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CASE REPORT AIRWAY MANAGEMENT

Awake fiberoptic intubation in a pediatric patient with cervical spine injuries on a halo-vest: a case report

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Abstract

Awake fiberoptic intubation (AFOI) in pediatric patients remains a continuous challenge for the anesthetists, and is considered more cumbersome a procedure as compared to the adult population. The coexistence of unstable cervical spine injuries, although rare, but complicates the procedure even more. Proper pre-planning, adequate sedation and analgesia and the patient's conscious cooperation are needed to ensure success. We describe a step-by-step approach to a successful AFOI in a 12-year-old child who had atlantooccipital instability and had a halo-vest on. Titrated dose of sedation and analgesia, obtunding airway reflex and patient's cooperation is a key to successful AFOI in this patient.

Abbreviations: AFIO: Awake fiberoptic intubation; OMF: Oromaxillofacial; BMI: body mass index; TCI: Target-controlled infusion

Key words: Airway Management; Airway Obstruction / complications; Anesthesia / methods; Child; Dexmedetomidine, Intravenous infusion; Fiber Optic Technology; Intubation, Intratracheal / methods; Laryngoscopes; Pediatric

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1. Introduction

There are different methods of intubation for patients with unstable cervical spine injuries. The two most acceptable methods are manual in-line stabilization, video laryngoscopy and awake fiberoptic intubation (AFOI).[1] Manipulation must be minimal, and overextension of the cervical spine must be avoided when performing intubation. It is crucial to avoid further injury to the spinal cord while securing the airway in traumatic spine injuries.

Awake intubation in pediatric patients is difficult. This technique is reserved only for children who can understand and cooperate during the procedure. Most of the time, the anesthetist needs to administer sedation and analgesia to ensure cooperation. Moreover, if the patient concurrently has a cervical spine injury, extra precautions must be taken to ensure immobility of the cervical spine and to prevent worsening of the underlying injury. From the viewpoint of the anesthetist, an *in situ* halo-vest will lead to even more limited view and more difficult accessibilty to the airway. We report a case of a child with atlanto-occipital instability on a halo-vest requiring elective intubation for an oromaxillofacial (OMF) injury.

2. Case Report

A 12-year-old girl, with a weight of 45 kg and a height of 140 cm, body mass index (BMI) 23 kg/m^2, presented following a fall from a height of approximately one meter, while playing hide-and-seek. She had complaints of vomiting, neck pain and bleeding from the mouth. Upon examination, the patient was alert and conscious, with stable vital signs. An extraoral examination revealed diffuse swelling of the left mandible, abrasion of the right zygoma and left cheek, and limited mouth opening. The patient had restricted oral occlusion and sublingual hematoma. Her cranial nerve examination and higher mental function were intact. Motor examination showed normal power, reflexes and proprioception but reduced sensation of both upper and lower limbs from the dermatome C5 downward. Her head and neck computed tomography (CT) scan revealed right temporal subdural hemorrhage, base of left occipital condyle fracture and C7 spinous process fracture. Magnetic resonance imaging (MRI) of the neck revealed atlanto-occipital ligament instability, posterior craniocervical ligament injury and surrounding clival and prevertebral cervical hematoma. There was no base of skull fracture. She also sustained fractures of right parasymphysis and left angle of mandible. The patient was admitted for close observation, and her neck was stabilized with a hard cervical collar.

A multidisciplinary discussion, between a neurosurgeon, an OMF surgeon, a radiologist and an anesthetist, was conducted on day 3 of the hospital admission. The halo-vest was applied on day 4 of admission. An open reduction and internal fixation of the right parasymphysis and left mandible via an intraoral lower vestibular and transbuccal trocar approach was planned on day 5. The patient and her guardian were seen by the anesthesia team one day prior to the surgery for counseling and a detailed explanation of AFOI. The written informed consent for surgery and anesthesia including AFOI was obtained from the patient's mother. The neurosurgeon was also informed to be standby on the operation day for anticipation of airway emergency which necessitate removal of the halo-vest.

On the day of the operation, the patient was brought to the operation theatre accompanied by her mother. She was calm with her mother by her side. She was put in a sitting position at 60°, and the anesthetist approached for the awake fiberoptic from her front (Figure 1). A blanket was applied on the posterior and lateral parts of the halo-vest to make her comfortable and to avoid excessive movement (Figures 2 and 3). A video laryngoscope, laryngeal mask airways and difficult airway trolley was made available for the AFOI. She was given inj. glycopyrrolate 200 µg IV and 3 ml of nebulized lignocaine 1%. Left nasal packing with 4% topical cocaine was applied, and her airway was further anesthetized with lignocaine spray at the posterior pharynx and bilateral peritonsillar pillars. An IV dexmedetomidine (DEX) loading dose of 1 µg/kg for over 10 min and 0.5 µg/kg/h was started. Target-controlled infusion (TCI) remifentanil (Minto model; Perfusor® Space, B. Braun, USA) was started in an up-titrating manner, with a maximum infusion of 1 ng/ml. TCI propofol (Pedfusor model; Alaris® PK, Germany) was subsequently started and titrated up to 1 µg/ml to ensure adequate sedation, the patient's cooperation and a smooth intubation process. The vocal cords and trachea were anesthetized using the 'spray as you go' technique using 1% lignocaine, 1 ml per spray. The serial non-invasive systolic blood pressure was maintained between

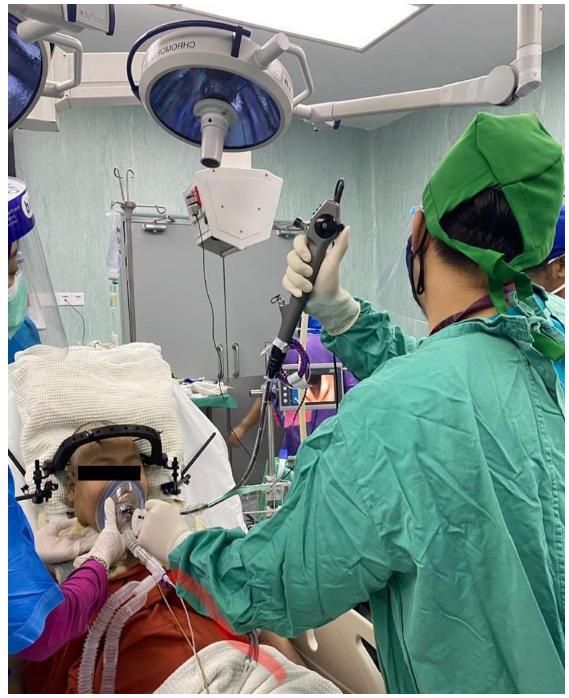

Figure 1: Position of the patient and the anesthetist. The patient in 60° semi sitting position with the anesthetist facing the patient, the video laryngoscope screen and vital signs monitor. The anesthesia assistant held the 'endoscopy mask' for oxygenation, while assessing the patient's breathing and sedation level.

Figure 2: Anterior view of the patient with halo-vest. The blanket was put to support and give patient comfort during the AFOI. Nebulization with lignocaine was given before the procedure.

Figure 3: Lateral view of the patient with halo-vest. The blanket was put to occupy hollow space to improve patient comfort during the procedure.

85 to 110 mmHg and diastolic blood pressure of around 50 to 68mmHg during awake AFOI. The heart rate was 68 to 88 bpm. Spontaneous breathing was ensured by regular chest expansion, presence of water vapor on endoscopy mask and capnography tracing. The jaw thrust maneuver was performed by an assistant to improve visualization of the laryngeal inlet during AFOI. There was no episode of desaturation, hypotension or bradycardia. The patient was maintained in moderate sedation, calm and arousable to call throughout intubation process. The nasal intubation was performed by the neuroanesthetist and total procedure time from insertion of the fiberoptic bronchoscope trough the mouth piece until intubation with size 6.5 mm ETT was 6 min. After intubation, the patient was put under anesthesia by increasing TCI propofol to 4 µg/ml and TCI remifentanil to 4 ng/ml. She was paralyzed with rocuronium 30 mg, midazolam 1 mg for retrograde amnesia and dexamethasone 4 mg. The surgery was performed under total intravenous anesthesia using TCI for 4 h. She was reversed with sugammadex 200 mg IV, and a 'leak test' was performed before extubation.

Postoperatively, she was given multimodal analgesia with morphine infusion @ 0.2 mg/h for 24 h and supplemented with syrup paracetamol 500 mg qid and syrup ibuprofen 340 mg tds for postoperative analgesia. Her postoperative neurological assessment revealed intact motor function and no worsening of sensory deficit. She was observed in the neurocritical care unit before being transferred to the general ward on day 1 postoperatively. She was discharged from the ward one month after the hospital admission with a halo-vest. The halo-vest was changed to hard cervical collar after the third month post-injury and was subsequently removed after four months, following complete recovery with no CT evidence of atlantooccipital dissociation. Reassessment showed intact neurology, especially the sensations in the upper and lower limbs.

3. Discussion

AFOI in children remains a big challenge for the anesthetists. To perform smooth and successful intubation, a combination of adequate analgesia and sedation, a cooperative patient and an adequately experienced anesthetist are essential. In a child with cervical spine injury, extra precautions must be given to avoid cervical movement and manipulation during intubation. The presence of a halo-vest as an external cervical spine fixater to avoid excessive cervical movement can cause overflexion in the occipito-cervical angle, reduce the oropharyngeal area and predispose the patient to upper airway obstruction.[2] As a rescue plan, a neurosurgical colleague needs to be standby in case of a failed AFOI requiring the removal of the halo-vest.

It is possible to ensure the good cooperation of a child without proper sedation and analgesia during AFOI. However, Totoz and Tolga et al. reported that a patient with restricted mouth opening and fixed flexion deformity needs to be intubated in a fully awake condition and that a preoperative demonstration and explanation are important in a successful procedure.[3] Sharma et al. used asleep fiberoptic intubation with an incremental dose of sevoflurane with maintenance of spontaneous breathing in a child with limited mouth opening for temporomandibular joint ankylosis.[4] In a child with giant hemangioma of the tongue, Mazlan et al. used a combination of a loading dose and infusion of dexmedetomidine and a titrating dose of midazolam and fentanyl to allow smooth and successful intubation.[5] In our patient, we had to ensure her cooperation and avoid cervical manipulation during intubation. A loading dose and infusion of dexmedetomidine provided conscious sedation while preserving spontaneous breathing, and the co-infusion of TCI remifentanil provided analgesic and synergistic sedation effects for the procedure.[6] Remifentanil has a short context-sensitive half-time. The titration of remifentanil TCI allows for a smooth procedure while preserving spontaneous respiration. However, as a precaution, we limited the use of remifentanil to less than 1 ng/ml to avoid the incidence of apnea. Moerman et al.[7] reported an incidence of apnea in patients given a combination of TCI with remifentanil 1 ng/ml and propofol 4 mg/ml. Pediatric patients require increased dosage of the drugs because of their larger body surface area, which leads to an increased volume of distribution. Familiarity and understanding of the drug pharmacokinetics is the key to a smooth and successful procedure.

Most importantly, continuous capnograph tracing and SpO_2 monitoring is required to detect any episode of apnea and desaturation, and a systematic rescue plan is essential for any incidence of an emergency airway situation. Proper preoperative preparation, decision on preferred anesthetic technique and adherence to pediatric difficult ventilation and intubation guidelines are crucial. Robert et al. highlighted the importance of maintaining oxygenation and ventilation and avoiding multiple and prolonged attempts when dealing with pediatric airways.[8]

To reduce anxiety and improve the patient's cooperation, preoperative visit by the anesthetist and a thorough explanation to the patient and his or her guardian/parent is necessary. The anesthetist needs to develop rapport with the patient and plan the most suitable approach for the patient's airway and intubation. The patient's guardian can also be invited to be with the patient in the operating room and allowed to leave once the patient is calm and sedated. By doing this, the patient will be less anxious and more cooperative with the AFOI. All functioning airway adjuncts and a difficult airway trolley should be available before the procedure. An experienced anesthetist nurse and a second anesthetist must be available to help manage the patient's breathing and oxygenation while adjusting the infusion of dexmedetomidine and remifentanil.

We used the front approach when performing AFOI in this patient. The patient was positioned in a 60° sitting position and her comfort ensured before the procedure. Sexana et al. described the importance of AFOI in a sitting position in a patient who cannot tolerate the supine position in an airway or respiratory compromise.[9] With a halo-vest in situ, awake fiberoptic in the supine position was the least tolerable to the patient. The airway was sprayed with local anesthetic to improve patient tolerance for the procedure and to avoid gagging during intubation. A jaw thrust maneuver was performed to improve the visualization of the laryngeal inlet, as the patient was slightly over-flexed due to the halo-vest. Although a nasal approach is more tolerable in a pediatric patient, a randomized comparative study by Chahar et al. found fewer alterations in hemodynamic profiles and a faster intubation time in oral intubation.[3,10] In a patient with base of the skull or panfacial fracture, although nasal intubation was not totally contraindicated and reducing surgical airway, the procedure might predispose a risk toward intracranial intubation without fiberoptic guide.[11,12] As our patient required nasal intubation, a combination of lignocaine nebulization, nasal packing with cocaine, topical lignocaine in the nasopharyngeal tube, lignocaine spray on the tonsillar pillar and posterior pharynx and the 'spray as you go' technique during fiberoptic intubation ensured adequate analgesia to the upper airway.

4. Conclusion

In conclusion, a combination of effective sedation and analgesia while preserving airway and breathing, patient counselling and cooperation, presence of an experienced anesthetist and a stepwise systematic approach to the airway are crucial for a successful awake fiber-optic intubation in children.

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7. Conflict of interest

The author declares no conflicts of interest.

8. Permissions

Permissions for reproducing pre-published information/material is not applicable for this work

9. Authors contribution

MHH was the sole author of this manuscript.

10. References

1. Stein DM, Knight WA 4th. Emergency neurological life support: traumatic spine injury. Neurocrit Care. 2017;27(1):170-180. [PubMed] DOI: 10.1007/s12028-017-0462-z
2. White AN, Wong DT, Goldstein CL, Wong J. Cervical spine overflexion in a halo orthosis contributes to complete upper airway obstruction during awake bronchoscopic intubation: a case report. Can J Anaesth. 2015;62(3):289-93. [PubMed] DOI: 10.1007/s12630-014-0282-y
3. Totoz T, Erkalp K, Taskin S, Dalkilinc U, Selcan A. Use of awake flexible fiberoptic bronchoscopic nasal intubation in secure airway management for reconstructive surgery in a pediatric patient with burn contracture of the neck. Case Rep Anesthesiol. 2018;2018:8981561. [PubMed] DOI: 10.1155/2018/8981561
4. Sharma A, Dwivedi D, Sharma RM. Temporomandibular joint ankylosis: "a pediatric difficult airway management". Anesth Essays Res. 2018;12(1):282-284. [PubMed] DOI: 10.4103/aer.AER_122_17
5. Mazlan MZ, Hassan SK, Mukmin LA, Hassan MH, Abiddin HZ, Mohamad I, et al. Novel usage of dexmedetomidine in a paediatric patient with giant tongue haemangioma. Mal J Med Health Sci. 2016;12(2):46-48. [Free Full Text]
6. Weerink MAS, Barends CRM, Muskiet ERR, Reyntjens KMEM, Knotnerus FH, Oostra M, et. al. Pharmacodynamic interaction of remifentanil and dexmedetomidine on depth of sedation and

tolerance of laryngoscopy. Anesthesiology. 2019;131(5):1004-1017. [PubMed] DOI: 10.1097/ALN.0000000000002882

7. Moerman AT, Herregods LL, De Vos MM, Mortier EP, Struys MM. Manual versus target-controlled infusion remifentanil administration in spontaneously breathing patients. Anesth Analg. 2009;108(3):828-34. [PubMed] DOI: 10.1213/ane.0b013e318198f6dc
8. Walker RW, Ellwood J. The management of difficult intubation in children. Paediatr Anaesth. 2009;19(1):77-87. [PubMed] DOI: 10.1111/j.1460-9592.2009.03014.x
9. Saxena KN, Kumar S, Taneja B, Gaba P. Awake fibreoptic intubation in the sitting position in a patient with a huge goitre. Case Rep Anesthesiol. 2011;2011:352672. [PubMed] DOI: 10.1155/2011/352672
10. Chahar JS, Das PK, Dubey RK, Malviya D, Harjai M, Rastogi S. Comparison of orotracheal versus nasotracheal fiberoptic intubation using hemodynamic parameters in patients with anticipated difficult airway. Anesth Essays Res. 2020;14(1):81-86. [PubMed] DOI: 10.4103/aer.AER_6_20
11. Paul M, Dueck M, Kampe S, Petzke F, Ladra A. Intracranial placement of a nasotracheal tube after transnasal trans-sphenoidal surgery. Br J Anaesth. 2003 Oct;91(4):601-4. [PubMed] DOI: 10.1093/bja/aeg203
12. Mittal G, Mittal RK, Katyal S, Uppal S, Mittal V. Airway management in maxillofacial trauma: do we really need tracheostomy/submental intubation. J Clin Diagn Res. 2014 Mar;8(3):77-9. [PubMed] DOI: 10.7860/JCDR/2014/7861.4112

