

Difficult Airway

Editor-in-Chief

Roland Hofbauer, University of Vienna (Europe)
Michael Frass, University of Vienna (Europe)

**Organ of the Viennese and International Clinical and Experimental
Research Society**

ISSN 1609-2961 = Difficult airway (Print)
ISSN 1609-297X = Difficult airway (Online)

Associate Editors

Bernhard Gmeiner, University of Vienna (Europe)
Elizabeth Frost, Mount Sinai Hospital (New York, NY)
Ricardo Urtubia, Santiago Hospital (Chile)
Ramez Salem, University of Illinois (Chicago, IL)

CONTENT

**The Use of a Video Intubation System for
Difficult Airway Management in Pediatrics** 30

F Hrska, M Frass, P Krafft

Negative Pressure Pulmonary Edema 40

FJ Alvarez, G Valenzuela, RM Urtubia

**Difficult airway management using the Esophageal
Tracheal Combitube[®] in general Anesthesia** 46

MN Cherian, N Eipe

Author Instructions, Checklist, Cover Letter 49

Scope – Difficult Airway

Each article is peer reviewed by at least two peer referees.

The Journal "Difficult Airway" is a new, international, ISSN registered, peer reviewed journal providing comprehensive coverage of current research in the field of Difficult Airway.

We are publishing original articles, case reports, brief reports, letter to the Editor, and reviews. We providing you with a special fast Editorial process (easy online submission).

The journal wants to improve the communication between the different clinical and/or experimental subspecialties in the field of Difficult Airway.

The Journal "Difficult Airway" was founded 2000 and is available in print version and Online (electronic version).

Indexed in the following biomedical databases

EMBASE - EURO-FACTOR-DATABASE

REVIEW

The Use of a Video Intubation System for Difficult Airway Management in Pediatrics

F Hrska¹, M Frass², P Krafft¹

¹Department of Anesthesiology and General Intensive Care, ² Department of Internal Medicine I, MICU, University of Vienna, Europe

Correspondence: Franz Hrska, MD, Department of Anesthesiology and General Intensive Care, University of Vienna, Waehringer Guertel 18-20, A1090 Vienna, Austria. E-mail: franz.hrska@akh-wien.ac.at

Abstract

Background: Difficult intubation can unexpectedly occur in clinical practice and emergencies. However, oxygenation must be maintained with resumed artificial ventilation. Tracheal intubation of older children does not significantly differ from intubation of adults. Children and infants are characterized by anatomic differences that make tracheal intubation more challenging.

Data collection: Review of the literature referring to the management of the difficult airway in children.

Conclusion: The anesthesiological management does not differ from the management of difficult airway situations in adults but many of the small children and infants present anesthetic difficulties requiring skills other than just fiberoptic intubation. Nevertheless the skills necessary for the performance of fiberoptic laryngoscopy and intubation in small children can be learned by every anesthesiologist. The video system will help to perform this method, as the use of the fiberoptic system needs an appropriate teaching in the management of the difficult airway.

Key Words: Fiberoptic laryngoscopy, intubation in children, video system, clinical use, emergencies, anesthesiological management

INTRODUCTION

The most secure technique for maintaining a patent airway is intubation of the trachea. Tracheal intubation of older children (with a $\geq 6,0$ mm cuffed endotracheal tube [ETT]) does not differ significantly from tracheal intubation of adults. Small children and infants, however, are characterized by anatomic differences that make tracheal intubation more challenging.

A clear understanding of the anatomy and physiology of the upper airway must precede any discussion of anesthesia for surgery of pathologies involving the upper airway.

REVIEW

Anatomy of the pediatric airways

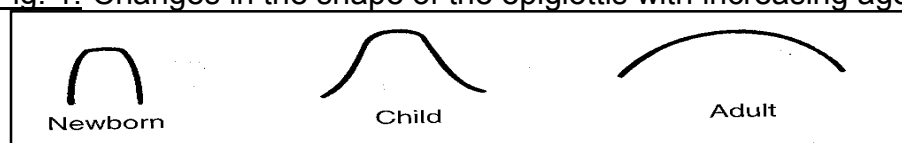
The respective **diameters and lengths are reduced** in children and vary depending upon the size of the head and the length of the trachea. There are several recommendations which can be used to estimate the correct tracheal tube size for the intubation of small children (1-3).

A line of structures must be identified which act as landmarks during intubation: Uvula above, lateral palatopharyngeal arches and two important inferior areas, namely vallecula and epiglottis.

In addition to this imaginary line, **three other points must be taken into consideration** when attempting pediatric intubation:

- infants have a relatively large head
- jaw angle is approximately 20° greater in the infant – 140° compared with 120° in the young adult
- The shape of the epiglottis in the newborn is long and thin but, with increasing age, it gradually flattens and widens until it reaches the adult shape (Fig. 1)

Fig. 1: Changes in the shape of the epiglottis with increasing age



The importance of head position in maintaining upper airway patency during anesthesia is well recognized. Post mortem studies show that flexing the head of the human infant causes upper airway to collapse more readily (4). Also, neonates (especially the premature neonate) have small, soft, and easily collapsible airways, particularly if the neck is flexed.

The larynx of a newborn projects at the level of C₃ - C₄; in the adult it projects at C₄ - C₅. The vocal cords are more cephalad in the infant and often appear tilted forward. This position aggravates the displacement of the tongue and mandible in order to visualize the infant's vocal cords. Therefore, straight laryngoscope blades are more commonly used for the intubation of the pediatric trachea.

It is also important to note that **the cricoid cartilage** is the only complete cartilage in the laryngeal structure. This structure is the narrowest part of the pediatric larynx and consequently **determines the size of the tracheal tube** (see Table A1 and Fig. 2a, 2b) compared to the adult the narrowest part of the larynx is at the level of the vocal cords. Naturally, oedema of the mucosal surface can also reduce the airway diameter considerably.



Fig. 2a
←
The pediatric scope
before the larynx
Fig. 2b
→



Table A.1 Endotracheal tube sizes.

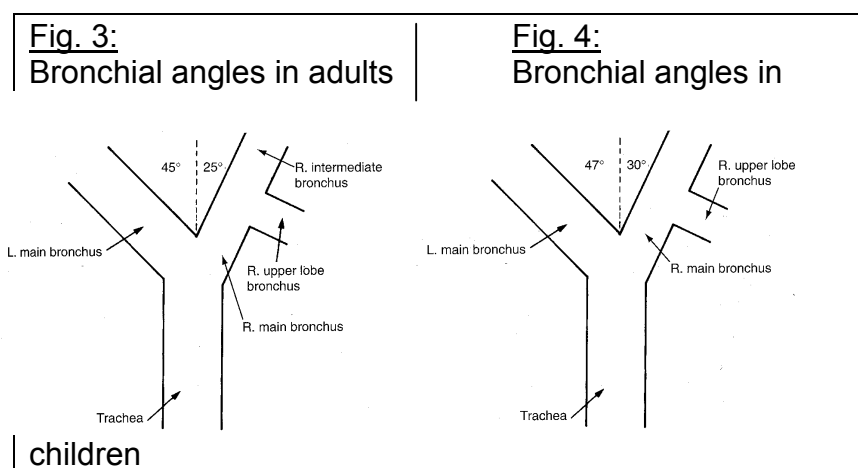
Age (yr)	Tube size*		Length (cm)	
	Magill	Int. diam. (mm)	Oral†	Nasal‡
0–3 months	00	3.0	10	–
	0A	3.5	10–11	–
3–6 months	0	4.0	12	15
6–12 months	1	4.5	12	15
2	2	5.0	13	16
3	2	5.0	13	16
4	3	5.5	14	17
5	3	5.5	14	17
6	4	6.0	15	18
7	4	6.0	15	18
8	5	6.5	16	19
9	5	6.5	16	19
10	6	7.0	17	20
11	6	7.0	17	20
12	7	7.5	18	21

$$\dagger \text{Oral length} = 12 + \frac{\text{Age (yr)}}{2} \text{ cm}$$

$$* \text{Tube size} = \frac{\text{Age (yr)}}{4} + 4,5 \text{ mm}$$

$$\ddagger \text{Nasal length} = 15 + \frac{\text{Age (yr)}}{2} \text{ cm}$$

For performance of **fiberoptic intubation and bronchoscopy** the anesthesiologist should be familiar with the anatomy of the lower airways since variations can cause difficulty during endobronchial intubation. Compared with the adult airway, the level of the **carina is higher in infants and also the angle between the main bronchi is different** (Figs. 3 and 4).



Pathology of the airways

A number of potentially life-threatening problems can occur during induction of general anesthesia in children:

- upper airway obstruction
- bronchospasm or laryngospasm
- cardiovascular problems or pulmonary diseases
- inadequate access to the airway

Maintenance of a patient airway and successful laryngoscopy and intubation might be difficult or impossible without special preparation and backup plans. For the management of difficult airway situations, the anesthesiologist must prepare a well-planned, flexible approach to maximize success and minimize risk. The goals are to avoid surprises, identify airway difficulties, and to be prepared for their management. Therefore it is important to have proper equipment available.

Congenital syndroms associated with difficult airways (5-8):

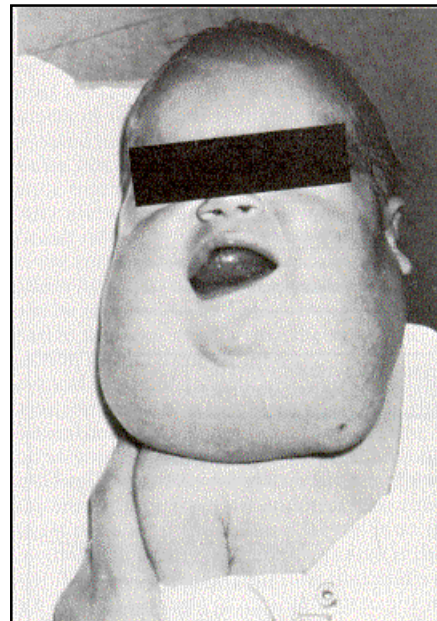
- | | | |
|----|---------------------|---|
| a) | Micrognathia: | Cri du chat syndrome
Pierre Robin syndrome
Trisomie 13 & 18 |
| b) | Macroglossia: | Down's syndrome
Hurler's syndrome
Hypothyroidism |
| c) | Midface hypoplasia: | Pierre Robin syndrome
Crouzon's syndrome
Goldenhar's syndrome |

Maroteaux-Lamy syndrome Rubenstein's syndrome

Inability to visualize of the patient's larynx presents an enormous challenge to the anesthesiologist and requires patience and a "bag of tricks" to accomplish tracheal intubation (see Fig. 5) (9). In this case the technique of intubation over a fiberoptic bronchoscope is ideal (10).

Fig. 5:

Massive bilateral cervical submandibular cystic hygroma in a newborn that involves the tongue and the retromandibular, pharyngeal and retropharyngeal areas.



Fiberoptic intubation in children

The fiberoptic bronchoscope has become an integral tool of anesthesia practice. This tool has **facilitated many difficult oral or nasal intubations** (11-14). The basic principles of fiberoptic management of difficult airways in adults can also be applied to pediatric patients. Generally, to train the technique of fiberoptic intubation, **an anesthesiologist must become familiar with**

- (1) the bronchoscope and its facilities used
- (2) the handling of the scope and
- (3) its shortcomings

in addition to the usual patient considerations.

Therefore, **guidelines for flexible fiberoptic bronchoscopy** have been developed by the *American Thoracic Society* and the *American Lung Association*. Technical proficiency in scope manipulation and identification of normal anatomic structures in normal patients requires expertise and time.

The anesthesiologist should be aware that the time to learn is not on a patient with a difficult airway.

There is no place for either the occasional fiberoptic intubator or the occasional pediatric anesthesiologist.

Children present a special challenge not only if fiberoptic intubation is required. Since the option of awake fiberoptic intubation with local anesthesia is not available for most difficult pediatric airways, the anesthesiologist may then be faced with both, difficult general anesthesia and difficult intubation.

The **laryngeal mask airway (LMA)** has the same disadvantage as the Guedel airway, namely the child has to be anesthetized deeply before the LMA is inserted. Once in place, it will provide a patent airway in the majority of patients and permits a guided placement of a fiberoptic bronchoscope.

The **esophageal – tracheal – Combitube™ (ETC)** from Frass et al. is an other interesting device that has performed satisfactorily in a variety of circumstances (15), specially for management of the difficult airway. But the Combitube can not be used for children below 120 cm in height, because at the moment there is no smaller size than the 37 F SA available. Therefore, infants and neonates with a difficult airway need a fiberoptic bronchoscope for guided placement of the ETT.

Equipment

The modern fiberoptic bronchoscopes range in size from 2,2 mm to 5,8 mm external diameter. The smaller scopes can be quite useful in experienced hands at securing even quite difficult airways, needing as small as 2,5 mm ID ETT (14).

The larger scopes offer

- more directional control
- are equipped with a channel for the suctioning of secretions
- a route for administration of local anesthetics or insufflation of oxygen
- or provide a channel for the placement of a flexible guide wire

Residents, staff anesthesiologists and critical care physicians should be well trained in the technique using flexible bronchoscope w/o a video intubation unit. Specially the **use of a TV screen** facilitate the introduction of this device in difficult airway management and the teaching within and without the OR. Nevertheless the fiberoptic devices for pediatric endotracheal intubation must be used regular, not only in emergencies.

The **Olympus™ pediatric fiberoptic bronchoscope LF 1** for instance has an external diameter of 3,5 mm and a 1,0 mm diameter suction channel. This scope will pass through a tracheal tube as small as 4,5 mm ID.

The **Pentax™ pediatric fiberoptic bronchoscope** has an external diameter of 3,5 mm and is equipped with a 1,2 mm diameter suction channel. However, smaller scopes can be useful if ETT's as small as 2,5 mm had to be inserted.

Karl Storz Company™ Germany produced **two new flexible pediatric fiberoptic bronchoscopes** with an external diameter of 2,8 mm and 3,7 mm, each with a working channel, the larger one equipped with a suction channel (Fig. 6 and 7). The built in Micro Video Module (MVM) provides an improved image by electronic processing with the added bonus of improved ergonomics (Fig. 8). The introduction of **a semi flexible scope** with an external diameter of 2,0 mm (also with the MVM – system, but without working channel) represents a big advantage.

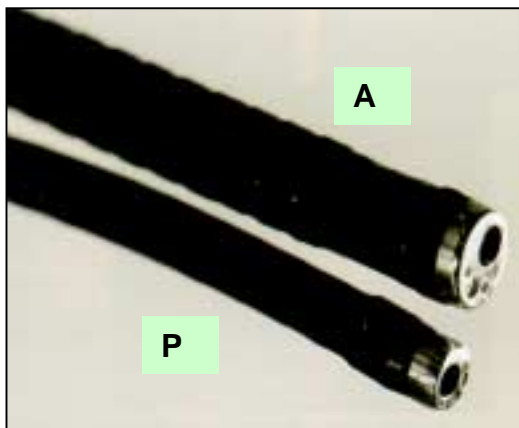


Fig. 6:
The tips of the **adult scope** 3,7 mm with an 1,5 mm channel and the **pediatric one** (2,8 mm with an 1,2 mm channel)



Fig. 7:
The new bronchoscop from Karl Storz, Germany



Fig. 8:
Micro Video Module (MVM)

All other pediatric fiberoptic bronchoscopes available with an external diameter less than 3 mm do not have a working channel.

Technique of fiberoptic intubation

Fiberoptic intubation under most circumstances is **simple, fast, and can be accomplished easily** when certain preparation steps are taken in advance (16). **Intubation under visual observation** - observed at the TV screen - **ensures an easy and atraumatic tracheal intubation** (17).

Several intubation techniques have been described:

- oral approach
- nasal approach
- endoscopy mask technique
- intubation using the nasal airway
- two – stage intubation using a guide wire and catheter
- tracheal intubation under fiberoptic observation

A conventional technique for fiberoptic bronchoscopy involves placement of a lubricated appropriately sized endotracheal tube into the naris at a depth of the posterior pharynx and passing the lubricated bronchoscope through and beyond the distal tip of the tube. Under direct vision the bronchoscope is placed through the vocal cords into the mid-trachea. The endotracheal tube get then passed over the fiberscope and tube position confirmed initially by direct visualization through the scope as it is removed. Once the fiberoptic bronchoscope has been removed, the tracheal tube is connected to the breathing system. Some anesthesiologists and critical care physicians find out that the administration of atropine or glycopyrolate before the bronchoscopy facilitates the procedure by reducing secretions.

In children even a pediatric fiberoptic bronchoscope can cause significant obstruction of the upper trachea and endotracheal tube. Therefore one must work quickly and remove the scope as soon as possible to improve oxygenation and ventilation. In infants, where FRC is quite close to RV (at about 15 - 20 % of total lung capacity), a tracheal tube can be associated with both a reduced FRC and impaired oxygenation.

Fiberoptic bronchoscopy and intubation can be performed on patients who are **awake**, have topical or nebulized **local anesthesia** of their airway, are **sedated** with intravenous drugs or received **volatile narcotic substances**. But, intubation of the trachea using topical anesthesia and sedation have some limitations in neonates and small children, as they will not cooperate with awake intubation. However, it is important to provide oxygen and to monitor patients undergoing these procedures to avoid worsening hypoxemia or dysrhythmias. If supplemental oxygen is necessary it can be delivered by several techniques including cannula, face mask and insufflation into the opposite naris.

The use of a **laryngeal mask airway (LMA) with the fiberoptic bronchoscope** is a further variation. The technique was used to facilitate fiberoptic airway endoscopy in children with tracheal stenosis (18).

Experience with the video system

Fiberoptic devices for pediatric and adult endotracheal intubation are readily available since many years. Residents and staff must be well trained in this technique. The incidence of fiberoptic intubation varies from institution to institution but probably does not exceed 5 – 10 % of the total number of cases. Teaching flexible fiberoptic intubation with video assistance offers distinct advantages in every training program. For the management of the difficult airway the use of the TV screen facilitates the introduction and the use of this device.

Karl Storz™ produced two flexible pediatric fiberoptic bronchoscopes with a new system. One with an external diameter of 2,8 mm, a working channel of 1,2 mm and 50 cm length. The other one has an external diameter of 3,7 mm with a 1,5 mm working channel and 65 cm length. A semi flexible scope with an external diameter of 2,0 mm is also available, but without a working channel. The Video Intubating Unit consists of the scope with an integrated TV camera (Micro Video Module = MVM), a light source, a color monitor and a videocassette recorder. This unit has been placed on a small cart and the monitor is mounted on a swivel arm, which can be positioned as desired (Fig. 9).

Video techniques have improved enormously in the last decade. The cameras have become smaller, producing higher quality images and are prices have become more reasonable. It is interesting that progress in this direction remains very slow. One cause could be that fiberoptic equipment is expensive, fragile and unavailable in many parts of the world.

In a clinical prospective multicenter study testing the use of an improved flexible



Fig. 9:
„The Video Intubating Unit“

video intubating scope was recorded in more than 600 cases (19). The investigators agree that the introduction of an improved flexible fiber intubation scope with an integrated TV system (MVM) may provide a tool for the future. Such a system is more effective for the difficult airway in pediatric patients requiring intubation.

CONCLUSIONS

The skills necessary for the performance of fiberoptic laryngoscopy and intubation in small children can be acquired by every anesthesiologist who is already familiar with adult fiberoptic laryngoscopy or is prepared to train conventional fiberoptic laryngoscopy in older children. It should be kept in mind that many of these patients present anesthetic difficulties requiring skills other than just fiberoptic intubation. Many of the cases are better dealt by two anesthesiologists, one to anesthetize and monitor the child, the other to perform the intubation. Specialized personnel and equipment are mandatory, the fiberoptic equipment can be used in the OR as well as in the ICU.

REFERENCES

1. Morgan GAR, Steward DJ. A pre-formed pediatric orotracheal tube designed based on anatomical measurements. *Can Anaesth Soc J* 1982;29:9-11
2. Gregory GA (ed.). *Pediatric anesthesia*, 3rd ed. Churchill Livingstone Inc. 1994
3. Latto IP, Vaughan RS (eds): *Difficulties in Tracheal Intubation*. W B Saunders Comp. Ltd 1997
4. Wilson SL, Thach BT, Brouillette RT, Abu-Osba YK. Upper airway patency in the human infant: influence of airway pressure and posture. *J Appl Physiol* 1980;48:500-504
5. Berry FA, Tompkins MJ. Anesthesia for congenital anomalies on the head and neck. In Stehling LC, Zauder HL (eds): *Anesthetic Implications of Congenital Anomalies in Children*. Appleton – Century – Crofts, Norwalk, CT 1980
6. McIntyre JWR. Continuing medical education article: the difficult tracheal intubation. *Can J Anesthesiol* 1987;34:2,204
7. Feingold M, Baum J. Goldenhar's syndrom. *Am J Dis Child* 1978;132:136-138
8. Populaire C, Lundi JN, Pinaud M, Souron R. Elective tracheal intubation in the prone position for a neonate with Pierre Robin syndrom. *Anesthesiology* 1985;62:214-215
9. Weller RM. Anaesthesia for cystic hygroma in a neonate. *Anaesthesia* 1974;29:588-594
10. Ovassapian A, Dykes MHM, Yelich SJ. Difficult pediatric intubation – an induction for the fiberoptic bronchoscope. *Anesthesiology* 1982;56:412-413
11. Salem MR, Mathrubhutham M, Bennett EJ: Difficult intubation. *N Engl J Med* 1976;295:879-881
12. Ament R. A systemic approach to the difficult intubation. *Anesthesiol Rev* 1978;7:12
13. Tahir AH. Use of fiberoptic endoscope in difficult orotracheal intubation. *Anesthesiol Rev* 1976;3:16
14. Finer NN, Muzyka D. Flexible endoscopic intubation of the neonate. *Pediatr Pulm* 1992;12:48-51
15. Frass M, Frenzer R, Zdrahal F, Hoflehner G, Porges P, Lackner FX. The esophageal tracheal combitube: preliminary results with a new airway for CPR. *Ann Emerg Med* 1987;16:768-772
16. Ovassapian A. Fiberoptic tracheal intubation. In: *Fiberoptic Airway Endoscopy in Anaesthesia and Critical Care*, New York: Raven Press. 1990;57-79
17. Ovassapian A, Yelich SJ, Dykes MHM, Brunner EE. Fibreoptic nasotracheal intubation – incidence and causes of failure. *Anesthesia and Analgesia* 1983;62:692-695
18. Asai T, Fujise K, Uchida M. Use of the laryngeal mask in a child with tracheal stenosis. *Anesthesiology* 1991;75:903-904
19. Kaplan M, Ward D, Chhibber A, Van De Wiele B, Berci G. *The Role Of The Universal Video Intubating System in The Management of The Difficult Airway*. Endo Press 2000

CASE REPORT

Negative Pressure Pulmonary Edema

FJ Alvarez¹, G Valenzuela¹, RM Urtubia²

¹Department of Anesthesiology, University of Chile Hospital, Santiago, Chile

²Mutual de Seguridad Hospital. C.CH.C., Santiago, Chile

Correspondence: Dr. Francisco Alvarez, Department of Anesthesiology, University of Chile Hospital, Santos Dumont 999, Santiago, Chile. Email: fjalvarez@mail.cl

ABSTRACT

Background: Negative pressure pulmonary edema (NPPE) is a potentially life-threatening complication of acute airway obstruction that occurs when a large, negative intrathoracic pressure is generated against an obstructed upper airway. The exact prevalence and mechanism remain unknown, but some risk factors have been identified and two different entities of NPPE have been characterized.

Case Report: We report a case of a healthy 23-year-old male patient who had acute pulmonary edema postoperatively.

Discussion: The incidence of NPPE is difficult to ascertain. Main cause of NPPE seems to be laryngospasm after tracheal extubation. Nevertheless, some other causes and risk factors have been identified. Although the exact mechanism is uncertain, the initiating event is a markedly negative intrapleural pressure generated by a forceful inspiratory effort against an obstructed extrathoracic airway. NPPE should be suspected in an individual who has a predisposing cause after reversal of upper airway obstruction. NPPE has been classified into two types. Type 1, occurs immediately after the onset of a precipitating event, Type 2, develops after resolution of chronic upper airway obstruction. Most cases of NPPE respond promptly to appropriate immediate treatment, but best treatment is prevention.

Conclusions: NPPE is a potential life-threatening complication that affect otherwise healthy patients. Despite some risk factors have been identified, any patient can present this complication. Prompt recognition and adequate management of this essentially reversible entity is of paramount importance for a better outcome. The prognosis for complete recovery is excellent.

Key Words: negative pressure, pulmonary edema, airway obstruction, respiratory distress, pathophysiology, laryngospasm

INTRODUCTION

The immediate post-extubation period can be complicated by sudden appearance of respiratory distress. Main cause is the so-called Negative Pressure Pulmonary Edema (NPPE), which is a potentially life-threatening complication of acute airway obstruction. Despite exact prevalence and mechanism remain unknown (1-3) some risk factors have been identified and two different entities of NPPE have been characterized. Both children and adults can be affected; recognition and prompt management are of paramount importance (4).

CASE REPORT

A 23-year-old male patient was scheduled for retroperitoneal lymphadenectomy because of malignant bilateral testicular tumor, which was diagnosed after total orchiectomy and biopsy. Physical examination was unremarkable. Using routine monitoring (non invasive blood pressure, pulse oximetry, electrocardiogram) an epidural catheter was installed for postoperative analgesia management.

Anesthesia was induced with IV fentanyl 2 µg/kg and propofol 2 mg/kg. Rocuronium bromide 0.6 mg/kg was used to facilitate tracheal intubation. Anesthesia was maintained using isoflurane in 100% oxygen. Surgery lasted 3 hours, and the endotracheal tube was withdrawn after appropriate neuromuscular blockade antagonism. Immediately after extubation the patient started with cough and bilateral wheezes were heard by auscultation. Pulse oximetry (SpO₂) dropped from 98% to 80%, and evidence of paradox ventilation was noted. The patient was reintubated without difficulty and copious quantities of blood-tinged secretions coming out from the endotracheal tube were noted. There was no evidence of laryngospasm at laryngoscopy and no gastric contents were observed in the hypopharynx. Bag ventilation with 100% O₂ and positive end expiratory pressure (PEEP) of 10 cm H₂O resulted in SpO₂ of 90%. Furosemide and hydrocortisone were administered intravenously. Oxygen saturation slowly increased to 95%. A portable chest radiograph demonstrated bilateral alveolar infiltrate suggesting pulmonary edema. The patient was transferred to the intensive care unit and was mechanically ventilated for approximately 8 hours. He recovered fully and was discharged three days later.

DISCUSSION

In 1927, animal studies demonstrated that acute airway obstruction could lead to pulmonary edema (2-3). NPPE was first described in humans in 1973 (4). In 1977, a report was published (5) of adult patients who experienced pulmonary edema minutes to hours after severe acute upper airway obstruction. It has also been reported in children (6) mainly associated to episodes of croup and epiglottitis.

After reporting 3 cases of NPPE in young athletic male patients, Anderson et al (7) hypothesized that young athletes might be at increased risk because their chest wall musculature could generate extremely high negative inspiratory pressures, similar to our case report patient.

The incidence of NPPE is difficult to ascertain. Most reports are of single cases or case series. Deepika et al (8) reported 30 cases of NPPE over a 4-year period and found a prevalence of 0,094% at a large metropolitan hospital covering a wide range of surgical specialties.

PATHOPHYSIOLOGY

Main cause of NPPE seems to be laryngospasm after tracheal extubation. Nevertheless, some other causes and risk factors have been identified (Tables 1 and 2, respectively).

NPPE is a condition with a multifactor pathogenesis. Although the exact mechanism is uncertain, the initiating event is a markedly negative intrapleural pressure

generated by a forceful inspiratory effort against an obstructed extrathoracic airway (modified Müller's maneuver) (9). Peak negative intrapleural pressure may exceed – 50 cm to –100 cm H₂O during acute upper airway obstruction, especially after vigorous inspiratory efforts. This phenomenon also increases venous return to the right atrium and thereby increases pulmonary artery blood flow. At the pulmonary capillary level, the high hydrostatic pressure generated by shearing forces during forced inspiration leads to a permeability disorder named "capillary leak syndrome" (5,10,11). This is supported by the finding of alveolar fluid containing high protein levels and inflammatory cells usually not present in transudative pulmonary edema (12). In addition, high blood flow through the right cardiac cavities results in overdistension of the right ventricle and displacement of the interventricular septum to the left, which in turn reduces the left ventricular compliance. The negative intrathoracic pressure also results in an increased afterload imposed to the left ventricular stroke volume (13,14). Hypoxia induces a massive sympathetic discharge, increasing venous return and causing pulmonary vascular constriction and increased pulmonary capillary pressure (PCP) (12,15,16). Thus, the combination of increased PCP and reduced left ventricular compliance in a disrupted capillary territory favor the fluid to shift into the pulmonary interstitium.

DIAGNOSIS

NPPE should be suspected in an individual who has a predisposing cause after reversal of upper airway obstruction. Clinical findings include tachypnea, tachycardia, rales and ronchi, use of accessory respiratory muscles, decreased SpO₂, pink frothy sputum and abnormal chest x-ray film.

NPPE has been classified into two types (17):

- 1) Type 1.- It occurs immediately after the onset of a precipitating event (15), it is related to almost any cause of acute airway obstruction. In some patients onset could be delayed for up to 6 hours (3,5,18,19), which can be due to the loss of the "auto-PEEP" (20).

- 2) Type 2.- It develops after resolution of chronic upper airway obstruction (21).

Type 2 NPPE is much less commonly reported than type 1 NPPE and predictive factors have not been clearly elucidated. Our case report patient described above is typical of type 1 NPPE. Both types of NPPE present with acute respiratory distress.

TREATMENT

Most cases of NPPE respond promptly to appropriate immediate treatment, but best treatment is prevention. In general, patients should not be extubated before protective airway reflexes are fully recovered. Premature tracheal extubation can expose the airway to aspiration of secretions and laryngospasm, which could trigger NPPE. In addition, hypopharynx should be suctioned before extubation, since direct stimulus by the suction catheter can also precipitate a response.

Since the main problem associated with this complication is hypoxia, adequate SpO₂ remains the primary goal of treatment. Reintubation may be necessary, especially if laryngospasm is present (10,12) and/or facemask ventilation with high inspiratory O₂ fail or are not sufficient to maintain a SpO₂ >95%. The use of PEEP is often required to recruit alveolar units, but its use must be weighed against the risks of barotrauma

and worsening a depressed cardiac output. Few patients may require prolonged intubation (>3 days) and progression to acute respiratory distress syndrome, with poor outcome is very uncommon (12,16,22,23). Goldenberg et al (22) reported that mayor complications are generally attributed to a delay in diagnosis.

Diuretics and steroids are controversial in the management of NPPE. One series (24) identified several subclinical cases of NPPE that resolved without specific treatment.

Similar to other cases reported in the literature (4, 5), our patient recovered fully with prompt recognition and treatment.

CONCLUSION

To our knowledge this is the first report of NPPE related to urologic surgery. Although other conditions and types of surgery have been associated most frequently with this complication, the urologic surgical procedures are not out of risk. This report also confirms that NPPE tends to affect young, healthy patient after general anesthesia, and that NPPE is a potential life-threatening complication that affect otherwise healthy patients, both children and adults.

Despite some risk factors have been identified, any patient can present this complication. Prompt recognition and adequate management of this essentially reversible entity is of paramount importance. Mechanical ventilation is the cornerstone of treatment and most patients completely recover in a short period of time.

TABLE 1

Causes of Negative Pressure Pulmonary Edema (NPPE)

Type I

Postextubation laryngospasm
 Patient biting down the endotracheal tube while intubated
 Endotracheal tube obstruction
 Intraoperative direct suctioning of endotracheal tube adapter
 Postoperative vocal cord paralysis
 Epiglottitis
 Croup
 Strangulation
 Hanging
 Laryngeal tumor
 Near drowning

Type II

Post-tonsillectomy/ adenoidectomy
 Post-removal of upper airway tumor
 Choanal stenosis
 Hypertrophic redundant uvula

TABLE 2**Risk Factors for NPPE**

Obesity
Short neck
Vocal cord paralysis
Acromegaly
History of obstructive sleep apnea
Conditions leading to increased capillary-alveolar pressure gradients
Nasal, oral or pharyngeal surgery

REFERENCES

1. Van Kooy M, Gargiulo R F. Postobstructive Pulmonary Edema. *Am Fam Physician* 2000;62:401-404
2. Moore RL. The response to respiratory resistance: a comparison of the effects produced by partial obstruction in the inspiratory and expiratory phases of respiration. *J Exp Med* 1927;45:1065-1080
3. Lang SA, Duncan PG, Shephard DA, Ha HC. Pulmonary oedema associated with airway obstruction. *Can J Anaesth* 1990;37:210-218
4. Capitanio MA, Kirkpatrick JA. Obstructions of the upper airway in children as reflected on the chest radiograph. *Radiology* 1973;107:159-161
5. Oswald CE, Gates GA, Holmstrom MG. Pulmonary edema as a complication of acute airway obstruction. *JAMA* 1977;238:1833-1835
6. Travis KW, Todres ID, Shannon DC. Pulmonary edema associated with croup and epiglottitis. *Pediatrics* 1977;59:695-698
7. Anderson AF, Alfrey D, Lipscomb AB Jr. Acute pulmonary edema, an unusual complication following arthroscopy: a report of three cases. *Arthroscopy* 1990;6:235-237
8. Deepika K, Kenaan CA, Barrocas AM, Fonseca JJ, Bikazi GB. Negative pressure pulmonary edema after acute upper airway obstruction. *J Clin Anesth* 1997;9:403-408
9. Timby J, Reed C, Zeilender , Glauser FL. "Mechanical" causes of pulmonary edema. *Chest* 1990;98:973-979
10. Cascade PN, Alexander GD, Mackie DS. Negative-pressure pulmonary edema after endotracheal intubation. *Radiology* 1993;186:671-675
11. Eid AA, Agabani M, Grady K. Negative pressure pulmonary edema: a cautionary tale. *Cleve Clin J Med* 1997;64:151-153
12. Kollet MH, Pluss J. Noncardiogenic pulmonary edema following upper airway obstruction. 7 cases and a review of the literature. *Medicine* 1991;70:91-98

13. Peters J, Kindred MK, Robotham JL. Transient analysis of cardiopulmonary interaction: I. Diastolic events. *J Appl Physiol* 1988;64:1506-1517
14. Peters J, Kindred MK, Robotham JL. Transient analysis of cardiopulmonary interaction: II. Systolic events. *J Appl Physiol* 1988;64:1518-1526
15. Moss G, Stein AA. The centroneurogenic etiology of the respiratory distress syndrome: induction by isolated cerebral hypoxemia and prevention by unilateral pulmonary denervation. *Am J Surg* 1976;132:352-357
16. Liu EJ, Yih PS. Negative pressure pulmonary oedema caused by biting and endotracheal tube occlusion: a case for oropharyngeal airways. *Singapore Med J* 1999;40:174-175
17. Guffin TN, Har-El G, Sanders A, Lucente FE, Nash M. Acute postobstructive pulmonary edema. *Otolaryngol Head Neck Surg* 1995;112:235-237
18. Sofer S, Bar-Ziv J, Scharf SM. Pulmonary edema following relief of upper airway obstruction. *Chest* 1984;86:401-403
19. Glasser SA, Siler JN. Delayed onset of laryngospasm-induced pulmonary edema in an adult outpatient [Letter]. *Anesthesiology* 1985;62:370-371
20. Lorch DG, Sahn SA. Post-extubation pulmonary edema following anesthesia induced by upper airway obstruction. Are certain patients at increased risk? *Chest* 1986;90:802-805
21. Miro AM, Shivaram U, Finch PJ. Noncardiogenic pulmonary edema following laser therapy of a tracheal neoplasm. *Chest* 1989;96:1430-1431
22. Goldenberg JD, Portugal LG, Wenig BL, Weingarten RT. Negative pressure pulmonary edema in the otolaryngology patient. *Otolaryngol Head Neck Surg* 1997;117:62-66
23. Adolph MD, Oliver AM, Dejak T. Death from adult respiratory distress syndrome and multiorgan failure following acute upper airway obstruction. *Ear Nose Throat J* 1994;73:324-327
24. Willms D, Shure D. Pulmonary edema due to upper airway obstruction in adults. *Chest* 1988;94:1090-1092

CASE REPORT

Difficult airway management using the Esophageal Tracheal Combitube[®] in general Anesthesia

MN Cherian, N Eipe

Department of Anesthesia, Christian Medical College Hospital, Vellore, India-632004

Correspondence: Meena N Cherian, MD, Department of Anesthesia, Christian Medical College Hospital, Vellore, India-632004

ABSTRACT

Objective: The Esophageal Tracheal Combitube[®] (ETC, Tyco Healthcare, Mansfield, MA, USA, www.combitube.org) is a double lumen airway with a double cuff system that permits positive pressure ventilation as well as affords protection from regurgitation or aspiration. The use of the ETC is indicated in prehospital and in hospital emergency situations as well as in intensive care and obstetric anesthesia.

Case: We report the use of the ETC in a case of severe kyphoscoliosis with a difficult airway requiring anesthesia for an elective surgery.

Conclusion: This case report underlines the validity and effectivity of the Combitube under difficult circumstances.

Key Words: Difficult airway, esophageal tracheal Combitube, kyphoscoliosis, general anesthesia, positive pressure ventilation, tracheostomy

INTRODUCTION

Severe deformities of the spine present with problems for successful endotracheal intubation, as laryngoscopy may be impossible. Deformities of the thoracolumbar spine make epidural or subarachnoid blocks very difficult to perform and these might be contraindicated in some cases. Elective surgery requiring general anesthesia may be performed using the esophageal tracheal combitube (ETC) which allows adequate ventilation without laryngoscopy (1-10). The ETC is a double lumen airway with two cuffs large proximal cuff that seals the oropharynx and a smaller distal cuff that seals either the esophagus or the trachea depending on its placement (11-18).

CASE REPORT

A 30-year old man with severe kyphoscoliosis and quadriplegia was diagnosed to have a large bladder calculus requiring cystolitholapaxy. He had suffered from a fall from a height at the age of two years and then was noticed to have progressive deformity of the thoracolumbar spine with no neurological complaints. Eight months prior to the current admission, he underwent surgery elsewhere for stabilization of the spine. Following the internal fixation of the spine he developed partial sensory loss and quadriparesis. The scar of the surgery did not heal completely and had been infected for three months after surgery. He was now restricted to bed and required help for his daily activities. Preoperative anesthetic evaluation revealed a thinly built young man, bed-ridden with severe spasticity of all four limbs and severe kyphoscoliosis of the thoracolumbar spine. He was unable to lie on his back due to

his deformity and was assuming a position of nearly universal flexion. He was in no obvious respiratory distress. The chest was barrel shaped with an expansion of 5 cms and equal air entry in all areas, with no added breath sounds. Neck extension was limited with a thyromental distance of 5 cms and a Mallampati score of II. The patient was accepted for anesthesia with additional risk and planned for general anesthesia. He was given a premedication of diazepam 5 mg to be taken two hours prior to surgery. In the operating room, intravenous access was obtained and induction achieved with thiopentone 250 mg, atracurium 20 mg and fentanyl 25 mg with a mixture of nitrous oxide 4 l, oxygen 2 l, and halothane 1% delivered via a face mask. Hand ventilation was not satisfactory due to the position of the patient's airway and the deformity of his spine preventing adequate extension of the atlanto-occipital joint. A Combitube 37 F SA (Tyco Healthcare, Mansfield, MA, USA) was inserted through the mouth without changing the position of the neck. Auscultation of the chest after attaching to the closed circuit confirmed oesophageal position of the ETC and the distal cuff was inflated with 15ml of air and then the proximal cuff was inflated to 80 ml. Ventilation was performed through the longer blue tube and repeated auscultation confirmed adequate air entry. The surgery commenced. Monitoring of oxygen saturation and end tidal carbon dioxide was performed throughout the procedure, which lasted for one hour. Oxygen saturation was 100% and the $ETCO_2$ was 24-26 mmHg. The airway pressures were 18-22 cms H_2O . Anesthesia, analgesia, and muscle relaxation for the surgery were found to be adequate. Reversal of neuromuscular blockade was done with atropine 1.2 mg and neostigmine 2.5 mg. Recovery was smooth and there was no reflex laryngospasm, retching, or vomiting. Patient was extubated after 1 hour of surgery. Extubation was performed after deflating the cuffs. The patient was transferred to the recovery room from where he was shifted to the ward after observation. In the postoperative period, he did not complain of any post operative cough, sore throat, dysphagia, or dysphonia. The chest was clear and there was no evidence of any aspiration pneumonia. The post operative period was uneventful.

DISCUSSION

Cystolitholapaxy requires analgesia up to T10 level and this patient to be placed in lithotomy for the procedure required adequate relaxation. This could have been achieved with a regional technique but as mentioned before, it would not have been suitable in this case because of his deformity and recent spine surgery with neurological deficit. General anesthesia was planned but laryngoscopy and endotracheal intubation would have been difficult. A laryngeal mask airway could have been a suitable alternative but it would not afford any protection from aspiration, which had to be avoided in a non-ambulant patient such as the case described. Fiberoptic laryngoscopy could have been considered though this will be a limitation in many hospitals due to cost and availability. A surgical airway such as a tracheostomy would not have been acceptable in this patient undergoing elective surgery. Using the ETC we were able to provide an adequate airway for delivery of anesthetic gases and thus the ETC served as a suitable solution for the management of a difficult airway requiring general anesthesia in a case of kyphoscoliosis (19-20).

REFERENCES

1. Gaitini LA, Vaida SJ, Mostafa S, Yanovski B, Croitoru M, Capdevila MD, Sabo E, Ben-David B, Benumof J. The Combitube in Elective Surgery: A Report of 200 Cases. *Anesthesiology* 2001;94:79-82
2. Frass M: Development, patent procedure, and 15 years experience: Combitube - from bench to bedside. *Curr Opin Clin Exp Res* 2000;2:31-38
3. Frass M, Lackner FX, Frenzer R, Hofbauer R. Analysis of 500 uses of the Combitube: Safety, efficacy, and maximum ventilatory pressures during routine surgery. *Difficult Airway* 2001;2:84-90
4. Klein U, Rich JM, Seifert A, Tesinsky P. Use of the Combitube as a Rescue Airway during a Case of "Can't Ventilate – Can't Intubate (CVCI)" in the Operating Room when a Laryngeal Mask failed. *Difficult Airway* 2002;3:4-7
5. Urtubia RM, Aguila M: New thoughts on the difficult airway. *Curr Opin Clin Exp Res* 2000, 2:61-67
6. Frass M. The Combitube: esophageal/Tracheal double-lumen airway. In Benumof JL, editor: *Airway Management Principle and Practice*, S. Louis, Missouri, 1996, Mosby 444-453
7. Urtubia RM, Aguila CM, Cumsille MA: Combitube: A study for proper use. *Anesthesia Analgesia* 2000; 90:958-962
8. Gaitini LA, Vaida SJ, Somri M, Fradis M, Ben-David B. Fiberoptic-guided airway exchange of the esophageal-tracheal Combitube in spontaneously breathing versus mechanically ventilated patients. *Anesth Analg* 1999;88:193-196
9. Walz R, Davis S, Panning B: Is the Combitube a useful emergency airway device for anesthesiologists ? *Anesthesia and Analgesia* 1999;88:233
10. Hartmann T, Krenn CG, Zoeggeler A, Hoerauf K, Benumof JL, Krafft P: The oesophageal - tracheal Combitube small adult. An alternative airway for ventilatory support during gynaecological laparoscopy. *Anaesthesia* 2000;55:670-675
11. Rumball CJ, MacDonald D. The PTL, Combitube, laryngeal mask, and oral airway: a randomized prehospital comparative study of ventilatory device effectiveness and cost-effectiveness in 470 cases of cardiorespiratory arrest. *Prehosp Emerg Care* 1997;1:1-10
12. Tanigawa K, Shigematsu A. Choice of airway devices for 12,020 cases of nontraumatic cardiac arrest in Japan. *Prehosp Emerg Care* 1998; 2: 96-100
13. Blostein PA, Koestner AJ, Hoak S. Failed rapid sequence intubation in trauma patients: esophageal tracheal combitube is a useful adjunct. *J Trauma* 1998; 44: 534-537
14. American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice guidelines for management of the difficult airway. *Anesthesiology* 1993; 78: 597
15. American Heart Association. Combination esophageal-tracheal tube. In *Guidelines for cardiopulmonary resuscitation and emergency cardiac care: recommendations of the 1992 National Conference of the American Heart Association*. *JAMA* 1992; 268: 2203
16. Doerges V, Sauer C, Ocker H, Wenzel V, Schmucker P. Airway management during cardiopulmonary resuscitation--a comparative study of bag-valve-mask, laryngeal mask airway and combitube in a bench model. *Resuscitation* 1999;41:63-69
17. Krafft P, Röggl M, Fridrich P, Locker GJ, Frass M, Benumof JL. Bronchoscopy via a redesigned Combitube in the esophageal position. A clinical evaluation. *Anesthesiology* 1997;86:1041-1045
18. Hoerauf KH, Hartmann T, Acimovic S, Kopp A, Wiesner G, Gustorff B, Jellinek H, Krafft P: Waste gas exposure to sevoflurane and nitrous oxide during anaesthesia using the oesophageal-tracheal Combitube small adultTM. *British Journal of Anaesthesia* 2001;86:124-126
19. Ochs M, Vilke GM, Chan TC, Moats T, Buchanan J. Successful prehospital airway management by EMT-Ds using the combitube. *Prehosp Emerg Care* 2000;4:333-337
20. Doerges V, Wenzel V, Sauer C, Schmucker P. Emergency airway management by non-anaesthesia house officers – a comparison of three strategies. *Emerg Med J* 2001;18: 90-94

Author Instructions

Manuscripts should be prepared according to the following instructions and sent to:

VICER, Editorial Department
DIFFICULT AIRWAY
P.O.Box 14
A-1097 Vienna
Austria
E-mail: office@vicer.org
Internet: <http://www.vicer.org>
FAX: +43-1-403 54 00

Type of manuscript submission.

Special Editorial Service (SES) to save time.

Please email the Editor-in-Chief your abstract only and we will let you know our editorial opinion in-between 4 days. This is our special service for scientists and clinicians to save time and also money for you.

Electronic submission (we would love to use this possibility).

The policy of our peer-reviewed Journal is quick and effective handling of manuscripts. Therefore, the Editor invites the author(s) to submit the manuscripts electronically written in WinWord 2.0 or higher (for IBM). Fonts are accepted only in ARIAL 11 point; margins should be 25 mm (1 in) all around. Please include tables in the WinWord program. Submit

figures as jpg-files or tif-files additionally. Please name the figures according to their appearance in the text with a number and the last name of the first author. Number pages consecutively beginning with the title page. Manuscript receipt will be acknowledged electronically within 2 weeks of arrival. Copyright form should be sent by separate mail.

Example: Text-file: schwarzenegger.doc (please include all figures and tables into the text by setting a table where you put the picture in)

If you have any further questions, please contact the Editorial Office via e-mail.

Classic submission.

Please submit four hard copies of the manuscript. All parts of the manuscript must be typed single-spaced on 216 x 279 mm (8.5 x 11 in) or 210 x 297 mm (A4) white paper (single-sided). Fonts are accepted only in ARIAL 11 point; margins should be 2.5 cm (1 in) all around. Number pages four copies must contain a complete set of photocopied tables, figure legends, and figures stapled to the end of the text. Please submit also a disc containing the text, tables (and figures) in the above mentioned format. Please send the disc also with the first submission, labeled with the name of the first author.

You personal preferences for handling the letter of receive.

Please mention in your cover letter if you want your letter of receive as email, fax, or regular mail. If you do not state this in your cover letter, we will send you an email. Thank you for your cooperation.

Guide for preparing your manuscript.

Please submit the articles (including Case Reports and Correspondence) in the following format:

A. Title page (Page 1). All submitted materials require a Title Page, including the corresponding author with mailing address, telephone, fax, and e-mail.

1. Limit the title to less than 200 characters.

2. List the name as followed: A Schwarzenegger, A Einstein

4. List all sources of financial support, including departmental or institutional funding. Please provide both the name and location of funding agency/source.

5. List all meetings at which the work has been presented, including meeting name, exact date (d/m/y), city, state, and country.

6. Type a 60 words summary statement to be printed in the Table of Contents.

8. Keywords: Please provide 5 to 10 key words.

B. Abstract (new page). Provide an abstract of no more than 250 words structured into: Background, Methods and Interventions, Results, and Conclusions. For review articles please use (Background, Data Collection and Conclusion).

C. Text.

The manuscript should be divided into four parts, each of them beginning on a new page:

1. Introduction. This should be limited to two pages.
2. Materials and Methods. Describe the methods, equipment, and techniques used, as well as the details of the protocol. A subsection entitled "Statistical Analysis" has to be included at the end of the Materials and Methods section.
3. Results. This section should follow the order mentioned in Materials and Methods.
4. Discussion. The discussion should focus on the findings of the current paper. This section should not exceed 5 pages.
5. References. Number references in the sequence as they appear in the text, please type reference numbers in parenthesis, e.g. (1-3). Use abbreviated titles of the medical journals as they appear in Index Medicus (see www.nlm.nih.gov/tsd/serials/lji.html). Please limit articles published without peer review, or material appearing in programs of meetings or in organizational publications to a minimum. Sites on the World Wide Web (URLs) may not be used as references. Abstracts, editorials, and letters used as references should be identified. Please provide four copies of accepted manuscripts "in press" and mark them as "in press" and the reference number.

Use the following formats for citations:**Journal:**

Anwar M, Younberg JA, Kaye AD. Effectiveness of air removal with a triple lumen central venous catheter. *Curr Opin Clin Exp Res* 2000;2:5-15

Book:

Hofbauer R, Frass M, Gmeiner, Kaye AD. Chemotaxis and Migration. VICER Publishing, Vienna, Europe, 2000.

Book Chapter:

Frass M: The Combitube: Esophageal/Tracheal Double Lumen Airway. In Jonathan L. Benumof (ed): Airway Management - Principles and Practice. Mosby, St. Louis, USA, 1996, pp 444-454

6. Tables. Number tables following the order of their appearance in the text (Table 1, etc.). Each table must have a title and should be typed on a separate page. The tables should be submitted within the text. Do not repeat information in a table that is already given in the text, and avoid tables when data can be reported in the text in a short way.

Illustrations.**a) Electronic submission.**

Include figures and table into the winword files and use the email submission or send us a CD-ROM.

If you have any further questions, please contact the Editorial Office via e-mail.

b) Classic submission.

Figures may not exceed 216 x 279 mm (8.5 x 11in) or 210 x 297 mm (A4) in size. Number figures consecutively in order of appearance (Figure 1, etc.). Submit four unmounted, untrimmed glossy prints or high-quality laser prints of each line drawing, graph, photograph, electron micrograph, x-ray, echocardiogram, etc.

Paste a label on the back of each illustration indicating figure number, first author's last name, and an arrow indicating the top. "Do not staple, clip, or write heavily on the back. The contents and lettering of the illustrations should be easily legible, even after being reduced for publication.

Supply a legend for each figure; all legends should be grouped on a single page or series of pages separate from the figures entitled "Figure Legends" and should be placed at the end of the manuscript.

Written permission has to be obtained from the author and publisher if any figure or table from a previously published document is used.

Additional Information.

Units of Measurement. Please use metric units. Molar units (e.g. mol/L or M) are preferable to mass units (e.g., mg/mL). The units for pressures are mmHg or cmH₂O.

Abbreviations. Please limit the number of abbreviations used to a minimum. Define all abbreviations except those approved by the International System of Units for length, mass, temperature, time, electric current, amount of substance, and luminous intensity. Please avoid to create new abbreviations for drugs, procedures, experimental groups, or substrates.

Drug Names and Equipment Please use generic names. If a brand name is used, insert it in parentheses after the generic name. For both drugs and apparatus, provide the name of the manufacturer, as well as city, state, and country.

Statistics. Statistical methodology has to be reported in detail. Please describe randomization procedures. The specify tests used to examine each part of the results are to be described. Care should be taken with respect to a) parametric vs. non-parametric data, b) corrections for multiple comparisons, and c) rounding errors. Variability should be expressed either as median +/- range (or percentiles) for nonparametric data, or mean +/- standard deviation (or confidence intervals) for normally distributed data. Standard errors may be used when appropriate.

Legal and Ethical Considerations.

Patient Identification Any data allowing identification of a patient must be avoided. A patient must not be recognizable in photographs unless written consent of the subject has been obtained and is provided at the time of submission.

Human Studies. Human studies must conform to ethical standards, and therefore be approved by the appropriate Institutional Review Board (IRB). A statement concerning IRB approval and consent procedures must appear at the beginning of the Methods section.

The Editors of DIFFICULT AIRWAY are concerned about appropriate informed consent. Authors may be questioned about the details of consent forms or the consent process. On occasion, the Editor-in-Chief may request a copy of the approved IRB application from the author. Lack of appropriate consent or documentation may be grounds for rejection.

Animal Studies. Experimental work on animals must conform to the Guiding Principles in the Care and Use of Animals as approved by the Council of the American Physiologic Society and published in their Guide for Authors (this can be found at <http://www.faseb.org/aps/guide.htm>).

Approval of the appropriate Institutional Animal Care Committee must be obtained, and a statement concerning such approval must be included at the beginning of the Methods section.

The Editors of DIFFICULT AIRWAY are also concerned about appropriate animal care and use. The Editor may request a copy of the approved Animal Care Committee application from the author. Inappropriate use of animals may be grounds for rejection.

Sponsorship and Conflicts of Interest. Authors have to clearly define all funding sources supporting the presented work including departmental, hospital, or institutional funds. All corporate sponsors must be identified, even if their support is indirect, e.g. to a local research foundation that funded the project. The authors must disclose any commercial associations that might pose a conflict of interest in connection with the work submitted for publication.

Divided Publications. DIFFICULT AIRWAY discourages authors from dividing the results of a single experiment into two or more separate papers .particularly when the parts are sent to different journals. Do not submit multiple small manuscripts; a single comprehensive paper is preferable. If the authors believe that subdivision is appropriate, or if multiple articles may result from the same study, the Editor-in-Chief should be notified. The Editor-in-Chief must be notified if another manuscript derived from the same experiment has been published previously, or has been submitted to another journal. Failure to provide such information may be grounds for rejection.

Editorial Policies.

Duplicate Publication. Submitted manuscripts must not have been published or submitted elsewhere for publication, in whole or in part. This also applies to electronic methods of publication.

It does not apply to abstracts of scientific meetings, If there are questions, contact the editorial office.

Data Analysis. All listed authors must have participated in the design, execution, and/or analysis of the work presented, and attest to the accuracy and validity of the contents. All persons or organizations involved in the work must be listed as authors or otherwise clearly acknowledged.

Check List/Cover Letter. The corresponding author must complete a Check List and sign a Cover Letter indicating that all authors agree to the contents of the submitted paper. These must accompany the submission. Forms can be found at the end of this guide. If the forms are not used, the wording of the letter must be identical. A second signed letter, containing the signatures of ALL authors, will be required for accepted manuscripts prior to publication.

Peer review. Manuscripts are reviewed to determine validity, significance, and originality. Authors are welcome to suggest the names of potential reviewers. Authors will be advised within a short time period of receipt regarding the decision reached. Delays are sometimes unavoidable; authors will be contacted when these occur.

Types of Papers.

Our journal published original articles, case reports, brief reports and reviews. All articles in the field of clinical experimental research, especially with clinical relevance and interdisciplinary approach are preferred. Structured abstracts are needed in all type of papers. The abstract must be max.250 words.

Author's Check List

COVER LETTER

stated how you want to get your letter of receive (email, fax, regular post)

CONFLICT OF INTEREST STATEMENT

Please make sure that all your paper is written in Arial 12, single lines.

Affiliations and Corresponding address, as well as Key Words has to be writing in Arial 10.

Make sure that you are writing your paper very exact to the sample layout you can find in the internet (www.vicer.org)

TITLE PAGE:

Brief Title

First letter of the first name, and last name of each author

Institutional affiliations for each author

Name, complete mailing address, phone, fax and email address of one corresponding author

Sources of financial support for the work

Individuals or organizations whose assistance is acknowledged

Abbreviated title (running head)

Key Words (5 to 10 Key words)

ABSTRACT (250 words):

Structured Abstract: original contribution (Background, Methods, Results, Conclusions)
Review papers (Background, Data Collection, Conclusion)

TEXT

Introduction

Materials & Methods

Statistics

IRB or IACC approval stated

Results

Discussion

ACKNOWLEDGEMENT – if there is anybody to be acknowledge

REFERENCES: Please be very precise in writing your references. All authors have to be stated, never "et. al." can be accepted. Please write very precise as stated into the author instruction.

Include by electronic submission TABLES and FIGURES by using a table function. Please provide your figure and table legends into a additional line of the table function. Please unmark border of the table which have to be used for including figures into the text.

COPIES OF ANY LISTED IN-PRESS PAPERS

© 2002 VICER, Vienna. All rights reserved

Cover Letter

Name of Corresponding Author:
(Address, phone, and email should be listed on the Title page of the paper)

VICER . Publishing
DIFFICULT AIRWAY
Editor-in-Chief
University Campus
Alser Str. 4 Building 1.15
A-1097 Vienna, Austria

Re (Title of Manuscript):

Dear Editor-in-Chief:
On behalf of my co-authors, I am submitting the enclosed material for possible publication in DIFFICULT AIRWAY.

It has not been submitted for publication nor has it been published in whole or in part elsewhere and in any other languages. In case we do not provide a translation we agree that VICER Publishing translate the article into a foreign language for their multilingual journal. I attest to the fact that all authors listed on the title page have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to DIFFICULT AIRWAY. Possible conflicts of interest, sources of financial support, corporate involvement, patent holdings, etc. for each author are disclosed on the attached Checklist or in an accompanying letter.
Copyright transfer and the signatures of all authors will be requested prior to publication of accepted manuscripts.

Signature Date
(of all authors)

Alternative:

The first author signs on behalf of all co-authors and has a written statement of all authors in his hands.
FIRST AUTHOR

Difficult Airway

Organ of the Viennese and International Clinical and Experimental Research Society

ISSN 1609-2961 =Difficult airway (Print)

ISSN 1609-297X =Difficult airway (Online)

Society of Viennese and International Clinical and Experimental Research

President: Roland Hofbauer

Vice-President: Bernhard Gmeiner

Board of Director: Michael Frass

Address: Alser Street 4, Building 1.15, University Campus, A-1090 Vienna, Europe.

Difficult Airway – Roland Hofbauer, Founding Editor

Publisher VICER Publishing

PO BOX 14

A-1097 Vienna, Europe

POSTMASTER

“Difficult Airway” is the official journal of the Society of Viennese and International Clinical and Experimental Research (VICER), and is published four times a year (one volume a year beginning in January) by VICER, P.O.Box 14, A-1097 Vienna, Austria and is a multidisciplinary journal in the field of cell Difficult Airway research, published in English only. Difficult Airway is a trademark of the Viennese and International Clinical and Experimental Research Society.

Subscription rates (private and institutional):

Print edition: 75,-EUR • 79,-USD per year.

Shipping: 16,-EUR • 19,-USD per year.

Online Subscription: 34,- EUR • 39,- USD per journal per year..

Online subscription for 3 VICER Journals: 51,- EUR • 55,- USD per year

Prices are subject to change.

Country of origin: Vienna (Europe) and Indianapolis (USA).

Address: VICER, Publication Department, P.O. Box 14, A-1097 Vienna, Austria

e-mail: vicer@vicer.org

Difficult Airway is on the internet: <http://www.vicer.org>

Whilst every effort is made by the publisher and the editorial board to see that no inaccurate or misleading data, opinion or statement appears in this Journal, they wish to make it clear that the data and opinions appearing in the articles herein are the responsibility of the contributor concerned. Accordingly, the publisher, the editorial committee and their respective employees, officers and agents accept no liability whatsoever for the consequences of any such inaccurate data, opinion or statement. Whilst every effort is made to ensure that drug doses and other quantities are presented accurately, readers are advised that new methods and techniques involving drug usage, and described within this Journal, should only be followed by conjunction with the drug manufacturer's own published literature.

Copyright 2002 Copyright VICER Publishing.

All rights of reproduction are reserved in respect of all papers, articles, illustrations, etc, published in this journal in all countries of the world.