Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Tracheal intubation with the Bonfils fiberscope in the difficult pediatric airway: a comparison with fiberoptic intubation

Jost Kaufmann[1,2], Michael Laschat[1], Thomas Engelhardt[3], Martin Hellmich[4] & Frank Wappler[1,2]

1 Department of Pediatric Anesthesiology, Children's Hospital of Cologne, Köln/Cologne, Germany
2 Department of Anesthesiology and Intensive Care Medicine, Witten/Herdecke University, Köln/Cologne, Germany
3 Department of Anaesthesia, Royal Aberdeen Children's Hospital, Aberdeen, UK
4 Institute of Medical Statistics, Informatics and Epidemiology, University of Cologne, Köln/Cologne, Germany

Keywords
airway management; Bronchoscopes; equipment; intubation; children; infants

Correspondence
Jost Kaufmann, Department of Anesthesiology and Intensive Care Medicine, University Hospital of Cologne, Kerpener Str. 62, D-50937 Köln/Cologne, Germany
Email: jost.kaufmann@uni-koeln.de

Section Editor: Charles Cote

Accepted 8 August 2014

doi:10.1111/pan.12523

Summary

Background: Fiberoptic intubation (FOI) is the gold standard for the tracheal intubation in adults with a difficult airway. However, this technique is more difficult in the narrow pediatric airway and the evaluation of alternative devices in children remains desirable. The Bonfils fiberscope (BF) is well described for the difficult airway, but no clinical data assessing its use in the difficult pediatric airway are available.
Methods: A controlled clinical study was conducted comparing BF and FOI in children and infants requiring tracheal intubation with a suspected difficult airway or who demonstrated a difficult airway which was unanticipated. Time to successful intubation, quality of imaging and ease of the intubation procedure were determined.
Results: A total of 26 patients (46% infants) were studied, and all successfully intubated at the first attempt using either the BF or FOI. Mouth opening was restricted in 38% of patients. Time required for intubation was shorter with the BF (52 ± 22 s) compared with the FOI (83 ± 24 s, $P = 0.008$). The image quality (excellent in 73% vs 45%, $P = 0.129$) and the ease of the procedure (excellent in 67% vs18%, $P = 0.015$) were considered better with BF than with FOI.
Conclusion: Although both the BF and FOI are suitable devices for the intubation of infants and children with difficult airways, the BF may allow faster tracheal intubation with a better image quality and ease of use.

Introduction

Difficulties with the pediatric airway are a leading cause for reported malpractice claims (1). The incidence of difficult direct laryngoscopy is lower in children than in adults, but almost 7 times greater in infants than in children more than 1 year old (2). In addition, the narrow pediatric airway makes the 'down-scaling' of adult recommendations and techniques more difficult (3). Whereas fiberoptic intubation (FOI) is the gold standard for the tracheal intubation in adults with difficult airways (4), the navigation of a pediatric fiberscope can be much more challenging (3). Therefore, the evaluation of alternative devices in children remains desirable.

The main advantages of the Bonfils fiberscope (BF) (steep learning curve, full visualization of intubation process, quick set-up and high transportability) are well established and have recently been reviewed (5). A particular advantage may be the reported shorter time required for tracheal intubation when compared with FOI (6) and is especially relevant in young children with their lower apnea tolerance.

The BF improves the laryngeal view compared with direct laryngoscopy and allows quick and safe tracheal intubation of children with normal airways (7).

© 2014 John Wiley & Sons Ltd

However, no clinical data assessing its use in children with difficult airways are currently available.

This controlled clinical study tested the hypothesis that children with difficult airways can be intubated faster with the BF than with the FOI without compromising the visual quality or ease of intubation procedure.

Patients and methods

Study population

All patients (<18 years) with a suspected difficult airway or who demonstrated a difficult airway which was unanticipated, requiring tracheal intubation for surgery at Children's Hospital in Cologne/Germany, were eligible for participation. Exclusion criteria were children requiring inotropic support, inadequate ventilation (facemask or laryngeal mask) or planned airway management using a supraglottic airway device only. Written informed consent was obtained from the parents or legal guardians prior to the enrollment of all children with known or suspected difficult tracheal intubation. IRB permitted retrospective consent for children presenting with an unexpected difficult intubation. Consent for study participation (and recording of additional outcome measures) was sought immediately after securing the airway.

Study design

The study was designed as a prospective, single-center comparison of the BF and FOI in children with an expected or unexpected difficult tracheal intubation. Only two experienced investigators conducted the tracheal intubations, both with regular and extensive experience of both devices of approximately 200 children per annum each. Randomization was rejected by the local IRB due to the inability to obtain prior written informed consent in children with an unanticipated difficult airway. However, as both intubation procedures were part of standard practice at this hospital, the IRB approved a comparison of procedures based on prospective case series following clinical routine—contingent on obtaining written informed consent in retrospect. Specifically, one of the two study investigators (J.K. or M.L.) was responsible for each given calendar day and known to all staff. This investigator was always immediately available throughout the day at all times with all necessary equipment prepared and ready to use.

All children were premedicated using oral midazolam and EMLA® cream to an appropriate site. Induction of anesthesia was performed intravenously or inhalational in case of difficult venous access. After successful 'test' facemask ventilation and 100% oxygen, all patients were paralyzed and total intravenous anesthesia was used for maintenance of anesthesia. Direct laryngoscopy was performed with Macintosh-shaped blades in appropriate sizes 3 min following muscle relaxation. Difficult intubation was defined as either a direct laryngoscopy Cormack and Lehane grade 3 or 4, or unsuccessful intubation attempts by the primary attending pediatric anesthesiologist, even under optimized conditions (e.g. positioning). Subsequently, the principal investigator was notified and attended immediately. Following confirmation of a difficult intubation (repeat direct laryngoscopy by the attending study investigator), the alternative intubation procedure using the BF or FOI was started. All patients were intubated during apnea after full oxygenation with sufficient ventilation.

Materials

The Bonfils Fiberscope (BF) is a semi-rigid optical stylet with a 40° distal curved tip and was available in two pediatric sizes (outer diameter of 2.0 and 3.5 mm; Karl Storz GmbH, Tuttlingen, Germany) (8). For FOI, two pediatric fiberscope sizes (outer diameter of 2.7 and 3.7 mm; Karl Storz GmbH, Tuttlingen, Germany) were used.

Intubation technique

The BF was prepared as described elsewhere (7) and armed with a tracheal tube of an appropriate size. The investigator placed a laryngoscope with his left hand into the mouth with the intention to provide a sufficient oral space and introduced the BF with his right hand. After oral suctioning, if required and visualization of the larynx, the BF was placed under continuous visualization into the middle of the trachea. While an assistant then fixed the tube, the BF was removed. Tracheal positioning was confirmed by bilateral auscultation and capnography.

The fiberscope was also armed with an appropriate tube. The bevel of the tube tip was positioned upwards, if an naso-tracheal intubation was intended and downwards for an oral intubation (9). The investigator introduced the intubating fiberscope. An assistant provided jaw thrust and stabilized the head. After passing the scope into the middle of the trachea, the tube was carefully advanced until entering the visual field. The fiberscope was removed from the tube and the position confirmed by bilateral auscultation and capnography.

© 2014 John Wiley & Sons Ltd

Outcome measures

The main outcome measure was the time required to successful intubation (TTI) and included time to best view (TTBV) and positioning of the tube (PT) (definitions see Figure 1). Secondary subjective outcome measures were image quality (judged as 'excellent', 'not perfect' or 'difficult to use') and the ease of the intubation procedure ('excellent', 'easy to perform' or 'feasible with some effort'). The characteristics of the difficult airway (underlying diagnosis, Cormack-Lehane classification and degree of restricted mouth opening (if less than 3 fingers of the patient) were noted. Additional anesthetic care data (administered drug doses, lowest oxygen saturation value, and first endtidal carbon dioxide value following intubation) as well as postoperative side effects (sore throat, stridor, and hoarseness) were recorded.

Sample size

Adult data suggested a 43% increased time for FOI (6), and therefore, 33 patients per group were required to detect a standardized effect of 0.7 = 69/98.8 (delta/sigma, (6)), with 80% power at two-sided alpha of 5%. To allow for protocol violations, a total of 35 patients in each group were planned to be recruited into this study.

Statistical analysis

Qualitative data were summarized by count and percentage, quantitative data by mean (standard deviation) or median (minimum to maximum), contingent on apparent skewness. Group differences between time measurements were evaluated by two-sample *t*-test and ANCOVA. The latter incorporated the propensity score for 'having been treated with FOI' (calculated from body weight, age, restricted mouth opening, investigator, and sex by multiple logistic regression) to adjust for lack of balance/randomization. Quality judgments were compared with Wilcoxon's rank sum test stratified by investigator (van Elteren test). $P < 0.05$ was deemed statistically significant. Analyses were performed using SPSS 21 (IBM Corp., Armonk, NY, USA) and Stata/SE 12.1 (StataCorp LP, College Station, TX, USA).

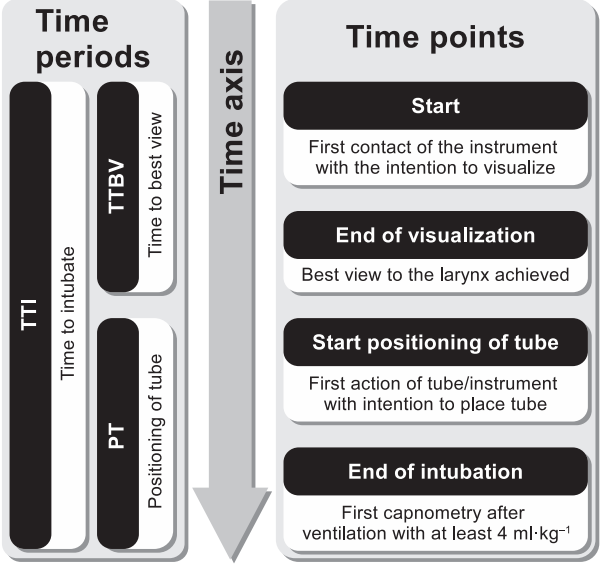

Figure 1 Protocol sequence and main outcome measure time definitions.

Results

Twenty-six patients were enrolled within the first 18 months of the study (Figure 2). Following a period of 4 month without any eligible patient, the feasibility to complete the study was reviewed. Following discussion with the IRB and to assess the quality of the observations obtained so far, an unplanned interim analysis was conducted. The results indicated a significant difference in the main outcome measure (*posthoc* adjustment for sequential monitoring using a Pocock-type boundary with two-sided level 2.46%), and permission was requested and obtained from the IRB to prematurely terminate this study.

A total of 26 patients were included in the final analysis. Almost one half of the patients (46%) were <1year of age, and 38% had a restricted mouth opening. All patients were easy to ventilate by facemask. Demographic data and the distribution of the characteristics of the difficult airway showed no differences between the study groups (Table 1).

All patients were successfully intubated using either the BF or FOI at the first attempt. The time required to obtain the best view on the larynx (TTBV) was comparable in both groups. The advancement of the tube and its positioning into the trachea (PT) were significantly shorter in the BF group than in the FOI group. As a result, a significant shorter time was required for the whole intubation procedure (TTI) when using the BF (Table 2, Figure 3). Regarding TTI, we found a significant 'quantitative' interaction of investigator and device, that is, the direction of the effect (in favor of BF) was equal, but size was different. There were no significant differences between the nasal or oral FOI regarding TTI.

The ease of intubation was rated as 'excellent' more often while using the BF, whereas the image quality did not differ between both devices (Table 3). The mode of induction of anesthesia (85% intravenously) or the

© 2014 John Wiley & Sons Ltd

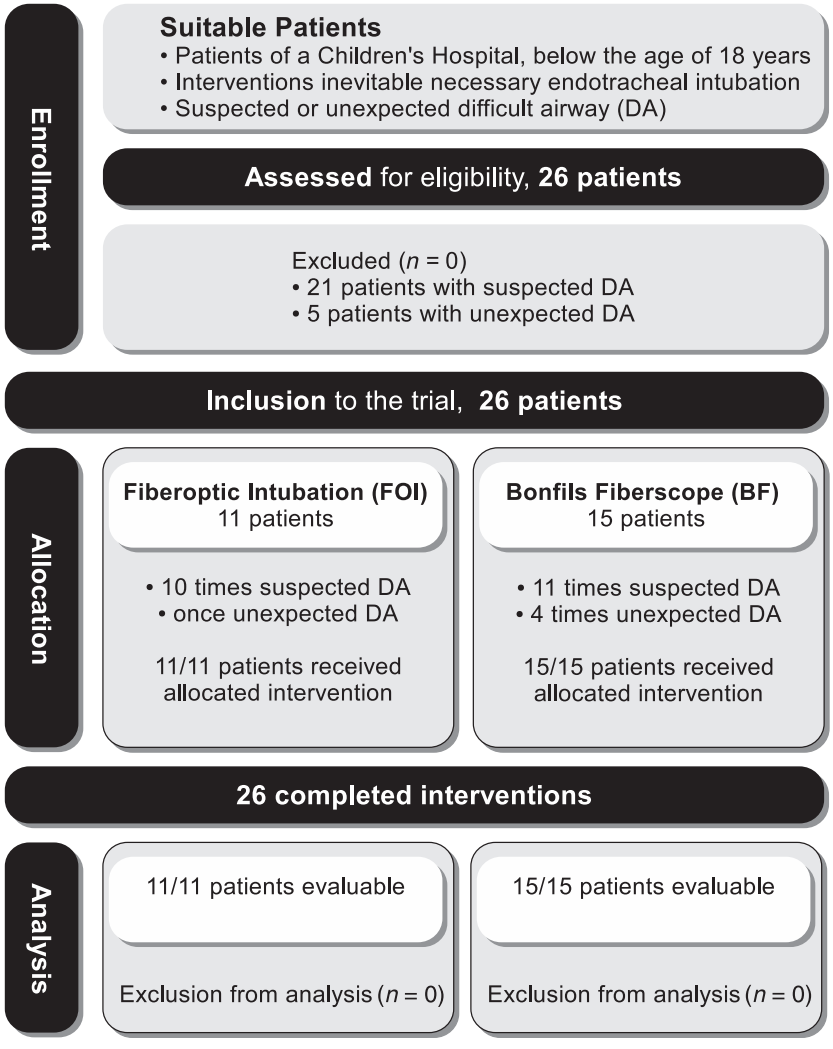

Figure 2 Study flowchart.

amount of drugs received did not differ between the groups.

Only one patient recorded a brief (seconds) desaturation below the 90% during an intubation with FOI without subsequent harm. This was due to accidentally lodging the tracheal tube in an arytenoid cartilage while advancing through the larynx. No differences in the average lowest oxygen saturation or first endtidal carbon dioxide values measured immediately after the first sufficient ventilation were observed. There were no postoperative side effects.

Discussion

This is the first controlled clinical study comparing the BF with FOI in children with difficult airways. It could be demonstrated that the BF and the FOI are both suitable devices for the tracheal intubation of infants and small children with difficult airways. A significant shorter time was required for the intubation using the BF when compared with FOI. Additionally, the ease of the intubation procedure was superior with the BF.

Fiberoptic intubation (FOI) is the gold standard for the tracheal intubation in adults with difficult airways. However, this technique is more difficult in the narrow pediatric airway (3). For example, the fiberscope may cause trauma of the pediatric airway as only the curvature of the tip is controlled, whereas the rest of the fiberscope may bend uncontrolled when advancing. In addition, the tip of the fiberscope needs to be placed into the trachea before the tube can be positioned there. Although the passing of the tube through the larynx is the most critical moment for potential failure and laryngeal injury (10), it cannot be visualized while the tip of the FOI is already placed in the trachea. Therefore, the evaluation of alternative devices overcoming these

© 2014 John Wiley & Sons Ltd

Table 1 Demographic data and characteristics of difficult airway

	FOI (n = 11)	BF (n = 15)
Investigator A (n)	6	5
Investigator B (n)	5	10
Male/Female (n)	6/5	6/9
Age (years, median (range))	1.7 (0–16)	3.3 (0–16)
Age <1 year (n)	5	7
Weight (kg, mean (range))	12.1 (2.9–36)	19.8 (2.1–60)
Weight <10 kg (n)	5	4
Underlying diagnoses (multiple nominations possible)		
Dysmorphic syndromes (8 patients), Epidermolysis bullosa (7), Cleft palate (4), Pierre-Robin-sequence (3), Metabolic syndromes (3), Mucopolysaccharidosis (2)		
Cormack-Lehane Grade		
1[a] (n)	1	1
2 (n)	–/–	–/–
3 (n)	4	8
4 (n)	6	6
P (van Elteren test[b]) for the difference between devices: P = 0.721		
Restricted mouth opening (n)	3	7
Of those: average mouth opening	1.3 cm	2.0 cm
DA expected (n)	10	11
DA unexpected (n)	1	4

FOI, Fiberoptic Intubation; BF, Bonfils Fiberscope; DA, difficult airway; SD, standard deviation.

[a]Difficult tube passage despite of good visualization due to oral tumor/palatal cleft.

[b]Stratified by investigator.

Table 2 Times (in seconds) by study groups

	FOI (n = 11)	BF (n = 15)	P-value[a]
TTBV [mean (SD)	23.5 (14.4)	26.6 (17.9)	0.638
min/max]	8.7/58.5	7.0/59.3	
PT [mean (SD)	59.6 (26.9)	25.6 (6.2)	<0.001
min/max]	20.4/93.9	14.0/36.0	
TTI [mean (SD) min/max]	83.1 (24.2)	52.2 (22.1)	0.008
	30.2/116.1	27.0/94.1	
TTI differentiated by Investigators (A), (B)			
(A) TTI [seconds, mean (SD)]	76.1 (30.1)	67.8 (24.1)	0.856
(B) TTI [seconds, mean (SD)]	91.5 (13.0)	44.4 (17.3)	<0.001
Interaction of investigator and device			0.038[b]
TTI with FOI differentiated by oral or nasal intubation (A), (B)			
(A) oral [n/mean (SD)]	6/88.0 (21.1)		
(B) nasal [n/mean (SD)]	5/77.2 (28.7)		0.491[c]

FOI, Fiberoptic Intubation; BF, Bonfils Fiberscope; TTBV, Time to best view; PT, Positioning of tube; TTI, Time to intubate; SD, Standard deviation.

[a]Maximum of t-test and ANCOVA (adjusted for propensity score for 'having been treated with FOI' (calculated from body weight, age, restricted mouth opening, investigator, and sex by multiple logistic regression).

[b]Two-way ANOVA.

[c]Two-sided t-test.

difficulties remains desirable and requires direct comparison to the FOI 'gold standard' for the difficult intubation of pediatric patients.

There are some well-known advantages of BF compared with other devices (e.g. fast set-up, very mobile, and steep learning curve) (5). However, a fundamental advantage of the BF is the continuous visualization of the advancement of the tube (due to the tip of the tube visibly positioned at the tip of the scope throughout the whole passage into the trachea). This appears to be particularly valuable in children with their narrow airways. It allows the tube to be positioned atraumatically into the larynx, where most FOI problems occur (10) and into the subglottic area, where injuries are more likely to happen (11).

The BF enables quick and safe tracheal intubation in children with normal airways (7). Previous contradictory observations (8,12) are likely due to a lack of sufficient oral space for the navigation of the BF and do not follow the recommendation of its inventor (13). This space is crucial to avoid contact of the mucosa, contaminating the lens and can be easily created by the additional use of a laryngoscope (5,7,14,15). It is not necessary to insert the entire laryngoscope blade but enough to provide a slight lift of the tongue. The introduction of about half the length of the blade into the mouth is often enough to permit safe navigation of the BF. This is possible even with a considerably restricted mouth opening as demonstrated in this study. The delicate navigation of the tube might be especially beneficial in children with epidermolysis bullosa, who frequently present with restricted mouth opening and are threatened by blistering caused by traumatic manipulation of the airway (16).

Another important, clinical benefit of the BF is the rapidity of the tracheal intubation even in difficult airways and is consistent with other reports (6). A quick tracheal intubation procedure is desirable especially in infants with a low apnea tolerance to avoid hypoxia (17). FOI in the preoxygenated apneic patient is the clinical practice of the investigators and others (18,19). FOI via a facemask can be difficult and time-consuming and the alternative FOI intubation via a laryngeal mask airway may not always be feasible (20). FOI via a laryngeal mask airway with intermittent ventilation/oxygenation is particularly useful if a sufficiently long apnea period is not possible in a small or compromised patient.

Although only two experienced investigators participated in this study the quick set-up of the BF as well as steep learning curve (5) may potentially make this technique attractive as a first alternative following failed ini-

© 2014 John Wiley & Sons Ltd

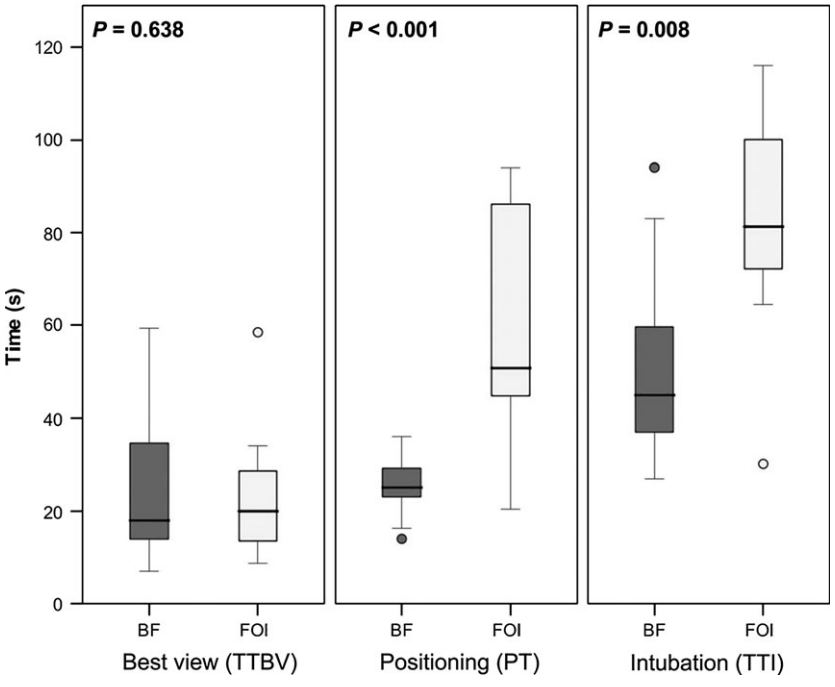

Figure 3 Time periods during intubation with BF or FOI. BF, Bonfils fiberscope; FOI, Fiberoptic Intubation; TTBV, time to best view; PT, Positioning of tube; TTI, time to intubate. The median is identified by a line inside the box, and the length of the box is the interquartile range (IQR). Values more than 1.5 IQR's but less than 3 IQR's from the end of the box are labeled as outliers (o). *P*-values = maximum of *t*-test and ANCOVA (adjusted for propensity score).

Table 3 Descriptive observances during the intubation procedure

	FOB (n = 11)	BF (n = 15)
Success at first attempt (n)	11	15
Lowest oxygen saturation		
[%, mean (SD)]	95.1 (10.0)	99.5 (1.1)
[%, min/max]	66/100	96/100
First endtidal CO_2 after Intubation		
[kPa, mean (SD)]	5.9 (1.6)	5.4 (1.2)
[kPa, min/max]	3.5/8.3	2.7/7.3
Image quality (n)		
1 = excellent	5	11
2 = not perfect	5	4
3 = difficult to use	1	0
P (van Elteren testa) for the difference between devices: P = 0.129		
Ease of Intubation (n)		
1 = excellent	2	10
2 = easy to perform	7	5
3 = feasible with some effort	2	0
P (van Elteren test[a]) for the difference between devices: P = 0.015		

FOI, Fiberoptic Intubation, BF, Bonfils Fiberscope, DA, difficult airway, SD, standard deviation.
[a]Stratified by investigator.

tial tracheal intubation attempts in the unexpected difficult airway even for less experienced operators (21). Basic tracheal intubation equipment such as a (video)-laryngoscope should always be available to provide sufficient lift of the tongue to navigate the BF even with restricted mouth opening.

FOI is essential in some clinical situations, such as naso-tracheal intubation, but requires maintenance of routine practice (21). It is of note that tracheal intubations with the BF also demand regular practice and the BF is, therefore, a valuable device only for operators, who can maintain sufficient experience with the device.

Study limitations

The inclusion of patients with unexpected difficult intubations made it impossible to randomize the intubation procedure. Consequently, following routine clinical practice, one investigator more often used BF and BF was also more often used in the unexpected difficult airway. However, we adjusted for the inevitable selection bias by taking a propensity score approach. Early termination of the study, primarily due to recruitment problems, lowered the power of the study. Although the subsequent interim analysis demonstrated statistically significant differences in the main outcome measures, it also resulted in a reduced precision of the estimated differences. Accordingly, an additional separate analysis of each of the two investigators of the TTI revealed a statistically significant difference in favor of BF for only one investigator and only a trend in the same direction for the other investigator. Nevertheless, both investigators consistently needed shorter time to intubate with BF. It is evident that the number of children with a difficult airway is low even in a large pediatric hospital and recruitment into a single-center study is difficult. However, publication of the currently largest study data still

© 2014 John Wiley & Sons Ltd

provides clinically useful information for the use of the BF in difficult tracheal intubation in children.

Conclusions

This study demonstrated that both the BF and the FOI are suitable devices for the tracheal intubation of infants and small children with difficult airways. We observed a significantly shorter time to intubation and easier intubation with the BF while maintaining or improving image quality. However, the advantage of a more rapid intubation and a fully visualized, atraumatic tracheal tube passage may make the BF preferable in some clinical situations. This study was also able to demonstrate that a restricted mouth opening does not preclude the successful use of the BF, as long as a sufficient oral space is provided. The BF will not be able to completely replace the FOI, but it is a valuable device for those operators, who can assure sufficient experience with both.

Ethical approval/Disclosure

This study was approved by the Ethics Committee (IRB) of the University of Witten/Herdecke, Germany (contact information: Ethics Committee of the University of Witten/Herdecke, Alfred-Herrhausen-Str. 50, Germany - 58448 Witten, http://www.ethik-kommission-uwh.de/Kontakt/kontakt.html) and registered at the International clinical trials register (ICTRP: Trial registry number DRKS00000715).

Acknowledgments

This research was carried out without funding.

Conflict of interest

No conflicts of interest declared.

References

1 Jimenez N, Posner KL, Cheney FW *et al*. An update on pediatric anesthesia liability: a closed claims analysis. *Anesth Analg* 2007; **104**: 147–153.
2 Heinrich S, Birkholz T, Ihmsen H *et al*. Incidence and predictors of difficult laryngoscopy in 11,219 pediatric anesthesia procedures. *Pediatr Anesth* 2012; **22**: 729–736.
3 Sunder RA, Haile DT, Farrell PT *et al*. Pediatric airway management: current practices and future directions. *Pediatr Anesth* 2012; **22**: 1008–1015.
4 Apfelbaum JL, Hagberg CA, Caplan RA *et al*. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. *Anesthesiology* 2013; **118**: 251–270.
5 Thong SY, Wong TG. Clinical uses of the Bonfils Retromolar Intubation Fiberscope: a review. *Anesth Analg* 2012; **115**: 855–866.
6 Rudolph C, Henn-Beilharz A, Gottschall R *et al*. The unanticipated difficult intubation: rigid or flexible endoscope? *Minerva Anestesiol* 2007; **73**: 567–574.
7 Kaufmann J, Laschat M, Hellmich M *et al*. A randomized controlled comparison of the Bonfils fiberscope and the GlideScope Cobalt AVL video laryngoscope for visualization of the larynx and intubation of the trachea in infants and small children with normal airways. *Pediatr Anesth* 2013; **23**: 913–919.
8 Bein B, Wortmann F, Meybohm P *et al*. Evaluation of the pediatric Bonfils fiberscope for elective endotracheal intubation. *Pediatr Anesth* 2008; **18**: 1040–1044.
9 Wheeler M, Dsida RM. UNDO your troubles with the tube: how to improve your success with endotracheal tube passage during fiberoptic intubation. *Anesthesiology* 2006; **104**: 378; author reply 379-380.
10 Johnson DM, From AM, Smith RB *et al*. Endoscopic study of mechanisms of failure of endotracheal tube advancement into the trachea during awake fiberoptic orotracheal intubation. *Anesthesiology* 2005; **102**: 910–914.
11 Holzki J, Laschat M, Puder C. Iatrogenic damage to the pediatric airway. Mechanisms and scar development. *Pediatr Anesth* 2009; **19**(Suppl 1): 131–146.
12 Houston G, Bourke P, Wilson G *et al*. Bonfils intubating fibrescope in normal paediatric airways. *Br J Anaesth* 2010; **105**: 546–547.
13 Bonfils P. Difficult intubation in Pierre-Robin children, a new method: the retromolar route. *Anaesthesist* 1983; **32**: 363–367.
14 Halligan M, Charters P. A clinical evaluation of the Bonfils Intubation Fibrescope. *Anaesthesia* 2003; **58**: 1087–1091.
15 Byhahn C, Nemetz S, Breitkreutz R *et al*. Brief report: tracheal intubation using the Bonfils intubation fibrescope or direct laryngoscopy for patients with a simulated difficult airway. *Can J Anaesth* 2008; **55**: 232–237.
16 Van den Heuvel I, Boschin M, Langer M *et al*. Anesthetic management in pediatric patients with epidermolysis bullosa- A single center experience. *Minerva Anestesiol* 2013; **79**: 727–732.
17 Engelhardt T, Weiss M. A child with a difficult airway: what do I do next? *Curr Opin Anaesthesiol* 2012; **25**: 326–332.
18 Wheeler M, Roth AG, Dsida RM *et al*. Teaching residents pediatric fiberoptic intubation of the trachea: traditional fiberscope with an eyepiece versus a video-assisted technique using a fiberscope with an integrated camera. *Anesthesiology* 2004; **101**: 842–846.
19 Kim SH, Woo SJ, Kim JH. A comparison of Bonfils intubation fiberscopy and fiberoptic bronchoscopy in difficult airways assisted with direct laryngoscopy. *Korean J Anesthesiol* 2010; **58**: 249–255.
20 Walker RW, Ellwood J. The management of difficult intubation in children. *Pediatr Anesth* 2009; **19**(Suppl 1): 77–87.
21 Weiss M, Engelhardt T. Proposal for the management of the unexpected difficult pediatric airway. *Pediatr Anesth* 2010; **20**: 454–464.

© 2014 John Wiley & Sons Ltd

Copyright of Pediatric Anesthesia is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.