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Equipment

The Shikani Seeing Stylet™ for Difficult Intubation in Children: Initial Experience

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SUMMARY

The Shikani Seeing Stylet™ is a recently introduced reusable intubating stylet, produced in adult and paediatric versions. It combines features of a fibreoptic bronchoscope and a lightwand.

Inside a malleable stainless steel sheath, the Shikani Seeing Stylet™ has a fibreoptic cable leading to a distal light source and high-resolution lens. In use, the stylet is placed in the lumen of the selected endotracheal tube and the light source enables the stylet to be used as a lightwand, while the fibreoptic capability enables visualization of the laryngeal inlet. It is portable, relatively inexpensive and easy to maintain.

This report describes the use of the stylet on eight occasions in seven children, all of whom were assessed preoperatively as being potentially difficult to intubate. Three had been difficult to intubate previously. All were anaesthetized using inhalational anaesthesia. Once an adequate depth of anaesthesia had been achieved, conventional direct laryngoscopy was performed and identified as Grade 3 in six of the patients and Grade 1 in one.

Tracheal intubation was then attempted using the Shikani Seeing Stylet™. On six of the eight occasions the attempt was made by different anaesthetists, none of whom had any prior clinical experience with the stylet. There were seven successful intubations and one failure in a patient who could not be intubated by any method.

The Shikani Seeing Stylet™ seems a useful device for use in children with difficult airway problems, suspected cervical spine instability or limited mouth-opening.

Key Words: AIRWAY; MANAGEMENT: intubation: difficult, technique. EQUIPMENT: Shikani Seeing Stylet™

Intubation of the difficult airway remains one of the major challenges in anaesthesia[1-3], and no less so in paediatric anaesthesia[4], although the incidence is less[5]. Many devices and aids have been described, two of which are the fibreoptic bronchoscope and the lighted stylet or lightwand. Unfortunately, both have limitations in use in many children.

The fibreoptic bronchoscope is an invaluable aid to awake intubation in the difficult intubation patient[3,5], but is impossible to use in many conscious children[4]. In anaesthetized children, the presence of blood and secretions can obscure vision[3,4,6] and posterior movement of the tongue and epiglottis can not only restrict visibility, but also result in airway obstruction[2]. Thin fibreoptic bronchoscopes that are used in infants and small children are more flexible and hence not as suitable for "railroading" an endotracheal tube[5]. Other limitations of the fibreoptic bronchoscope are the cost of purchase and of maintenance, the ease with which the fragile optical fibres can be damaged, and the fact that its use requires experience and practice. The lightwand can assist with the intubation of many children with difficult airways[4,7-9]. Its use has resulted in successful intubation where both direct and fibreoptic laryngoscopy have failed[10], and also where fibreoptic bronchoscopy has failed[8]. However, its role may be limited in many groups of patients, such as those with tumours, polyps or foreign bodies in the upper airway, and those with upper airway trauma[2,4,11,12].

The Shikani Seeing Stylet™ is another aid to tracheal intubation that has recently become available. It is sold under the Ventus™ brand name and is manufactured by Clarus Medical Systems,

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Minneapolis, MN. It combines the advantages of both a lightwand and a fibreoptic bronchoscope. It is lightweight, portable, can be used by a single operator, is more robust and less expensive than a fibreoptic bronchoscope, and is available in both adult and paediatric versions.

Its use in the paediatric difficult intubation patient has not previously been described. We report its application in seven children who were identified as being difficult or potentially difficult to intubate.

MATERIALS AND METHODS

The Seeing Stylet is a fibreoptic endoscope made from malleable stainless steel (Figure 1). It has a preformed "J" shape that may be moulded to a limited degree for the individual patient. It has a high resolution (30 000 pixel) image bundle with separate glass illumination fibres, and an eyepiece attachment that does not have a focus adjustment. A sharp image is obtained without the need to focus and, as with conventional bronchoscopes, the eyepiece can be connected to a video camera.

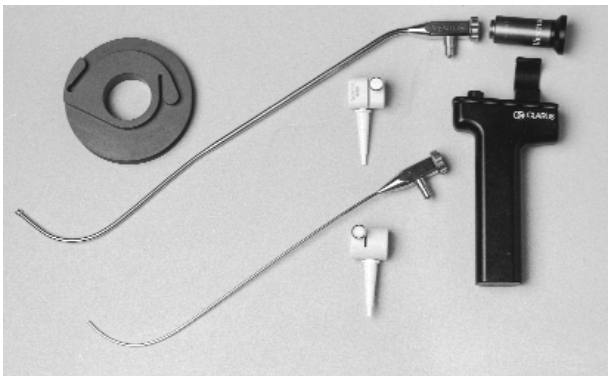

FIGURE 1: Components of the Shikani Seeing Stylet™. The eyepiece and light source are shown on the right side of the Figure. Both adult and paediatric stylets are coupled with their corresponding "Adjustable Tube Stop" and "Oxygen Port". The instrument used to mould the 'J' shape is shown top left.

A practical feature is an "Adjustable Tube Stop" which fits over the stylet and holds the endotracheal tube in the optimal position. An "Oxygen Port" connector may be attached to allow the fresh gas flow or oxygen to pass through the interior of the endotracheal tube.

The unit is completely sealed allowing ease of cleaning and sterilization with ethylene oxide, the Steris process™ or the Sterrad process™. Two sizes are available. The paediatric version has a stylet that may be used with 3.0 mm internal diameter endotracheal tubes and larger. The adult version has a stylet that can be used with a 5.5 mm endotracheal tube or larger.

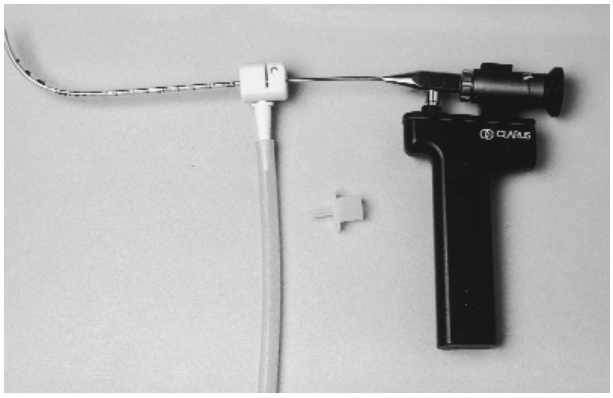

FIGURE 2: The Shikani Seeing Stylet™ prepared for use. An endotracheal tube is positioned on the stylet with the "Adjustable Tube Stop". Fresh gas or oxygen flows through the "Oxygen Port" and via the endotracheal tube to the airway.

Prior to use, the stylet is lightly lubricated, antifogging agent is applied to the distal lens, and the endotracheal tube is positioned on the stylet so that the distal lens does not protrude past the end of the endotracheal tube (Figure 2). Under the guidance of both external trans-illumination of the neck and direct endoscopic visual control, the aim is to advance the endotracheal tube until the trachea is just entered, then the endotracheal tube is advanced over the stylet. It can be seen going down the trachea.

RESULTS

In this series, the Seeing Stylet was used in eight anaesthetics given to seven patients aged between two and 15 years. All patients were either proven or potentially difficult intubations. The clinical details of each patient are summarized in Table 1. Three had tumours, two congenital anomalies and two traumatic injuries, all affecting the upper airway. Three had previously been classed as difficult intubations, two had features suggesting a likely difficult intubation, and the two trauma patients required special care with intubation.

All patients were anaesthetized using an inhalational induction, and once an adequate depth of anaesthesia was achieved direct laryngoscopy was performed. Using the Cormack and Lehane classification of the view that was achieved of the laryngeal inlet[13], there was a Grade 3 view in six patients and a Grade 1 view in one.

Tracheal intubation using the Seeing Stylet was successful in seven of the eight anaesthetics. The one failure occurred in a 14-year-old patient with retropharyngeal rhabdomyosarcoma and a history of prior surgery and radiotherapy. In this patient, use of

TABLE 1

Patient	Age (y)	Planned Procedure/s	Patient History	Airway Assessment	Direct laryngoscopy (13)	Result
1	3	1. MRI/ CT head, neck, chest, abdomen 2. Left hemi-mandibulectomy	Left mandibular tumour	Difficult previous fibreoptic intubation, limited mouth opening, micrognathia	Grade III	First attempt
2	14	Functional Endoscopic Sinus Surgery—abandoned	Retropharyngeal rhabdomyosarcoma & velocardiofacial syndrome —prior surgery and radiotherapy	Previous difficult intubation, limited mouth opening	Grade III	Failed intubation
3	10	Repositioning and splinting of teeth	Motor bike accident with facial trauma	Extremely loose teeth & fractured nose	Grade I	First attempt
4	2	MRI cervical spine	Traumatic C1-2 subluxation with hyperreflexia	Rigid collar, spine board, sand bags	Grade III	First attempt
5	9	Biopsy of left mandibular mass	Left mandibular mass	Poor mouth opening	Grade III	First attempt
6	15	Central venous line insertion	Hunter's syndrome (25)	Previous difficult intubation —stiff, short neck & limited mouth opening	Grade III	Second attempt
7	6	Costochondral graft from left chest to right mandible	Right hemifacial microsomia (26)	Hypoplastic right mandible, larynx tethered to right	Grade III	Second attempt

the Seeing Stylet revealed no more than the "pink" image that is seen with the lens lying adjacent to the pharyngeal mucosa. Although subsequent fibreoptic bronchoscopy was successful in identifying the laryngeal inlet and the trachea, the endotracheal tube could not be railroaded over the bronchoscope. The surgeon involved was of the view that a previously performed pharyngeal flap was responsible for the difficulties being experienced, and the planned nasal sinus surgery was abandoned.

Of the seven successful intubations, five were achieved on the first attempt and two on the second attempt. In one of the latter two instances, the patient was at an inadequate depth of anaesthesia during the first attempt. In the other, the patient was a 15-year-old youth with Hunter's syndrome, in whom the vocal cords were initially difficult to recognise. Even when a McCoy laryngoscope was used and the tip of the Seeing Stylet was placed behind the epiglottis, the only image obtained was the "pink" of the fibreoptic lens apposed to mucosal surface. The next manoeuvre tried was the insertion of the Seeing Stylet in the midline whilst the tongue was gripped with gauze and actively pulled forward. This allowed not only visualization of the vocal cords, which were distorted and deviated to the left, but also the successful passage of the endotracheal tube.

Patient 1 was included twice in the series. This was because previous intubation in this patient had proven difficult using a fibreoptic bronchoscope, and different operators had used the Seeing Stylet on two separate occasions. The anatomy had not changed between procedures.

Because patients 1 and 7 were both undergoing major surgery to the mandible, the tracheal tube was electively replaced with a nasal tube, with the aid of fibreoptic bronchoscopy in both patients.

DISCUSSION

The use of the Shikani Seeing Stylet™ in 120 patients with both routine and difficult airways was initially described by Shikani in 1999[14]. A subsequent report described its effective use in 20 adult patients with normal airways[1]. Our experience with eight intubations in seven difficult paediatric intubations suggests that the Seeing Stylet is likely to be a

valuable aid in this setting. Preparation for use is minimal, which is important for the unanticipated difficult intubation. It is simple to use, especially for those anaesthetists familiar with malleable intubating stylets. Six anaesthetists were involved in this assessment of the Seeing Stylet. Although all had received brief instruction in its use, none had any previous experience with its use in a normal patient, and one had prior experience on an intubation mannequin. Four of the anaesthetists were senior anaesthetic consultants and two were advanced trainees in anaesthesia. Ease of use was confirmed by all but one. This was the anaesthetist involved in the case that had to be cancelled because all attempts at intubation failed.

One potential difficulty occurs when the lens is in contact with a mucosal surface and there is a loss of the visual field so that the image the viewer sees is "pink". This loss of view restricts the anaesthetist's ability to manoeuvre the fibreoptic lightwand past an epiglottis that is in contact with the posterior pharyngeal wall[2]. An appropriate sized laryngoscope used to retract the base of the tongue can create space between the epiglottis and the posterior wall of the pharynx[14-18]. Apart from this, other manoeuvres that may create operating space for the fibreoptic lightwand are lifting the mandible[4,11,14,19] and, as we ourselves found, gripping the tongue with gauze and pulling it forward[5,19]. In the absence of cervical spine instability, placing the head in the neutral to slightly extended position may lift the epiglottis off the posterior pharyngeal wall[11]. Once space is created, the fibreoptic lightwand should be introduced in the midline. It serves as both an aid to intubation and confirms successful intubation[16,20].

We found that it was easier to use the Seeing Stylet with a video camera attached, although the view with the eyepiece and battery light source was sufficient. Use of the video camera system is also valuable for teaching purposes[16,21].

When a fibreoptic lightwand is used, the traditional methods of predicting a potentially difficult intubation may not apply[10]. In fact, the success rate of the fibreoptic lightwand is not adversely affected by many of the factors that make conventional intubation difficult, such as reduced jaw mobility and cervical spine injury[1]. Saruki describes the successful intubation of 16 patients who were extremely difficult or impossible to intubate using direct laryngoscopy[17].

It seems likely that there will be a wide range of indications in paediatric patients for use of either the Seeing Stylet, or one of the several other brands of fibreoptic lightwand that are available[8,10,15-17,20,22]. Some are limited by image quality, image rotation and a recessed lens that traps secretions or blood[15,22]. Others can only be used with a video monitor[20]. Studies on all these fibreoptic lightwands have shown high success rates, reasonable intubation times, haemodynamic stability and absence of arterial desaturation[1,15,17,20,22,23]. One has the facility for the distal tip of the stylet to be angulated so that the instrument can be better directed towards the laryngeal inlet[15].

The advantages of the fibreoptic lightwand over the flexible fibreoptic bronchoscope are its lower cost, its reduced susceptibility to damage, and its ability to manoeuvre around a large epiglottis[14]. It may also be used as a lightwand alone when blood or secretions obscure or temporarily obscure the fibreoptic view.

Davis et al reported the blinded lightwand to be as effective at intubation as traditional laryngoscopy[10]. Indeed, the lightwand may be more reliable, achieve intubation in a shorter time, and be better tolerated by the patient[10]. The advantage of the Seeing Stylet over a lightwand is that it provides visualization as well as illumination[14].

Gravenstein et al compared use of the fibreoptic lightwand with both direct laryngoscopy and flexible fibreoptic bronchoscopy[22]. Direct laryngoscopy provided the most easily obtained view of the laryngeal inlet, and the shortest time for intubation. The fibreoptic lightwand was associated with a lower incidence of sore throat than direct laryngoscopy, and achieved intubation faster than the fibreoptic bronchoscope when used by anaesthetists not skilled in the use of the fibreoptic lightwand or the fibreoptic bronchoscope[22]. In simulated difficult intubation situations, Weiss and Biro found that the fibreoptic lightwand was simpler to use and more effective than a video-imaging laryngoscope[16,20].

A further important advantage of the Seeing Stylet is its portability. It could be a valuable aid to intubation in the field or pre-hospital and emergency department settings, as well as in the emergency and general theatres. It would be a cheaper alternative for difficult intubation in developing countries than flexible fibreoptic technology. The ease of use of a fibreoptic lightwand is a very important advantage, especially with the unanticipated difficult intubation patient[24].

Limitations of the Seeing Stylet included a limited depth of view, only being in focus at a distance of approximately one centimetre, and poor visibility when secretions cover the lens. Also, the ability to pass the stylet any distance beyond the vocal cords is restricted because of its angulated shape, which results in its impinging against the anterior tracheal

wall. An important limitation is that it can only be used for oral intubations. Sore throat and minor hoarseness have been reported[15,22,23].

We believe that, although the fibreoptic lightwand does not replace the flexible fibreoptic bronchoscope, it is easy to use and is a valuable additional aid in the management of the paediatric difficult intubation patient, or the child with an unanticipated difficult laryngoscopy. Our assessment confirms its value in a small group of children with quite major difficult airway problems, limited mouth-opening, or suspected cervical spine instability.

Financial declaration: The Seeing Stylet used was purchased at cost price from the manufacturer.

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