Cardiothoracic Anesthesia, Respiration and Airway

Awake tracheal intubation through the intubating laryngeal mask airway in a patient with halo traction

[L'intubation endotrachéale vigile au travers du masque laryngé d'intubation chez un patient avec un halo en traction]

Elif Bengi Sener MD, Binnur Sarihasan MD, Emre Ustun MD, Serhat Kocamanoglu MD, Ebru Kelsaka MD, Ayla Tur MD

Purpose: To report a case of awake tracheal intubation through the intubating laryngeal mask airway (ILMA) in a patient with halo traction.

Clinical features: A 16-yr-old, 40 kg, boy with atlanto-occipital instability and halo traction was scheduled for surgery under general anesthesia. The head of the patient was fixed in a position of flexion and extension was impossible. Cranial magnetic resonance imaging revealed that pharyngeal and laryngeal axes were aligned, but that the oral axis was in an extreme divergent plane. The tongue and oropharynx were anesthetized with 10% lidocaine spray and bilateral superior laryngeal nerve blockade was performed. Under sedation, awake orotracheal intubation via ILMA was successful. Fiberoptic bronchoscopy has been recommended for awake tracheal intubation in such patients. Other techniques, such as use of the Bullard laryngoscope have been described also but awake tracheal intubation through the ILMA in patients with a halo device in situ has seldom been reported in the medical literature.

Conclusion: Airway management of patients with cervical spine instability includes adequate preoperative evaluation of the airway and choosing the appropriate intubation technique. We suggest that the ILMA may be an adequate alternative for awake tracheal intubation in patients with an unstable cervical spine and cervical immobilization with a halo device.

Objectif: Rapporter un cas d'intubation endotrachéale vigile au travers du masque laryngé d'intubation (MLI) chez un patient avec un halo en traction.

Éléments cliniques: Un garçon de 16 ans, pesant 40 kg, présentait une instabilité atlanto-occipitale et portait un halo en traction. Il devait subir une intervention chirurgicale sous anesthésie générale. Sa

tête a été immobilisée en position de flexion. L'extension était impossible. L'examen du crâne par résonance magnétique a montré l'alignement des axes du pharynx et du larynx, mais un plan très divergent pour l'axe buccal. La langue et l'oropharynx ont été anesthésiés avec une pulvérisation de lidocaïne à 10 % et un blocage du nerf laryngé supérieur bilatéral a été réalisé. L'intubation orotrachéale vigile au travers du MLI a été réussie sous sédation. La fibroscopie bronchique est recommandée pour l'intubation trachéale vigile chez ce type de patients. D'autres techniques, comme l'usage du laryngoscope de Bullard sont aussi décrites, mais l'intubation trachéale vigile au travers du MLI chez des patients à qui on a installé un halo en traction in situ a rarement été mentionnée.

Conclusion: La prise en charge des voies aériennes de patients souffrant d'instabilité de la colonne cervicale comprend l'évaluation préopératoire complète des voies aériennes et le choix d'une technique d'intubation appropriée. Le MLI semble un choix valable pour l'intubation trachéale vigile dans les cas d'instabilité de la colonne cervicale et d'immobilisation cervicale avec un appareil en halo.

NORMALLY, the anatomy of the cervical spine permits a high degree of mobility without endangering the structures within the neck, but cervical spine anomalies reduce mobility of the neck and produce difficulties in managing the airway for the anesthesiologist.

Cervical spine subluxation and rigidity are the most difficult anomalies to manage.¹ Cervical spinal subluxation often involves the atlanto-occipital joint. The atlanto-occipital joint cannot be extended optimally in these patients. Without adequate cervical spine mobil-

From the Department of Anesthesiology and Reanimation, Ondokuz Mayıs University, Faculty of Medicine, Samsun, Turkey.

Address correspondence to: Dr. Elif Bengi Sener, Ondokuz Mayıs University, Faculty of Medicine, Department of Anesthesiology, Kurupelit - 55139, Samsun, Turkey. Phone: 00-90-362-4576000, ext. 3350; Fax: 00-90-362-4576041; E-mail: bengimd@hotmail.com

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ity and, particularly, when other airway anomalies are present, direct laryngoscopy can be exceedingly difficult. The halo traction is often used for cervical spine stabilization. The anesthetic airway management of patients with halo traction is impacted by the fixation position and tracheal intubation can be very difficult.

Adequate preparation involves assuring that airway management tools are available and functional. Useful instruments include the laryngeal mask airway (LMA), flexible nasopharyngeal airways, oral airways, fibreoptic endoscopes, a high-pressure compressed oxygen source for transtracheal insufflation, Magill forceps, retrograde intubation set, and emergency cricothyrotomy set.²

Clinical features

A 16-yr-old, 40 kg boy was admitted to the neurosurgery department with dysphonia, weakness, and impaired walking. When he hyperextended his neck, neck pain and transient unconsciousness occurred. He wasn't able to hold his head up straight and move his neck. On physical and neurological examination, neck movement was limited, the patient was conscious and quadriparetic. Right hemihypoesthesia, Babinsky and Hoffman's pathological reflexes and clonus were present. Cranial magnetic resonance imaging (MRI) showed atlanto-occipital instability. On vertebral angiography; the vertebral arteries were thin at the C₁₋₂ level bilaterally. These findings and further investigations suggested a diagnosis of atlanto-occipital and atlanto-axial instability, and basilar invagination. Under local anesthesia, the patient's unstable cervical spine was immobilized temporarily by a halo fixator device prior to main surgical reconstruction. Posterior decompression and fusion were scheduled for the treatment of atlanto-occipital instability. The patient was evaluated for intraoperative airway management. The head of the patient was fixed in a flexed position and extension was impossible. Mandibular space was normal, thyromental distance was 7 cm, and the airway was evaluated as a Mallampati class II. Cranial MRI revealed that pharyngeal and laryngeal axes were aligned, but that the oral axis was in an extreme divergent plane. Therefore, direct laryngoscopy was considered impossible (Figure 1).

We suggested that intubation could be carried out awake under local anesthesia using the intubating laryngeal mask airway (ILMA- Fastrach™). If intubation failed and airway obstruction occurred at any step, cricothyrotomy or emergency tracheostomy were immediately available. The patient was premedicated with famotidine 40 mg and diazepam 5 mg orally and atropine 0.5 mg *im*.

FIGURE 1 Alignment of the laryngeal (L), pharyngeal (P) and oral (O) axes by cranial magnetic resonance imaging.

In the operating room, standard monitors were installed (electrocardiogram, pulse oximeter, capnograph). The tongue and oropharynx were anesthetized with 10% lidocaine spray and bilateral superior laryngeal nerve blockade was performed. Midazolam 0.05 mg·kg⁻¹ *iv* was administered for sedation. The ILMA was inserted awake, under sedation. A clear airway was established immediately, and the patient was ventilated easily. A well-lubricated 7.0-mm internal diameter tracheal tube was inserted into the size 4 ILMA (Figure 2) and advanced without obstruction to a depth of 21 cm. The patient was very cooperative, yet kept his eyes closed tightly throughout the procedure. His eyes were taped temporarily with his consent while the photograph was taken, in order to protect his anonymity.

Spontaneous breathing through the tracheal tube, auscultation and capnography confirmed correct endotracheal placement of the tube. The cuff of the ILMA was deflated, and withdrawn over the tube. Oxygen saturation (SpO₂) remained above 97% throughout the procedure. Anesthesia was induced, the invasive monitors were applied and the patient was moved to the sitting position.

At the end of surgery, the patient was extubated while awake. The recovery and postoperative periods were uneventful.

FIGURE 2 Tracheal intubation via the intubating laryngeal mask airway. The halo is in place and the ILMA has been inserted under local anesthesia. The photograph was taken prior to insertion of the endotracheal tube. The patient is awake/sedated but tapes were placed on his eyes during the photograph to preserve anonymity.

Discussion

We used the ILMA to facilitate awake orotracheal intubation in a patient with a halo device. After topical anesthesia and nerve blockade, the ILMA was inserted easily because pharyngeal and laryngeal axes were in alignment. Subsequently, the tracheal tube was passed into the trachea without complications. Awake extubation is recommended in patients with unstable cervical spine and a difficult airway.^{3,4} In our case, the patient was fully awake, breathing spontaneously and the trachea could be extubated safely.

A wide spectrum of congenital, developmental and acquired abnormalities arise at the craniocervical border. This is because of the complex developmental anatomy, the transition between the spinal cord and the brain, and the junction between the highly mobile upper cervical spine and the skull.⁵ This results in compression and distortion of neural structures, the vertebral basilar vascular system and cerebrospinal fluid pathways. Intermittent attacks of altered consciousness, confusion and transient loss of visual fields, as well as vertigo, occurs in 25% of children with abnormalities of the craniocervical junction. This is provoked by rotation or extension of the head, or manipulation of the

head and neck. The excessive mobility of the unstable atlanto-occipital joint may cause repeated trauma to the anterior spinal artery as well as the perforating branches of the upper cervical cord.⁵

If cervical spine pathology suggests a difficult airway, awake tracheal intubation should be considered as a first choice, as this allows maintenance of spontaneous ventilation. In the anesthetized and paralyzed patient, loss of muscle tone tends to distort anatomic orientation. The larynx tends to move to a more cephalic position with induction of anesthesia and muscle paralysis, which may make endotracheal intubation more difficult.⁶ Topical anesthesia (glossopharyngeal nerve), blockade of the superior laryngeal nerve and *iv* sedation (e.g., midazolam, fentanyl), anticholinergic premedication can help facilitate awake intubation.⁷ Furthermore, in patients with unstable cervical spine, cervical spine hyperextension during tracheal intubation may increase the risk of atlantoaxial subluxation and neurologic injury from spinal cord compression. Therefore, in this population, to perform awake intubation is very important also because of the opportunity of neurological assessment at the postintubation period.

Airway management of patients in halo traction may be difficult. These difficulties are compounded by additional challenges and the fixation position of the halo device. In the case of a halo cast, sufficient provision must be made for mouth opening. If orotracheal intubation proves difficult due to the device, nasal or fiberoptic intubation or emergent cricothyroidotomy should be available.⁸

Fiberoptic bronchoscopy has been recommended for elective tracheal intubation in these patients⁹ but, flexible fiberoptic intubation bronchoscopes are expensive and fragile instruments. Although experienced anesthesiologists make the procedure seem simple, fiberoptic intubation requires skill. This technique requires more time than direct laryngoscopy, even when performed by an expert. Thus, alternative management techniques should be available.

Cohn *et al.*¹⁰ suggested using the Bullard laryngoscope in emergent airway management in a patient with halo traction as it allowed tracheal intubation with direct visual confirmation in difficult circumstances. Unfortunately, this device is expensive also and may not be available in all centres.

The role of the LMA has become more important in the management of the difficult airway.¹¹ The LMA is now a recognized part of the ASA difficult airway algorithm. The clinical record of the LMA in a "cannot ventilate-cannot intubate" situation to prevent hypoxia is excellent. Placement of the ILMA and sub-

sequent intubation are blind techniques, thus ancillary equipment is not required and placement unaffected by heavy secretions or blood which might impair fiberoptic techniques. Moreover, ILMA allows for continuous ventilation and oxygenation during tracheal intubation attempts.

Cros *et al.*¹² confirmed that tracheal intubation through the ILMA can be used in patients with a difficult airway. The ILMA has been recommended in patients with cervical spine disease as an alternative method for tracheal intubation.¹³ Fukutome *et al.*¹⁴ found that tracheal intubation through the ILMA was successful in 93% of patients with difficult airways. Also the ILMA may facilitate blind tracheal intubation when fiberoptic intubation is unsuccessful.¹⁵ Therefore, the ILMA may be a valuable alternative to awake fiberoptic intubation.^{16,17} Wong *et al.*¹⁸ also suggested using the ILMA to facilitate awake tracheal intubation in patients with cervical spine disorders.

In conclusion, airway management of patients with unstable cervical spine includes adequate preoperative evaluation of the airway and choosing the appropriate intubation technique. Awake tracheal intubation and maintenance of spontaneous ventilation provide safeguards against loss of airway in patients who may be difficult to intubate by direct laryngoscopy. Based on our experience in this case we suggest that the ILMA can be an adequate alternative to fiberoptic bronchoscopy for awake tracheal intubation in patients with unstable cervical spine and a halo device *in situ*.

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