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Original Article

The Parker Flex-Tip™ tracheal tube makes endotracheal intubation with the Bullard laryngoscope easier and faster

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Summary

Background: The Bullard laryngoscope can be useful in management of difficult airway. When the endotracheal tube is advanced over the original Bullard laryngoscope stylet, the endotracheal tube sometimes makes contact with structures around the vocal cords, especially the right arytenoids. A similar problem also occurs with flexible fibreoptic intubation and it has been shown that use of the Parker Flex-Tip™ tube usually resolves the problem. In this study we tested our hypothesis that use of the Parker Flex-Tip™ tube might improve endotracheal tube passage with the Bullard laryngoscope. *Methods:* Forty patients scheduled for elective anaesthesia were randomly assigned into group ST (standard tube) or Group PT (Parker Flex-Tip™ tube). The time taken to achieve successful endotracheal tube placement after obtaining the best laryngeal view, the number of attempts at intubation and the incidences of successful intubation at first attempt and of re-direction of the Bullard laryngoscope during intubation were recorded. Unpaired t-test and χ^2-test were employed and $P < 0.05$ was considered significant. *Results:* Use of the Parker Flex-Tip™ tube reduced the time required for successful endotracheal tube placement after the best laryngeal view was obtained from 14 ± 6 to 6 ± 2 s ($P < 0.01$). It also reduced the incidence of requirement for re-direction of the Bullard laryngoscope during intubation from 10/19 to 1/19 ($P < 0.01$). The incidence of successful intubation at the first attempt (18/19 vs. 15/19) was higher in the PT group but the difference was not statistically significant. *Conclusions:* During intubation with the Bullard laryngoscope, use of the Parker Flex-Tip™ tube is associated with more rapid success and a lower incidence of re-direction of the Bullard laryngoscope during endotracheal intubation when compared to a standard endotracheal tube.

Keywords: LARYNGOSCOPES, Bullard laryngoscope; INTUBATION INTRATRACHEAL.

Introduction

The Bullard laryngoscope (BL) can be useful in management of the difficult airway. It often enables tracheal intubation under vision in patients in whom this had not been possible with the Macintosh laryngoscope [1]. In comparison with the blind use of stylets and introducers with the Macintosh laryngoscope, the BL facilitates fast, less-traumatic tracheal intubation [2] under vision because of the anatomical shape of the blade and transfer of the proximal end of the line of sight of the larynx from the maxillary teeth to the laryngopharynx so that displacement of the tongue is not necessary. Its rigidity allows rapid control of the position of the tip of the laryngoscope. Passage of the endotracheal tube (ETT) from the stylet is an integral part of the laryngoscope design and intubation technique. However, when the ETT is

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advanced with the original stylet (standard introducing stylet), it sometimes impinges on laryngeal structures around the vocal cords. Many techniques have been advocated to make intubation with the BL easier [3–11]. The Parker Flex-Tip™ tube (PT) has a tapered fountain pen-shaped tip, which is designed to glide past obstructions and pass easily through the glottis (Fig. 1). A recent study demonstrated that use of the PT results in a significantly lower incidence of repositioning and repeated attempts when oral flexible fibreoptic intubation is performed. This success is attributed to the minimal gap between the ETT tip and the fibre insertion cord so that there is little chance for the ETT to impact the vocal cords [12]. In this study we tested our hypothesis that the PT could improve the reliability of ETT passage with the BL.

Methods

The protocol was approved by the Clinical Research Committee of our institution, and written informed consent was obtained from 40 unpremedicated ASA I or II, adult patients, scheduled for elective surgery, who required a general anaesthetic with endotracheal intubation. Patients with known pathology or previous surgery to the mouth, pharynx, larynx or cervical spine were excluded. Mallampati classification without phonation and thyromental distance were evaluated before surgery and recorded in all patients. Three anaesthesiologists (AS, AT, NA), who are skilled in endotracheal intubation with the BL, performed all intubations in order to eliminate a learning process bias.

The two ETTs compared were a standard tube (ST) (7.5 mm ID, 10 mm OD; Fuji Systems, Tokyo) and a PT (7.5 mm ID, 10 mm OD; Parker Medical, Englewood, CO). Both tubes have high-volume, low-pressure cuffs. Patients were randomly assigned into two groups, the ST group and the PT group, immediately prior to induction determined by sealed envelope technique.

The standard introducing stylet for the BL was used, and the ETT was backloaded over the lubricated stylet. The distal end of the stylet was passed through the Murphy eye of the ST as instructed in the manufacturer's manual. The stylet was passed through only the central lumen and not through the side holes of the PT.

The prepared stylet was then attached to the BL, and the BL and ETT were kept warmed until use. Before intubation, the BL was connected to a video camera, monitor and hard disk drive (HDD) recorder in order to store a visual record.

Unpremedicated patients were placed in the supine, neutral neck position with a U-shaped pillow and then they breathed 100% oxygen for 3 min. Induction of anaesthesia was performed with propofol (1.5–2.0 $\mu g\,kg^{-1}$) and fentanyl (1 $\mu g\,kg^{-1}$) intravenously. After loss of consciousness, confirmed by loss of eyelid reflex, positive pressure mask ventilation was initiated. Anaesthesia was then maintained with sevoflurane (3–5%) with oxygen. Once adequate mask ventilation was established, vecuronium (0.1 $\mu g\,kg^{-1}$) was administered. After complete paralysis developed, as determined by a peripheral nerve stimulator, the BL without the blade extender was passed into the oropharynx and, after optimal visualization of the vocal cords located in the centre of the field of view was achieved, the ETT was advanced from the stylet and tracheal intubation was completed.

The position of the ETT tip in relation to the laryngeal structures just before the ETT passed between the vocal cords was recorded on a diagram of the clock face similar to the one described previously [13].

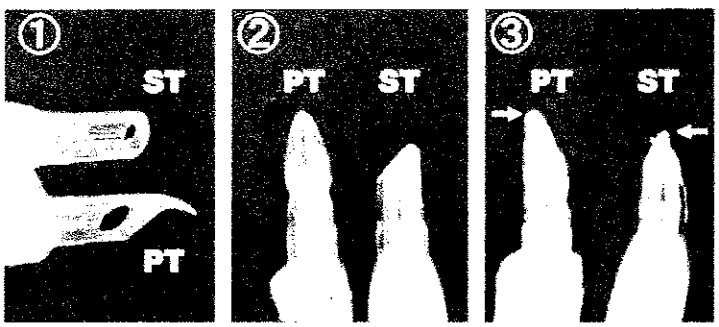

Figure 1.
The tip difference between the Parker tube and Standard tube: ① lateral view; ② top view; and ③ top view with the standard Bullard stylet. Arrow indicates stylet tip. The stylet lies entirely within the lumen of the PT but the tip passes through the Murphy eye of the ST to lie lateral to the tip. (PT: Parker tube; ST: Standard tube).

When the ETT tip touched or was impeded by laryngeal structures, or any abnormal resistance was felt by the operator, the tube was withdrawn to the initial position (for the ST group, the Murphy eye could not be passed through the stylet during withdrawal) and fine adjustment of the BL position was made to improve ETT direction towards the glottis.

When any of the following situations occurred, the BL was removed and mask ventilation employed: (1) intubation had not been achieved after three adjustments of the BL position; (2) the ETT could not be positioned in the trachea within 60 s of the BL entering the oral cavity; and (3) S_PO_2 dropped below 95% during the procedure. Under these situations, the ETT and stylet were again attached as in the initial set-up and the procedure was counted as one tracheal intubation attempt. If intubation was not achieved within three attempts, the operator was allowed to choose a different intubation technique, and those cases are excluded from the analysis.

The video record of the procedure recorded in the HDD was analysed after surgery. Both the time from the blade entering the oral cavity until the best laryngoscopic view (T1) and the time to complete the tube placement after achieving the best laryngeal view (T2) were obtained, and the total time for intubation (T3) was the sum of T1 and T2. The number of intubation attempts and adjustments made was counted. The incidence of the ETT tip touching or meeting resistance from the vocal cords or other laryngeal structures was counted.

After the operation, all patients were asked to phonate and to report if they had a sore throat or hoarseness.

Data are expressed as mean ± SD unless otherwise noted. Unpaired *t*-test and χ^2-test were employed where appropriate to examine the difference between the groups. A value of $P < 0.05$ was considered statistically significant.

Results

Two patients who required more than three attempts to complete intubation were excluded from the analysis. One was from the group ST and had poor visualization as a consequence of excessive saliva secretion, and the other, from the group PT, required the blade extender to achieve intubation with the BL. No significant differences were found between the groups regarding age, sex, ASA class, height, weight, Mallampati class and thyromental distance (Table 1).

Table 1. Patient characteristics.

	Standard tube ($n = 19$)	Parker tube ($n = 19$)
Age (yr)	52 ± 21	52 ± 14
Gender (M/F)	9/10	10/9
ASA Grade (I/II)	11/8	10/9
Height (cm)	159 ± 9	161 ± 11
Weight (kg)	59 ± 11	59 ± 12
Mallampati Class (I/II/III)	3/15/2	2/13/4
Thyromental distance (cm)	8.0 ± 1.1	7.8 ± 0.9

Data are presented in mean ± SD or numbers of patients.

Although the time to obtain the optimal laryngeal view (T1) was similar in both groups, the time to place the ETT after best visualization of glottis (T2) was significantly shorter in the PT group. The total time to position the ETT (T3) was less in the PT group, but the difference was not statistically significant (Table 2).

The higher success rate of ETT placement at the first attempt (without additional adjustment of the BL position) in the PT group was statistically significant. The lower incidence of the ETT touching the vocal cords or other laryngeal structures in the PT group was also statistically significant. Examination of ETT tip position just prior to intubation in the video showed that in the PT group there was no arytenoid contact, but that in one case the left vocal cord was touched (Fig. 2). In one case in which the ETT tip passed between the vocal cords, the BL was removed as a consequence of timeout (>60 s) criteria, because further tube advancement was difficult since the ETT made contact with the right vocal cord and the operator felt an abnormal resistance. A similar situation happened once in the ST group. In another nine cases in the ST group, the tube tip made contact with the right arytenoid. This is similar to the results from previous investigators who showed that in most cases, the ETT was directed to between 3 and 6 h of a clock face [13]. However, in most cases, the ETT was passed into the trachea at first intubation attempt with fewer than three adjustments of the BL position and there were no significant differences between the groups (Table 2). The incidence of postoperative sore throat and hoarseness was lower in the PT group, but the difference was not statistically significant. Every symptom disappeared within 48 h.

Discussion

Our results show that use of the PT improves the reliability of ETT placement in the trachea when

Table 2. Tracheal intubation results.

	Standard tube ($n = 19$)	Parker tube ($n = 19$)	P
Successful intubation at very first attempt (without adjustment of Bullard laryngoscope position)	9	18	0.001
Success at first tracheal intubation attempt (within three adjustments of the Bullard laryngoscope position)	15	18	0.1
T1 (Time to obtain the best laryngeal view) (s)	24 ± 12	25 ± 14	0.88
T2 (Time to place the tube after best laryngeal view obtained) (s)	14 ± 6	6 ± 2	0.0006
T3 (Total time to complete tube placement; T1 + T2) (s)	39 ± 15	32 ± 16	0.28
Frequency of tracheal tube impingement	10	1	0.003
Number of intubation attempts	1.4 ± 0.8	1.1 ± 0.3	0.1
Postoperative sore throat	12/19	9/19	0.3
Postoperative hoarseness	12/19	6/19	0.1

Data are presented in mean ± SD or numbers of patients.

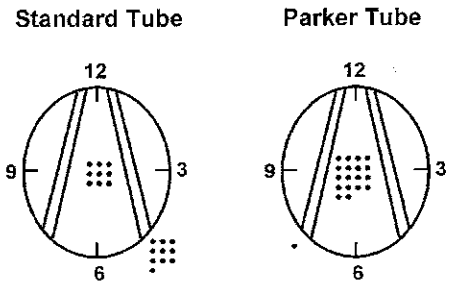

Figure 2.
Distribution of the tube tip positions in relation to the vocal cords. The numbers refer to those on a clock face. Each dot indicates an individual case.

the BL is used with the standard introducing stylet. The incidence of success at first intubation attempt was significantly higher, with less impingement of the tip around the vocal cord. Although it took a similar time to get an optimal laryngeal view (T1) in both the groups, the tube passed more quickly (T2) in the PT group when compared with the ST group. The two ETTs that were compared have the same internal and external diameters, are made of the same material (poly vinyl chloride) and have identical pre-formed curvatures. Therefore, the differences in tip design must be responsible for the improved ETT passage. Similar results have been found with the LMA Fastrack™ Endotracheal Tube [3].

Problems as a consequence of the ETT tip striking the vocal cords or other laryngeal structures when the ETT is advanced from the BL into the trachea have been reported. Mounting the ETT on the stylet with the bevel facing right (reversed bevel) has been suggested as a method of preventing this problem [9]. However, it is often difficult to mount the ETT on the BL stylet in this manner. In addition, when the ETT has been mounted in reversed bevel position, it starts to rotate to an undesirable direction as it is advanced off the stylet. Although rotation of the ETT on the stylet as it is advanced has also been suggested [8], fine adjustment of ETT rotation is difficult because of the shape of the stylet. The torque applied to the proximal end does not transmit well to the distal end of the ETT. Our results show that selection of the PT is an easier solution to this ETT advancement problem.

A recent study revealed that the right arytenoid frequently prevents passage of the standard ETT into the trachea during flexible fibreoptic intubation [14]. Use of the PT was associated with a higher incidence of initial successful passage of the ETT during flexible fibreoptic intubation [12]. Our results also show that the most frequent site of obstruction of passage of the standard ETT during intubation with the BL is at the right arytenoid and lies between 4 and 5 h on the clock face.

Although the different tip designs did not result in statistically significant differences in the incidence of hoarseness and sore throat, a lower incidence was observed in the PT group. A larger study would be needed to determine whether this is actually the case. Multiple intubation attempts in the difficult airway can cause bleeding or oedema and may further compromise the airway. Thus, use of the PT with the BL to reduce the number of intubation attempts is recommended.

This study compared the PT with the manufacturer's recommended technique of ST passage. However, an unavoidable limitation of the study design concerns maintenance of the stylet position in relation to the Murphy eye during intubation attempt. Once the tube was advanced from the stylet and failed to be placed, the stylet cannot be returned through the Murphy eye any more but contained within the tube during the following

adjustment. When the stylet is in this position, the tube tip will be located further to the right and the risk that it will impinge on the right arytenoids will be greater. Further changes of BL direction will then be required in order to pass the tube. Thus, altered set up of the stylet on the Bullard in our study may affect the result. We used the Murphy eye, aiming for easier intubation as proven in Kato and colleague's [9] work, although some authors suggest that it should not be used. Passage of the stylet through the Murphy's eye remains a controversial issue. Further studies to compare the PT with other techniques of passing the ST with the BL, which include the position of the stylet in relation to the Murphy eye, are needed. Also, further research should be undertaken in patients with difficult airways since this study only investigated patients with normal airways.

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References

1. Mendel AP, Bristow A. Anaesthesia for procedures on the larynx and pharynx. The use of the Bullard laryngoscope in conjunction with high frequency jet ventilation. *Anaesthesia* 1993; 48: 263–265.
2. Wahlen BM, Gercek E. Three-dimensional cervical spine movement during intubation using the Macintosh and Bullard laryngoscopes, the bonfils fibrescope and the intubating laryngeal mask airway. *Eur J Anaesthesiol* 2004; 21: 907–913.
3 Suzuki A, Tampo A, Abe N *et al.* The LMA Fastrack™ Endotracheal Tube facilliates use of the Bullard laryngoscope. *Anesth Analg* 2007; 104: 1307
4. Karsnelson T, Farcon E, Schwalbe SS, Badola R. The Bullard laryngoscope and the right arytenoid. *Can J Anaesth* 1994; 41: 552–553.
5. Hikawa Y, Maeda M, Tanaka N *et al.* Use of Bullard intubating laryngoscope in emergency room. *Masui* 1994; 43: 1761–1765.
6. Miyazawa N, Shigematsu T, Kaneko S *et al.* A new method for endotracheal intubation with the Bullard laryngoscope. *Masui* 1992; 41: 263–269.
7. Baraka A, Muallem M, Sibai AN. Facilitation of difficult tracheal intubation by the fiberoptic Bullard laryngoscope. *Middle East J Anesthesiol* 1991; 11: 73–77.
8. Cooper SD, Benumof JL, Ozaki GT. Evaluation of the Bullard laryngoscope using the new intubating stylet: comparison with conventional laryngoscopy. *Anesth Analg* 1994; 79: 965–970.
9. Katoh H, Nishiyama J, Takiguchi M *et al.* A better method to attach an endotracheal tube to the stylet of the Bullard laryngoscope. *Masui* 1993; 42: 237–241.
10. Shulman GB, Connelly NR, and Gibson C. The adult Bullard laryngoscope in paediatric patients. *Can J Anaesth* 1997; 44: 969–972.
11. Ringwalt EC. Use of a guide wire to facilitate tracheal intubation with the Bullard laryngoscope. *Anesthesiology* 1998; 89: 805.
12. Kristensen MS. The Parker Flex-Tip tube versus a standard tube for fiberoptic orotracheal intubation: a randomized double-blind study. *Anesthesiology* 2003; 98: 354–358.
13. Shigematsu T, Miyazawa N, Kobayashi M, Yorozu T, Toyoda Y, Morisaki H. Nasal intubation with Bullard laryngoscope: a useful approach for difficult airways. *Anesth Analg* 1994; 79: 132–135.
14. Johnson DM, From AM, Smith RB, From RP, Maktabi MA. Endoscopic study of mechanisms of failure of endotracheal tube advancement into the trachea during awake fiberoptic orotracheal intubation. *Anesthesiology* 2005; 102: 910–914.