal of the foreign body showed that the neural structures (e.g., dura mater) were intact. At surgery completion, the patient's trachea was easily extubated. Her postoperative course was uneventful (no neurological impairment was reported) and she was discharged from the hospital 3 days later.

## Discussion

The conventional anesthetic management (including instrumentation of the airway) of patients undergoing elective surgery in the prone position usually starts with a standard induction of general anesthesia and endotracheal intubation in the supine position, with the patient subsequently being turned onto the prone position.

However, such management might not be applicable to trauma patients presenting with posterior thoracic or cervical spine injuries [4–8].

If airway manipulation in the prone position is indicated, it can be anticipated that this position might increase the risk of difficult ventilation and cervical/thoracic spine injury [4,5]. The prone position impairs orotracheal intubation by direct laryngoscopy, particularly when the patient's head is positioned on the operating table [4]. Moving the patient's body close to the head of the operating table, and freeing the patient's head and shoulders (as demonstrated in our patient), might facilitate access to the patient's airway (oropharynx). It is reasonable to speculate that, following the induction of general anesthesia in the prone position, the patient's jaw and the tongue will protrude (fall) anteriorly making direct laryngoscopy and endotracheal intubation easier (as demonstrated in our patient).

Although awake fiberoptic intubation of the trachea is probably the "gold standard" [2,4–6] of airway instrumentation in patients with posterior thoracic/cervical trauma (and it was our first-choice technique for this patient), this technique requires the patient's cooperation, special equipment, and extensive training [4,5], all of which might be difficult to accomplish in emergency situations (as proven in our report). The stress of the trauma alone (thoracic spine injury) combined with the patient's negative attitude towards awake management of her airway (and subsequent lack of cooperation) contributed to the failure of the first trial of awake intubation.

Our second airway management option was to perform direct laryngoscopy (under general anesthesia), which proved successful, while the third option included the insertion of a laryngeal mask airway (LMA), which had been demonstrated to be effective in the prone position in other studies [5,9].

Although all the authors of this article have extensive experience in several different airway management strategies, including the use of an LMA, LMA-Fastrach, and LMA-CTrach (Laryngeal Mask, Mahe, Seychelles), in this particular case (given the emergent nature of this situation) it was decided to proceed with our most frequently used technique; namely, direct laryngoscopy. As a matter of interest, we have recently added the video-assisted laryngoscope to our airway management algorithm. However, our experience with this (rather novel) technique is currently limited to those patients requiring airway instrumentation in the standard supine position.

The regular elective training sessions conducted in our "anesthesia skills lab" at both hospitals (Catharina Hospital–Brabant Medical School, Eindhoven, The Netherlands, and the University of California Medical Center, San Diego, California, USA) have proven to be very beneficial in our acquisition of important

airway management skills, which might be greatly needed in a situation such as the one described in our case report. This type of training is offered to our attendings/staff anesthesiologists and anesthesia residents on a regular basis. The endotracheal intubations on a model (mock airway instrumentations) are performed not only in the standard (supine position) but also in the sitting and/or prone positions. This experience has certainly contributed to our successful intubation in the patient we have herein reported. Had an attempt at direct laryngoscopy failed in this patient, we would have used an LMA as our next step (rescue) device to establish the airway. Interestingly, in a recent report, Agrawal et al. [9] successfully established an airway (at the first attempt) in a 25-year old patient with an extensive wound over her back and fractured pelvis, using an intubating LMA.

Although the prone position is not the standard position for airway instrumentation with direct laryngoscopy and endotracheal intubation under general anesthesia, our experience indicates that this technique is possible (and relatively easy to perform) and might/should be considered in emergency situations/circumstances similar to those described in our report.

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## References

- Peterson GN, Domino KB, Caplan RA, Posner KL, Cheney FW. Management of the difficult airway—a closed claims analysis. *Anesthesiology*. 2005;103:33–9.
- Kuczkowski KM, Reisner LS, Benumof JL. Airway problems and new solutions for the obstetric patient. *J Clin Anesth*. 2003;15:552–63.
- American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice guidelines for management of the difficult airway. *Anesthesiology*. 2003;98:1269–77.
- Valero R, Serrano S, Adalia R, Tercero J, Blasi A, Sánchez-Etayo G, Martínez G, Caral L, Ináñez G. Anaesthetic management of a patient in prone position with a drill bit penetrating the spinal canal at C1–C2, using a laryngeal mask. *Anesth Analg*. 2004;98:1447–50.
- Ng A, Raitt DG, Smith G. Induction of anesthesia and insertion of a laryngeal mask airway in the prone position for minor surgery. *Anesth Analg*. 2002;94:1194–8.
- Raphael J, Rosenthal-Ganon T, Gozal Y. Emergency airway management with a laryngeal mask airway in a patient placed in the prone position. *J Clin Anesth*. 2004;16:560–1.
- Neal MR, Groves J, Gell IR. Awake fiberoptic intubation in the semi-prone position following facial trauma. *Anaesthesia*. 1996;51:1053–4.
- Lipp M, Mihaljevic V, Jacob H, Mildenerger P, Rudig L, Dick W. Fiberoptic intubation in the prone position. *Anaesthesia in a thoraco-abdominal knife stab wound*. *Anaesthesist*. 1993;42:305–8.
- Agrawal S, Sharma JP, Jindal P, Sharma UC, Raja M. Airway management in prone position with an intubating laryngeal mask airway. *J Clin Anesth*. 2007;19:293–5.