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# Airtraq in difficult paediatric airway: report of three cases

## *Airtraq en la vía aérea difícil en pediatría: reporte de tres casos*

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## Abstract

The difficult pediatric airway is a challenge for the anesthetist due to the difficulty achieving an adequate assessment, the paucity of management algorithms, lack of accurate knowledge regarding incidence, as well as limitations of the various devices in this group of patients. We present 3 clinical cases of pediatric patients with craniofacial malformations. Although amenable to ventilation, they had a history of difficult orotracheal intubation during previous interventions but were managed successfully with the Airtraq videolaryngoscope. Although this device has not been studied to a large extent in pediatrics, there are different sizes suitable for patient age. This, together with ease of use, fast learning curve and successful approach to the difficult airway in the few published studies, has contributed to turn it into a primary and rescue technique when the initial approach has failed in situations of difficult pediatric airway.

## Resumen

La vía aérea difícil (VAD) en pediatría representa un reto para el anestesiólogo debido a la dificultad para realizar una valoración adecuada de la misma, a los escasos algoritmos de manejo, al desconocimiento de su incidencia exacta, asociado a las limitaciones que tienen los diferentes dispositivos en este grupo de pacientes. Presentamos tres casos clínicos pediátricos de malformaciones craneofaciales; se trata de pacientes ventilables, pero con antecedentes de dificultad en la intubación orotraqueal en intervenciones previas que fueron posteriormente manejados con éxito con el videolaringoscopio Airtraq. Aunque este dispositivo ha sido poco estudiado en pediatría, existen diferentes tamaños adaptados a la edad del paciente, que, junto a su rápido aprendizaje, facilidad de manejo y el acceso exitoso en la VAD en los escasos estudios publicados; lo están convirtiendo en una técnica primaria o de rescate cuando ha fallado la técnica inicial en situaciones de VAD en pediatría.

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## Introduction

The exact incidence of difficult airway in pediatrics is not known because assessing the airway is challenging in itself. This has resulted in a lower incidence being cited as compared with adults, leading to the misconception that it is a rare event. However, in cases of craniofacial malformations, airway management may be challenging. There are few algorithms available for the management of difficult airway in pediatrics, and predictive scores are mainly adaptations of scores used in adults. In pediatrics, it is of the utmost importance to conduct a thorough interview including perinatal history, symptoms of airway obstruction, and prior anesthetic problems. This must be followed by a physical examination, depending on how cooperative the patient is, to look for the clinical signs most frequently associated with difficult intubation even if not yet validated for pediatric patients[1] (Table 1).

There are physiological and anatomical differences between children and adults, requiring adjustment in management strategies. Some difficult airway devices are not suited to the anatomy and the size of the child, whereas others have not been validated because of the limitations concerning studies in pediatric patients. Consequently, difficult airway in pediatrics is a challenge for the anesthetist, not to mention that many of the difficulties are due to respiratory problems secondary to laryngospasm, bronchospasm, and hypoxia.[1]

## Patient information

We present 3 cases of patients with anticipated difficult airway in whom intubation under Airtraq (Prodol Meditec, Las Arenas, Vizcaya, Spain) guidance was successful. Adequate pre-oxygenation with 100% oxygen was provided through a face mask, followed by anesthetic induction with sevofluorane plus fentanyl and no muscle relaxant. Spontaneous breathing was maintained. Airtraq-guided orotracheal intubation was successful on the first attempt in 2 of the cases, but in the third case, it was achieved only after the third attempt (Table 2). As mentioned previously, these are patients amenable to ventilation through a face mask, and, according to the difficult airway algorithm, they are not an urgent airway and the recommendation is to use the technique the anesthetist is more comfortable with (laryngeal mask, fastrach, fiberoptic bronchoscope, videolaryngoscope), or to use direct laryngoscopy provided it is performed by a more experienced anesthetist, or provided prior laryngoscopies have not been traumatic.[1,2]

## Clinical findings, diagnostic assessment, and interventions

### *Case 1*

A 13-month-old patient weighing 9 kg, with a history of DiGeorge syndrome, pulmonary atresia, ventricular septal defect, aberrant right subclavian artery, with left aortic arch, and left superior vena cava to coronary sinus; dysmorphic facial features, short neck, retrognathia, extrinsic tracheal compression secondary to ascending aorta dilatation, chronic hypoxemia, cyanosis, and bronchial hyperreactivity with several episodes of respiratory failure. The patient was scheduled for pulmonary atresia correction by means of right ventricle-to-pulmonary artery conduit. Following anesthetic induction, direct laryngoscopy was performed by a pediatric anesthetist, revealing a Cormack-Lehane 4. An Ambu AuraOnce laryngeal mask (Ambu A/S, Ballerup, Denmark) was used and fiberoptic bronchoscopy-guided intubation was performed through the mask, and was successful on the second attempt.

**Table 1. Clinical signs associated with a difficult intubation.**

| Parameter | Predictor of difficult intubation |
|---|---|
| Mouth opening | Less than 3 patient fingers across |
| Teeth | Dental maloclusion or prominent incisors |
| Mallampati test | III–IV |
| Mandibular and submental space | Micrognathia, rethrognathia or mandibular hypoplasia |
| Thyromental distance | Less than 15 mm in neonates, 25 mm in infants |
| | Less than 35 mm in 10-year-old children |
| Others | Facial asymmetry, mass in the neck or airway, pointed palate |
| | Cleft lip |

Source: Authors.

**Table 2. Main clinical characteristics and interventions performed.**

| Case | Background history | Type of craniofacial malformation | Prior success at intubation | Intubation success in current case |
|---|---|---|---|---|
| 1 | DiGeorge syndrome | Dysmorphic facial features | Laryngeal mask plus fiberoptic bronchoscopy for the second attempt | Airtraq on first attempt |
| | | Short neck, retrognathia | | |
| 2 | Peters plus syndrome | Marked laryngomalacia | Direct laryngoscopy (multiple attempts) | Airtraq on first attempt |
| | | Prominent arytenoids | | |
| | | Short aryepiglottic folds | | |
| 3 | CHARGE syndrome | Dysmorphic facial features | Oral fiberoptic bronchoscopy plus external laryngeal manipulation on the third attempt | Airtraq plus Frova guide on the third attempt |
| | | Short neck, retrognathia | | |
| | | Choanal atresia | | |

Source: Authors.

Postoperatively, the patient continued with mechanical ventilation due to low cardiac output syndrome. Reintubation was required after accidental extubation on the 3rd day because of polypnea and hypoxemia. Given the history of a difficult airway, the Airtraq had been made available and was used successfully on the first attempt by a pediatric anesthetist who was also familiar with the use of the device. Finally, on the 10th postoperative day, the patient was put on orotracheal continuous positive airway pressure (CPAP) and 48 hours later was extubated uneventfully.

### *Case 2*

A 10-month-old patient weighing 5.5 kg was presented with a history of Peters plus syndrome, left anophthalmia, and right microphthalmia; corpus callosum hypoplasia, pychomotor retardation, and laryngomalacia with intense inspiratory stridor. The patient had been taken previously to corneal transplant and was considered to have a difficult airway after several attempts at intubation, laryngospasm, failed due to airway edema and prolonged intubation. The patient was admitted for corneal transplant. Following anesthetic induction, Airtraq intubation was achieved on the first attempt by a trained pediatric anesthetist experienced with the use of the device. At the end of the procedure, CPAP was administered during 12 hours to minimize the inspiratory stridor, intensified by residual sedation. Diagnostic fiberoptic bronchoscopy was performed postoperatively, showing marked laryngomalacia, very prominent arytenoids, very short aryepiglottic folds, and no subglottic, tracheal, or bronchial injuries.

### *Case 3*

A 4-year-old patient weighing 13 kg, with a history of CHARGE syndrome (coloboma of the retina or the iris, heart anomalies, choanal atresia, mental retardation, genital and ear anomalies), was taken to surgery for choanal atresia during the neonatal period and Nissen fundoplication due to gastroesophageal reflux, with no evidence of difficult intubation in either of those interventions. A cranioplasty due to scaphocephaly was aborted due to unforeseen difficult airway, with failed orotracheal intubation after several unsuccessful attempts at direct laryngoscopy. For the rescheduled procedure, intubation was achieved on the third attempt with oral fiberoptic bronchoscopy and external laryngeal manipulation.

The patient was admitted for a scheduled abdominal eventration repair. Because of the history of a known difficult airway (short neck, micrognathia, macroglossia, impossible intubation through direct laryngoscopy), an Airtraq videolaryngoscope was used by a pediatric anesthetist. The first 2 attempts at intubation failed because of a very anterior glottis and a posteriorly directed tube by the Airtraq canal. As these attempts were not traumatic, spontaneous breathing was not lost and good

oxygenation was maintained during the attempts at intubation. A third attempt was made by an anesthetist with greater experience using the Airtraq, and finally, with the use of a Frova intubation guide advanced through the tube lodged in the Airtraq canal, the patient was intubated with no injuries secondary to intubation attempts.

## Discussion

Patients with craniofacial malformations pose difficulties when it comes to the use of airway control techniques. Consequently, it is recommended to preserve spontaneous breathing after anesthetic induction and to use fiberoptic bronchoscopy to guide intubation.[1,3,4] However, videolaryngoscopes are now available that are associated with a fast learning curve and provide good outcomes.[3,5]

We describe 3 cases of patients with a history of difficult intubation determined by pediatric anesthetists, in whom successful but difficult intubation was achieved using fiberoptic bronchoscopy. In 2 cases, intubation was successful on the first attempt using the Airtraq; and in the third case, the airway was secured after 3 attempts using this videolaryngoscope. We believe that the Airtraq may be an alternative to intubation with fiberoptic bronchoscopy, although it must be used with caution in patients with a very anterior glottis because of a potential difficulty guiding the orotracheal tube (OTT).

The use of the videolaryngoscope in difficult airway cases follows the same recommendations applied for direct laryngoscopy, meaning that no more than 2 attempts must be made with the same device and, in case of a failed first attempt, a substantial change must be made for the second attempt (e.g., change the size of the videolaryngoscope, guide the OTT, or defer to an anesthetist with more experience).[2]

In the third case in our report, technique optimization was done after the second intubation attempt. In retrospect, the Frova intubation guide should have been used for the second attempt. This would have avoided potential complications of a third attempt and would have been consistent with the difficult airway management guidelines.

The Airtraq is a disposable optical laryngoscope which facilitates visualization of the upper airway by improving vocal cord exposure in the neutral position. It is designed for use in both the normal and the difficult airway, but is particularly indicated for the latter.[3–6] The Airtraq blade has 2 channels, 1 for the placement of the OTT and the other for the optical components. It ends in a distal lens that offers adequate intubation conditions, allowing visualization of the glottis, surrounding structures and the tip of the tube.[5] For pediatric use, it comes in 2 sizes: 0 (2.5–3.5 mm) and 1 (3.5–5.5 mm)[3–5] (Table 3). There is another version for nasotracheal intubation in children under 3 years of age.[5,7,8] It is introduced through the mouth along the midline until the epiglottis is recognized and the tip is placed on the vallecula; vertical traction is applied and when the glottis is in the centre of the optical field, the OTT is allowed to slide through the vocal folds and then the device is removed while holding the tube firmly in place.[4,5] Advantages include less optimization maneuvers to achieve a patent airway, good quality glottis visualization, and a fast learning curve.[3,5,6]. Although there is still a paucity of information regarding the use of the Airtraq and other videolaryngoscopes in pediatrics,[4,9] more and more studies are coming along showing its successful use in the difficult airway.[6]

Burjek et al, based on the Paediatric Difficult Intubation registry, compared the rate of success using flexible optical fiberoptic intubation through a supraglottic device (FBO-SGD) versus videolaryngoscope-guided intubation in patients under 18 years of age. Their results showed that the rate of successful intubation with FBO-SGD was higher (86% vs 73%) and the rate of success on first attempt was similar in the 2 groups; however, in children under 1 year of age, less attempts at intubation were required with

**Table 3. Available Airtraq types and sizes.**

| Size | Model | Color | Tube size | Minimum opening (mm) |
|---|---|---|---|---|
| 3 | Standard adult | Blue | From 7.0 to 8.5 | 16 |
| 2 | Small adult | Green | From 6.0 to 7.5 | 15 |
| 1 | Pediatric | Purple | From 4 to 5.5 | 11.5 |
| 0 | Neonatal | Gray | From 2.5 to 3.5 | 11 |
| | Nasotracheal intubation (under 3 years of age) | White | Not applicable | 11.5 |
| | Nasotracheal intubation | Orange | Not applicable | 15 |
| | Double lumen tubes | Yellow | From 28 to 41 Fr | 19 |

Source: Authors.

FBO-SGD compared with the videolaryngoscope. They did not find significant difference in complication rates with the 2 techniques. They conclude that videolaryngoscopy continues to be the most widely used technique for intubation in difficult airways in pediatrics; however, FBO-SGD may offer unique advantages in the more vulnerable patients (under 1 year of age) as it prevents upper airway obstruction and hypoxemia when ventilation is maintained during the intubation attempt.[10]

In terms of disadvantages, the Airtraq is relatively large when compared with the size of the oral cavity in children and may produce inadvertent injuries to the mouth. For this reason, manipulation must be done with care to avoid trauma to the airway because blood and secretions may hinder vision,[3] especially in children with tonsillar hypertrophy.[11] Owada et al[12] carried out a cross-over, randomized study in a pediatric intubation model and showed that the Airtraq is associated with higher rates of success and less dental trauma. They argue that the Airtraq is superior in cases of severe mandibular, because it does not require large mandibular area to align the field of vision.

Occasionally, even though the glottis is visualized, OTT orientation is difficult, because it tends to slide posteriorly, an issue found commonly in pediatric patients with micrognathia, short neck, and limited cervical extension, creating the need for the use of introducers or intubation guides at the time of inserting the OTT;[7–9] external laryngeal manipulation can also be used to solve the issue and guide orotracheal intubation with the Airtraq.[7]

It is common for patients with craniofacial abnormalities to be taken to surgery for early correction of their malformations. In these cases, the availability of devices to help with airway management is mandatory because of the possibility of intubation issues even in expert hands. This, added to little tolerance of apnea time and high demand for oxygen,[10] makes difficult intubation responsible for a large part of anesthetic morbidity in pediatrics.

The literature recommends expertise with the use of an advanced device for airway management. However, the choice will depend on the device available at our institutions, which ultimately will be the one we are more skilled at. No device for advanced management of the difficult airway in pediatrics has been shown to be superior, mainly due to the limitations in performing studies in this patient population. In the future, the Airtraq could become an indispensable tool in the pediatric airway cart, considering its place in the difficult airway algorithm (indicated in patients amenable to ventilation with anticipated or potential difficulty with orotracheal intubation using the conventional laryngoscope). Special caution is recommended in patients under 1 year of age, in whom intubation under FBO-SGD guidance has been associated with a higher rate of success on the first attempt, which would point to the use of these devices as the first choice in this age group, provided the anesthetist is well experienced with the use of this technique.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors declare that in this article there is no data that reveals patients' identity.

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## Conflicts of interest

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## References

1. Andreu E, Schmucker E, Drudis R, et al. Algorithm for pediatric difficult airway. Rev Esp Anestesiol Reanim 2011;58:304–311.
2. Law JA, Broemling N, Cooper RM, et al. The difficult airway with recommendations for management—Part 1—Difficult tracheal intubation encountered in an unconscious/induced patient. Can J Anaesth 2013;60:1089–1118.
3. Morales AC, San Norberto L, Prieto RM, et al. Airtraq tracheal intubation in a girl with Pierre Robin syndrome. Rev Esp Anestesiol Reanim 2011;58:526–528.
4. Vlatten A, Soder C. Airtraq optical laryngoscope intubation in a 5-month-old infant with a difficult airway because of Robin Sequence. Paediatr Anaesth 2009;19:699–700.
5. Castañeda M, Batllori M, Gómez Ayechu M, et al. Airtraq optical laryngoscopy. An Sist Sanit Navar 2009;32:75–83.
6. Savoldelli GL, Ventura F, Waeber JL, et al. Use of the Airtraq as the primary technique to manage anticipated difficult airway: a report of three cases. J Clin Anesth 2008;20:474–477.
7. Xue FS, Liu HP, Liao X, et al. Endotracheal intubation with Airtraq optical laryngoscope in the pediatric patients. Paediatr Anaesth 2011;21:703–704.
8. Xue FS, Yuan YJ, Wang Q, et al. Laryngoscopes with a guiding channel cannot avoid difficulty in passing endotracheal tube through the glotis. Acta Anaesthesiol Scand 2011;55:134.
9. Holm-Knudsen RJ, White J. The Airtraq may not be the solution for infants with difficult airways. Pediatr Anesth 2010;20:374–375.
10. Burjek NE, Nishisaki A, Fiadjoe JE, et al. Videolaryngoscopy versus fiber-optic intubation through a supraglottic airway in children with a difficult airway: an analysis from the multicenter pediatric difficult intubation registry. Anesthesiology 2017;127:432–440.
11. Shimada N, Hirabayashi Y. Tonsillar injury caused by the Airtraq optical laryngoscope in children. J Clin Anesth 2011;23:344–345.
12. Owada G, Mihara T, Inagawa G, et al. A comparison of the Airtraq®, McGrath®, and Macintosh laryngoscopes for difficult paediatric intubation: a manikin study. PLoS One 2017;12:e0171889.