Airway Adventures of Airtraq: Use of Airtraq Optical Laryngoscope with Adaptor in Infants with Obstructive Hydrocephalus Posted for Endoscopic Third Ventriculostomy

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Abstract

Keywords

- Airtraq
- endoscopic third ventriculostomy
- obstructive hydrocephalus

The pediatric airway is a challenge for the anesthetist due to difficulty in adequate assessment, scarcity of management algorithms, lack of precise knowledge regarding incidence, as well as limitations of the various devices, instruments, and video laryngoscopes. We present a case series of infants with obstructive hydrocephalus with anticipated difficult intubation posted for endoscopic third ventriculostomy (ETV) in whom the airway was successfully secured using Airtraq optical laryngoscope with adaptor. Although this device has not been widely studied in pediatrics age group, there are different sizes available for use among children. The ease of use, short learning curve, low cost, single use, and successful approach to difficult airway have made it to being the main rescue technique when the initial approach has failed.

Introduction

Hydrocephalus makes airway management challenging mainly due to the increased circumference of head, difficulty in positioning for intubation, and other associated congenital anomalies. The probability of hypothermia along with rise in intracranial tension (ICT) may lead to herniation, respiratory and cardiac arrest, and possibly death during management of hydrocephalic infants.¹

These days, a variety of video laryngoscopes are available for managing anticipated difficult airway, but experience and familiarity with the device used are certainly more important than the actual device itself.

There are scarce case series available on the use of pediatric Airtraq in hydrocephalic infants. The pediatric Airtraq optical laryngoscope is an airway device, which facilitates tracheal intubation in infants having both normal, as well as difficult airways. An application (Airtraq mobile by Airtraq) that allows live picturing of the intubation process

has been made freely available on Google play (for Android) and Application Store (for iPhone). It works along with a specially designed adaptor (A-308) for smartphone manufactured by Prodol Meditec Limited, Zhuhai, Guangdong, China. Airtraq is distributed through the worldwide AIR-TRAQ distributors' network (Prodol Meditec SA; Las Arenas, Spain; ► **Fig. 1**).

We report a series of eleven infants with obstructive hydrocephalus posted for endoscopic third ventriculostomy (ETV) who were successfully intubated using Airtraq with smartphone adaptor.

Case Series

After obtaining written informed consent, 11 infants under 1 year of age, who presented with obstructive hydrocephalus and were scheduled for ETV, were selected for this case series. Data regarding age, sex, congenital anomalies, and any neurological deficit were noted.

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Fig. 1 Airtraq mounted on universal adaptor for smartphone.

A thorough preoperative evaluation was done including the possibility of other congenital and genetic anomalies, and neurologic deficits, as well as any signs of raised intracranial pressure (frontal bossing, dilated scalp veins, and cranial nerve palsies). Routine laboratory results were obtained along with CT scan. None of the infants had any associated congenital anomalies.

Demographic and airway assessment records are depicted in ►Table 1. The Mallampati grading was difficult to assess, and airway assessment was done by Colorado

Pediatric Airway Score (COPUR; ►Fig. 2). This scale rates chin size, interdental opening, previous intubation or OSA, uvula visualization, and estimated range of motion of neck on a four-point scale. Scores above 10 predict difficult intubation.

A standardized protocol for anesthesia was maintained for all cases. Airtraq intubation was achieved by an experienced and skilled anesthesiologist (>50 uses). All children were kept nil per mouth as per standard guidelines. They were premedicated with atropine 0.02 mg/kg intravenously (IV), dexamethasone 0.5 mg/kg IV, and fentanyl 2 µg/kg IV in the OT, and standard monitoring including pulse oximetry, electrocardiogram (ECG), noninvasive blood pressure recording, and temperature monitoring were established. The infants were positioned with a shoulder roll, the head (occiput) was laid on a thin head ring while the body allowed to rest on the stack, so as to align the glabella horizontally with the chin, the external auditory meatus (EAM) with suprasternal notch (SN), and neck wide open.

Preoxygenation was adequately provided with 100% oxygen through a face mask, followed by anesthetic induction with inhalation of 8% sevoflurane in 50% nitrous oxide (N₂O) and 50% oxygen (O₂), the inspired concentration was reduced to 4% when pupils diverged. Centralization of pupils and absence of hemodynamic response to jaw thrust were deemed to confirm adequate depth of anesthesia for intubation. None of the infants received muscle relaxants prior to intubation.

An infant Airtraq laryngoscope (size zero) with adaptor was introduced midline into the oral cavity over the tongue base and the tip placed in the vallecula. Trachea was intubated with age appropriate uncuffed endotracheal tube in the first attempt after centralizing the vocal cord in the proximal view finder, which required slight adaptation of Airtraq and wrist movements pulling the Airtraq back and up (►Fig. 3). Correct positioning of endotracheal tube was confirmed by capnography and chest auscultation bilaterally. Anesthesia was maintained with 1 to 2% sevoflurane and 60% N₂O in O₂.

We used Airtraq with adaptor in difficult airway cases, following the same recommendations as applied for direct laryngoscopy, implying that no more than two attempts were made with the same device. Maneuvering techniques such as the use of introducers or intubation guides at the time of insertion^{2,3} and external laryngeal manipulations were used according to Fremantle's score (►Fig. 2).⁴

Table 1 Demographic and airway assessment data

Case	Age (mo)	ASA status	Weight (kg)	COPUR score	Fremantle score view	Fremantle score ease	Expert satisfaction
1	08	I	6.2	6	F	1	1
2	11	II	9	9	F	1	1
3	12	I	11	8	F	1	1
4	09	I	5.3	9	F	1	1
5	07	II	8	9	F	1	2
6	08	II	13	12	P	2	2
7	09	I	10	8	F	1	1
8	11	II	8.2	10	F	1	1
9	12	II	8	7	F	1	1
10	09	I	9	10	P	2	1
11	10	II	8.2	12	P	2	1

Abbreviations: ASA, American Society of Anaesthesiologists; COPUR, Colorado pediatric airway score; F, full view; P, partial view.

Expert satisfaction about device adaptor was rated ranging from 1 to 4 (1 = better than without adaptor and useful; 2 = normal, not different than without adaptor; 3 = worst; and 4 = extremely worst/worse and inutile).

Discussion

Congenital hydrocephalus is commonly associated with Arnold–Chiari, myelomeningocele or Dandy–Walker malformations, arachnoid cysts, and vascular malformations. Acquired

Fremantle score component			Comparison scores
View	F (full)		CL grade 1 POGO 100%
	P (partial)		CL grade 2a POGO 50%
	N (none)		CL grade 3 POGO 0%
Ease	1 - Easy	TT passed first time using manufactures technique	
	2 - Modified	TT passed with more than 1 attempt or a modified technique or adjunct used	
	3 – Unachievable	Unable to pass TT	
Device		Name of the device and blade used	

Fig. 2 Freemantle scores in pediatric population.⁹ CT, Cormack Lehane; POGO, percentage of glottis opening; TT, tracheal tube.

Fig. 3 View of Airtraq with adaptor video laryngoscope.

hydrocephalus may be a consequence of infection, intraventricular hemorrhage, trauma, and tumors.⁵

Anesthetic management for patients with obstructive hydrocephalus posted for ETV poses specific challenges; airway management in small patients with large heads along with anatomical and physiological differences, maintaining adequate cerebral perfusion, and preventing rise in ICT during the surgery, especially during intubation and endoscopy. A large occiput, in these patients, places the neck in extreme flexion and large forehead may obscure the view of laryngoscopy. Therefore, optimum position was made, so as to align glabella horizontally with the chin, the EAM with SN, and the neck wide open. Securing the airway in a timely and effective manner is a priority in these patients due to respiratory problems secondary to laryngospasm, bronchospasm, and hypoxia.

Airtraq, an indirect laryngoscope has an optical channel accommodating a series of lenses, prisms, and mirrors that reflect the magnified image from the tip of the blade to the viewfinder.⁶ It has a channel in which the endotracheal tube is loaded and advanced. Since direct line of sight is not required, there is neither need to displace the tongue nor that of the sniffing position.

The Airtraq allows better glottis visualization than direct laryngoscopy.⁷ It demands special consideration because of its easy maneuvering, low cost, and more rapid learning curve.⁶ There are two sizes of pediatric Airtraq available: infant (endotracheal tube size, 2.5–3.5 mm ID) and child (endotracheal tube size, 4.0–5.5 mm ID).⁸

The use of smartphone has gradually become popular among anesthesiologists.⁹ The addition of smartphone to an Airtraq provides a high-quality view, allowing image recording, editing, analysis, and sharing for teaching purpose, without changing the line of sight.¹⁰ However, with regard to recording of patient data on a smartphone, legal issues should be considered.

In our case series, we have attempted to prove that the Airtraq with adaptor may be an alternative to intubation with video laryngoscopy, especially in the developing countries. Advantages of Airtraq with adaptor are that it works as a videolaryngoscope, its feasibility, ease of assistance and guidance. We found 8 of 11 (72.7%) full Freemantle score in our patients. According to the expert opinion, 9 of 11 (81.8%) patients rated it as useful and better than without the adaptor. Intubation using Airtraq with smartphone adaptor thus improved the visualization of the vocal cords and provided greater satisfaction during airway management.

It is reported by Vlaten et al, wherein a 5-month-old infant with Pierre-Robin sequence was successfully intubated using Airtraq.¹¹ Similarly, a 3-month-old child of Apert syndrome with difficult airway was intubated with Airtraq.¹² Péan et al intubated a 10-year-old child, which was a case of difficult airway due to the Treacher Collins syndrome with 5.5 ID armored tracheal tube using a size-2 Airtraq.¹³ Ali et al reported a case where they successfully intubated a 3-month-old infant with occipital meningocele using Airtraq.¹⁴

Until now, no case report describing the use of Airtraq with adaptor in pediatric hydrocephalus has been discussed in literature.

Conclusion

The successful execution of anticipated difficult intubation largely depends on adequate preoperative evaluation, assessment, planning, preparation, and finally execution.

This case series highlights the utility of Airtraq with smartphone adaptor in infants with hydrocephalus with known difficult airway. The authors are of the opinion that intubation with this device is a better and more feasible alternative for known difficult intubations in any hospital setting, mainly in developing countries where resources are scarce. It can be used as an effective primary technique or rescue device in patients of anticipated difficult airway as in infants with obstructive hydrocephalus.

Conflict of Interest

None declared.

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