

Case report

Management of the difficult pediatric airway with Shikani Optical Stylet™

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Summary

The airways of children with many craniofacial and mandibulofacial malformations often present unique challenges to the anesthesiologists. We report the application of Shikani Optical Stylet™ (SOS) in facilitating the tracheal intubation of four children with history of difficult airway management. The SOS combines the benefits of the lightwand and fiberoptic bronchoscope.

Keywords: intubation, difficult; Shikani Optical Stylet; fiberoptic bronchoscope; lightwand; syndrome: Treacher-Collins, Goldenhar, Pierre-Robin

Introduction

The Shikani Optical Stylet™ (SOS; Clarus Medical, Minneapolis MN, USA) is another tool to facilitate tracheal intubation. It combines the benefits of a lightwand and a fiberoptic bronchoscope (FOB). It consists of a malleable stainless steel fiberoptic stylet in a preformed 'J', a removable 'no focus' eyepiece, and either a portable battery-operated light source handle or a traditional AC-powered light source connected via a fiberoptic light cable. The SOS is lightweight, portable, sturdy, can be used by a single operator, and is considerably less expensive than a FOB. The pediatric version is 27 cm long and can accommodate a 2.5 mm inner diameter (I.D.) tracheal tube (TT) or larger (Figure 1).

Tracheal intubation facilitated by the SOS has never been reported in the following disease states (Table 1).

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Case one

A 19-month-old female with Pierre Robin Sequence presented for cleft palate repair. At 11 months of age, she underwent a difficult and traumatic tracheal intubation for palatoplasty and frenulectomy.

For the current procedure, general anesthesia was induced with sevoflurane in oxygen followed by i.v. placement and rocuronium administration. Two direct laryngoscopy attempts failed to visualize the vocal cords. The pediatric SOS with a 4.5 mm I.D. TT was introduced into the mouth while an assistant applied gentle jaw thrust. Using the endoscopy camera/video monitor option, the upper airway structures and the vocal cords were easily visualized. The tip of the scope was passed beyond the vocal cords and the TT was then advanced. Following removal of the scope, endtidal CO₂ (P_ECO₂) and bilateral breath sounds corroborated the tracheal intubation. The TT was secured and surgery was performed as planned. This atraumatic intubation was executed in less than 35 s. At the end of surgery, the patient's trachea was successfully extubated without postoperative airway complications.



Figure 1
The pediatric Shikani Optical Stylet™ accommodates a 2.5 mm inner diameter tracheal tube.

Case two

A 2-month-old infant with Treacher Collins syndrome and situs inversus presented for placement of a Blalock–Taussig shunt. At birth, the patient experienced respiratory distress and underwent a difficult and traumatic tracheal intubation by direct laryngoscopy. At 1 month of age, she underwent a second traumatic intubation for Nissen's fundoplication.

On the day of the current surgery, general anesthesia was induced with sevoflurane in oxygen. Following confirmation of positive pressure ventilation (PPV) and i.v. placement, rocuronium ($0.6 \text{ mg}\cdot\text{kg}^{-1}$) was administered. The SOS with a threaded 3.5 mm I.D. TT was introduced into the mouth while an assistant applied jaw thrust, but the uvula could not be visualized. The tongue was then grasped between the fingers with a gauze sponge, pulled anteriorly (tongue thrust), and the scope reintroduced. At this point, upper airway structures were easily visualized and the trachea was intubated within 45 s.

Case three

An 8-year-old male with a history of Goldenhar (oculoauricularvertebral dysplasia) syndrome presented for mandibular distraction. Except for the last surgery 2 years ago, his previous surgical history was significant for difficult laryngoscopy and tracheal intubations.

Table 1
Summary of cases

Patient	Age	Planned procedure/s	Patient history	Airway assessment	Direct laryngoscopy	Number of attempts
1	19 months	Cleft palate repair	Pierre Robin sequence	Difficult previous intubation, micrognathia, cleft palate	Grade III	1
2	2 months	Blalock–Taussig shunt	Treacher Collins syndrome	Difficult previous intubation, mandibular hypoplasia, high palate	Not attempted	2
3	8 years	Mandibular distraction	Goldenhar syndrome	Difficult previous intubation, micrognathia, vertebral fusion, failed fiberoptic intubation	Grade III	1
4	7 years	Posterior spinal fusion	Merosin deficiency	Difficult previous intubation, head fixed to the right	Not attempted	1

On the day of this surgery and following i.v. placement per patient's request, general anesthesia was induced with propofol. Rocuronium was administered once assisted ventilation (PPV) was verified. Oxymetazoline drops were introduced into both nostrils as nasotracheal intubation was planned to avoid the surgical field. The introduction of a lubricated 5.5 mm I.D. cuffed TT caused nasal bleeding, and mask ventilation became increasingly difficult. However, placement of a 2.5 laryngeal mask airway LMA™ provided an excellent conduit for PPV. Orotracheal intubation was attempted by direct laryngoscopy without success, so flexible fiberoptic oral intubation was sought, but blood obscured the view. The SOS was obtained and the trachea was intubated at the first attempt with an assistant applying tongue thrust. Maneuvering the SOS around the epiglottis was easier than maneuvering the FOB. The TT was sutured in place, and the surgery was allowed to proceed.

Case four

A 7-year-old male with merosin deficiency, rigid spine syndrome, and severe scoliosis presented for posterior spinal fusion. His past medical history was significant for sleep apnea (requiring BIPAP) and hydrocephalus (treated with VP shunt). On physical examination, his head was 'fixed to the right' and his left upper incisor was missing from a previous traumatic tracheal intubation (Figure 2).



Figure 2
Patient with severe scoliosis in neutral position. Note how the head is fixed to the right in a 90 degree angle.

On the day of this surgery, dexmedetomidine infusion was administered to facilitate sedated tracheal intubation (a bolus of $0.5 \mu\text{g}\cdot\text{kg}^{-1}$ over 10 min followed by infusion of $0.75 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ to a total of $1.1 \mu\text{g}\cdot\text{kg}^{-1}$). Sedated tracheal intubation was performed at the first attempt using the SOS. Anesthesia was maintained with total intravenous medications (TIVA) as merosin deficiency patients are malignant hyperthermia susceptible. At the end of surgery, the patient was transported to the pediatric intensive care unit where he was extubated 2 days later without difficulty.

Discussion

Shikani, who developed the SOS in the late 1990s, reported using it in pediatric and adults in 1999 (1). However, only one case series describes its use in pediatric difficult airways (2). The authors describe a short learning curve and postulate that prior experience with a lightwand or FOB positively transfers to the SOS. From our experience, we agree and additionally note that operating the SOS requires minimal preparation which makes it valuable in the unanticipated difficult intubation such as case 3. The pediatric FOB is thinner and more flexible than the adult version which may make it difficult to maneuver. Similarly, the SOS has the benefits of fiberoptic visualization to direct the course of a TT. However, its semi-rigid structure allows better maneuverability around a large floppy epiglottis which, especially in the supine patient, may constitute an obstacle. Furthermore, with its strong source of illumination, the SOS can be used as a lightwand in the trachea if blood or secretions obscure the fiberoptic view.

Teaching anesthesia residents the art of difficult airway management is sometimes limited because difficult airway situations occur infrequently and more experienced staff tend to handle these cases themselves. The SOS can be attached to a video monitor, which allows anesthesia residents a 'hands-on' experience under the direction of the experienced staff. Some limitations of the SOS include: a limited clear depth of field of approximately 1 cm, inability to use in nasotracheal intubations, and similar to all fiberoptic devices, poor visibility when secretions cover the lens. In addition, it is not possible to pass the curved semi-rigid stylet any significant distance beyond the vocal cords.

Finally, we applied tongue thrust to visualize the hypopharynx in the second and third cases. This technique was reported to be helpful in a patient with Treacher Collins syndrome (3), and we find it an easy and useful maneuver to retract the epiglottis and enhance the fiberoptic view.

The SOS is easy to learn and requires minimal training and practice. From our experience, we find it less traumatic and less time-consuming when compared with multiple attempts at direct laryngoscopy, FOB, or blind tracheal intubation. We believe that the SOS is a valuable aid in the management of the anticipated or unanticipated pediatric difficult tracheal intubation.

Disclaimer

The SOS used was purchased retail from the manufacturer and the Department of Anesthesiology at Tulane University does not receive any financial support nor has any commercial involvement with the manufacturer. Dr Koveleskie discloses that he

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