Endotrol tracheal tube and McGrath Mac are an effective combination for oral tracheal intubation

ABSTRACT

Background: Tracheal intubation using the 2nd-generation video laryngoscope sometimes cannot be performed easily because there is no functional endotracheal tube (ETT) guide. Therefore, a rigid stylet is often required during tracheal intubation. The Endotrrol® tracheal tube (Endotrrol) is a single use ETT that whole tube can be bent and slide easily into the trachea. We studied the intubation ease of a combination of an Endotrrol and the McGrath® video laryngoscope (McGrath), which is one of the 2nd-generation video laryngoscopes.

Methods: Sixty adult patients under general anesthesia were randomized into three groups: Group A: McGrath with Endotrrol, B: McGrath with a rigid stylet attached ETT, and C: Direct laryngoscope with an ETT. The primary outcome measure was intubation time. Secondary outcomes were the number of insertion attempts required and the number of patients who complained of a sore throat after the procedure. The level of significance for each test was set at \( P < 0.05 \).

Results: Intubation time (median [range] in seconds) was shorter in Group A (32 [27–54]) than Group B (37 [27–49]) and C (37 [27–50]) \((P = 0.01\) for both comparison). There was no significant difference among groups for the number of insertion attempts required. The number of patients with a sore throat was lower in Group A (0) than Group B (5) and C (6) \((P = 0.02\) and 0.01, respectively).

Conclusion: A combination of an Endotrrol and a McGrath is effective for shortening intubation time and avoiding sore throats.

Key words: Endotracheal tube; tracheal intubation; video laryngoscope

Introduction

Many types of video laryngoscopes have been used worldwide. The use of a video laryngoscope is reported to reduce the failure rate of intubation. McGrath® video laryngoscope (Medtronic Japan, Tokyo, McGrath), which is one of the 2nd-generation video laryngoscopes, is said to be effective for several clinical situations, such as operation room, intensive care unit, and emergency room. However, the tracheal tube using the McGrath sometimes cannot be inserted easily because the McGrath does not have an endotracheal tube (ETT) guide function. Therefore, we often insert a rigid stylet in the tracheal tube during tracheal intubation.

The Endotrrol® tracheal tube (Medtronic Japan, Tokyo, Endotrrol) [Figure 1] is a single ETT that can provide directional tip control by pulling the ring loop. Previously, researchers have reported that the Endotrrol is effective for nasotracheal intubation. Therefore, even if we do not use a rigid stylet during tracheal intubation, the Endotrrol may be able to be
general anesthesia was induced with fentanyl 1–2 µg/kg and propofol 1–2.5 mg/kg and neuromuscular blockade was achieved with rocuronium 0.6–0.9 mg/kg. After rocuronium injection, adequate neuromuscular block was checked with neuromuscular monitor. Then, the grade of Cormack–Lehane was firstly measured by the direct laryngoscope for all patients before the intubation, and then, the trachea was intubated by the attending anesthesiologists. The anesthesiologist had >5 years’ clinical experience and was accustomed to handling Endotrol. The patients were randomly allocated to one of three groups. In Group A, a McGrath with an Endotrol was used. In Group B, a McGrath with a rigid stylet (Shiley™ Intubating Stylet, Medtronic Japan, Tokyo) attached ETT was used, and in Group C, direct laryngoscopy (Macintosh Laryngoscopy, Intersurgical Japan, Tokyo) with an ETT (Mallinckrodt Tracheal Tube, Medtronic Japan, Tokyo) was performed. The group allocation was concealed in sealed opaque envelopes that were opened after enrollment of the patients. The size of the ETT was planned as 7.0 and 8.0 mm internal diameter ETT for male and female study population, respectively.

Anesthesia was maintained with desflurane 4%–6% in 40%–60% oxygen with air and remifentanil 0.05–0.2 µg/kg/min. Rocuronium 0.1–0.2 mg/kg was given at the discretion of the anesthesiologists. Additional boluses of fentanyl 50 µg were administered to maintain blood pressure or heart rate values within 30% of the first vital signs the patients had when first entering the operation room.

At the end of the surgery, the patient was checked for a response to verbal commands and the trachea was extubated. The patient was transferred to the recovery room. When the exit criteria score increased to over 8 points using the Aldrete Score, the patient was shifted to the ward.

The primary outcome measure was intubation time. Secondary outcomes were the number of insertion attempts required and the number of patients who complained of a sore throat after the procedure.

The intubation time was measured by other anesthesiologists from first taking hold of the Endotrrol to detection of CO₂ on the capnogram. When the number of intubation attempts went over three or the value of the pulse oximeter was less 97%, the intubation was performed by an alternative method such as others types of video laryngoscopes or bronchofiberscopes. Assessment for sore throats was performed by complaint of patient at 1 postoperative hour.

Methods

Patients and design
This prospective study was approved by the Showa University Hospital Institutional Review Board (approval number 1785) and was registered at the University Hospital Medical Information Network (UMIN ID number 000020079). From December 2015 to November 2016, American Society of Anesthesiologists physical status 1 and 2, 60 adult patients who were scheduled to undergo general anesthesia with orotracheal intubation were recruited to participate in the study. All patients gave written informed consents to this study.

The exclusion criteria were an inability to cooperate, inability to communicate, and already intubated patients. Furthermore, we excluded the patients who could expect difficult mask ventilation and intubation.

Perioperative anesthesia
After entering an operation room, each patient was monitored to electrocardiogram, oxygen saturation, and intermittent blood pressure. After the preoxygenation, inserted easily. Therefore, a combination of an Endotrrol and a McGrath may provide an accurate and safe method of intubation.[10] We studied the efficacy of a combination of an Endotrrol and a McGrath.

Figure 1: Endotrrol® tracheal tube (Medtronic Japan, Tokyo, Endotrrol). (a) Endotrrol is a single endotracheal tube. (b) Endotrrol can provide direction tip control by pulling the ring loop (white arrow)
Statistical analysis

JMP® Pro software version 12.2.0 (SAS Institute, Cary, NC, USA) was used to test the normality of the data. The measured data were compared by using the Kruskal–Wallis test and $\chi^2$ test for all groups. The intubation time and number of attempts were compared using the Kruskal–Wallis test for pairwise comparisons. The number of sore throats was compared using the Fisher’s exact test. We performed statistical analysis in 1 week after the clinical study.

According to a preestablished analysis plan with Group A, a McGrath with an Endotrol was intubated ($n = 10$), the required sample size was calculated. Taking the intubation time with standard deviation 20 s, for a 10 s difference in the intubation time at an $\alpha$ error of 5% and a $\beta$ error of 0.2, a total sample size of 34 patients would be required (17 in each group of the two groups). Considering this fact, we planned to enroll 60 patients (20 in each of the three groups) to take into account any cases of withdrawal.

Results

All patients were included in this study [Figure 2]. Patients’ characteristics and other factors were similar across the groups [Table 1]. Intubation time (median [range] in seconds) was shorter in Group A (32 [27–54]) than Group B (37 [27–49]) and C (37 [27–50]) ($P = 0.01$ for both comparison) [Figure 3]. The difference in the number of intubation attempts (average) was not significant among the groups (Group A: 1.2, Group B: 1.2, Group C: 1.0) ($P = 0.2$ and 0.1, respectively). The number of patients with a sore throat was significantly lower in Group A (0) than Group B (5) and C (6) ($P = 0.02$ and 0.01, respectively).

Table 1: Patients’ characteristics and other factors. Data are expressed as median (range)

|                      | Group A ($n=20$) | Group B ($n=20$) | Group C ($n=20$) |
|----------------------|-----------------|-----------------|-----------------|
| Age (years)          | 46 (34–78)      | 51 (21–71)      | 52 (26–76)      |
| Gender (M/F)         | 9/11            | 2/18            | 6/14            |
| Bmi (kg/m²)          | 21.2 (15.1–32.3)| 21.8 (16.8–26.1)| 21.8 (17.9–35.2)|
| Neck circumference (cm)| 35.0 (31.5–47.0)| 34.8 (30.8–46.9)| 34.5 (31.8–43.5)|
| Thyromental distance (cm) | 6.5 (5.8–7.8) | 6.3 (4.8–7.8) | 6.4 (5.1–8.4) |
| Asa (1/2)            | 12/8            | 14/6            | 10/10           |
| Number of attempts (1/2/3) | 17/3/0       | 17/3/0          | 20/0/0          |
| Cormack lehane (1/2/3) | 20/0/0        | 20/0/0          | 19/1/0          |
| An amount of fentanyl ($\mu$g) | 200 (100–300) | 200 (100–400)  | 150 (100–300)  |
| An amount of remifentanil (mg) | 0.2 (0.1–0.35) | 0.2 (0.1–0.6) | 0.25 (0.1–0.6) |

Figure 2: Flowchart of this study
Discussion

We have shown that a combination of an Endtrol and a McGrath is effective for shortening intubation time and avoiding sore throats. Our results are different from a study done by Cattano et al.[11] They studied the performance of anesthesiology residents, while this study was of attending anesthesiologists, who may be more accustomed to handling ETTs.

The EndoFlex tube (Merlyn Associates, Tustin, CA, EndoFlex) featuring a flexible tip is very similar to Endtrol. EndoFlex has been reported to be effective for not only oral intubation, nasal intubation, and predicted difficult intubation but also for intubation during cervical spine immobilization even when there is a difficult to access airway.[12‑16] The tip flexibility allows it to negotiate the glottis easily without the use of a stylet. Like the EndoFlex, the Endtrol may be effective for not only normal intubation but also difficult intubation.

In addition, this study shows that a combination of an Endtrol and a McGrath can intubate easily without the use of a stylet at the emergency airway management. In the future, there is a possibility that the combination will be performed in several challenging clinical settings having higher incidence of difficult airway and limited resources for management such as intensive care unit, emergency room, and non-operating remote locations.

This study has some limitations. The trachea was intubated by the attending anesthesiologists, and the results of this study may therefore be dependent on their personal skills. Skills and experience in handling Endotrol tubes must be acquired through training. In addition, we did not include any patients who had a difficult to access difficult airway. We do not know whether this combination will be appropriate for patients with difficult to access airways.

As for a significance of the intubation time in this study, there may not be clinical significance. However, a combination of an Endtrol and McGrath must improve security.

Conclusion

A combination of using McGrath videolaryngoscope with Endotrol ETT may provide better intubating conditions by reducing intubation time and postextubation sore throat. However, its effectiveness in difficult airway and more challenging clinical situations such as critical care and emergency settings need to be evaluated further.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Shippey B, Ray D, McKeown D. Use of the McGrath videolaryngoscope in the management of difficult and failed tracheal intubation. Br J Anaesth 2008;100:116‑9.
2. Kaki AM, Almarakbi WA, Fawzi HM, Boker AM. Use of airtraq, C‑mac, and GlideScope laryngoscope is better than Macintosh in novice medical students’ hands: A manikin study. Saudi J Anaesth 2011;5:376‑81.
3. Asi T, Enomoto Y, Okuda Y. Airway scope for difficult intubation. Anaesthesia 2007;62:199.
4. Maharaj CH, Higgins BD, Harte BH, Laffey JG. Evaluation of intubation using the airtraq or Macintosh laryngoscope by anaesthetists in easy and simulated difficult laryngoscopy – A manikin study. Anaesthesia 2006;61:469‑77.
5. Cavus E, Kieckhaefer J, Doerges V, Moeller T, Thee C, Wagner K, et al. The C‑MAC videolaryngoscope: First experiences with a new device for videolaryngoscopy‑guided intubation. Anesth Analg 2010;110:473‑7.
6. Murphy LD, Kovacs GJ, Reardon PM, Law JA. Comparison of the king vision video laryngoscope with the Macintosh laryngoscope. J Emerg Med 2014;47:239‑46.
7. Lewis SR, Butler AR, Parker J, Cook TM, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. Cochrane Database Syst Rev 2016;11:CD011136.
8. Foulds LT, McGuire BE, Shippey BJ. A randomised cross-over trial comparing the McGrath® series 5 videolaryngoscope with the Macintosh laryngoscope in patients with cervical Spine immobilisation. Anaesthesia 2016;71:437‑42.
9. Bailly A, Lascarrou JB, Le Thuaut A, Boisrame-Helms J, Kamel T, Mercier E, et al. McGrath MAC videolaryngoscope versus Macintosh laryngoscope for orotracheal intubation in intensive care patients: The randomised multicentre MACMAN trial study protocol. BMJ Open 2015;5:e009853.
10. Imashuku Y, Kura M, Sukenaga C, Otada H, Kitagawa H. Nasotracheal intubation using the airway scope and an endotracheal tube.
11. Ueshima H, Tominaga A, Usuda Y, Kitamura A. The endotracheal tube using McGrath can be a viable alternative to laryngoscope intubation. J Clin Anesth 2015;27:86-7.

12. Yamakage M, Takahashi M, Tachibana N, Takahashi K, Namiki A. Usefulness of EndoFlex endotracheal tube for oral and nasal tracheal intubations. Eur J Anaesthesiol 2009;26:661-5.

13. Phua D, Wang CF, Yoong CS. Use of the EndoFlex endotracheal tube as a stylet-free alternative in glidescope intubations. Can J Anaesth 2008;55:473-4.

14. Sugiyama K, Takahashi N, Kohjintani A. Combining the EndoFlex tube with fiberoptic bronchoscopy in difficult intubation. Acta Anaesthesiol Scand 2009;53:960-3.

15. Teoh WH, Sia AT, Fun WL. A prospective, randomised, cross-over trial comparing the EndoFlex and standard tracheal tubes in patients with predicted easy intubation. Anaesthesia 2009;64:1172-7.

16. Gaszynska E, Stankiewicz-Rudnicki M, Wieczorek A, Gaszynski T. A comparison of conventional tube and EndoFlex tube for tracheal intubation in patients with a cervical spine immobilisation. Scand J Trauma Resusc Emerg Med 2013;21:79.