A randommized, prospective, controlled trial of Glidscope®, C-MAC®(D) videolaryngoscope and Macintosh laryngoscope for double lumen endotracheal intubation in patients with predicted normal airways

Ping Huang
Shanghai Jiao Tong University School of Medicine
Renlong Zhou
Shanghai Jiao Tong University School of Medicine
Zhixing Lu
Shanghai Jiao Tong University School of Medicine
Yannan Hang
Shanghai Jiao Tong University School of Medicine
Shanjuan Wang
Shanghai Jiao Tong University School of Medicine
zhenling Huang (zhenlinghuang@shsmu.edu.cn)
Shanghai Jiao Tong University https://orcid.org/0000-0001-6676-3164

Research article

Keywords: GlideScope® videolaryngoscope, C-MAC®(D) videolaryngoscope, Macintosh laryngoscope, double-lumen tracheal tube, endotracheal intubation

Posted Date: February 14th, 2020

DOI: https://doi.org/10.21203/rs.2.23609/v1

Version of Record: A version of this preprint was published at BMC Anesthesiology on May 20th, 2020. See the published version at https://doi.org/10.1186/s12871-020-01012-y.

Abstract

Background Double lumen endotracheal tube (DLT) is the most widely used method for lung isolation in current thoracic anesthesia practice. In recent years, the routine application of videolaryngoscope for tracheal intubation has gradually increased, but there are still few related reports. We doubted whether we could get benefits from applying the videolaryngoscope for double-lumen tracheal tube placement in patients with predicted normal airways. Therefore, this study was designed to compare the clinical performance of GlideScope ® , C-MAC ® (D) videolaryngoscope and Macintosh laryngoscope in DLT intubation. Methods 90 adult patients with no predictors for difficult airways were allocated randomly into three groups. All the patients were anesthsized by a routine anesthesia process with different laryngoscopes according to the result of allocation. We accessed DLT insertion time, first-pass success rate, numerical rating scale (NRS) of DLT delivery, NRS of DLT insertion and Cormack-Lehane degree(C/L degree). The hemodynamic change and the incidence of intubation complications were also recorded. Results Compared with GlideScope, Macintosh resulted in shorter time for DLT insertion (median:96(IQR:51[min-max:62–376]s v 73(26[48-419]s, $p=0.003$), but there was no difference between Macintosh and C-MAC(D) ($p=0.610$). As for the success at the first attempt, Macintosh was significantly associated with higher successful rate compared with GlideScope and C-MAC(D) ($p=0.001$, $p=0.028$, respectively). NRS of DLT delivery and NRS of DLT insertion were significantly lower in Macintosh group than others ($p<0.001$, respectively). However, C/L degree (Ⅰ/Ⅱ A /Ⅱ B /Ⅲ) in Macintosh group was statistically higher than others ($p<0.001$, respectively). The incidence of oral bleeding, hoarseness, sore throat and dental trauma were low in all groups ($p>0.05$, respectively). There were no statistical difference about DLT misplacement, fibreoptic time and hemodynamic changes among three groups. Conclusions GlideScope ® and C-MAC ® (D) videolaryngoscopes may not be recommended as the first choice for routine DLT intubation in patients with predicted normal airways.

Background

Double lumen endotracheal tube (DLT) is the most widely used tubes for lung isolation in current thoracic anesthesia practice [1]. But due to its larger diameter, larger volume of oral cavity occupation, and rotating insertion technique, double lumen tube is generally more difficult to insert and advance than lumen endotracheal tube.

In recent years, videolaryngoscopes are becoming a new standard of care for intubation by providing a clear view of the glottis from video-camera or video-chip which is positioned close to the tip of the laryngoscope blade. Of the various videolaryngoscopes available, each is unique in design [2, 3]. They can be divided into three main types according to different blade: the standard Macintosh shaped blade, the angulated blade, and a channel for tube passage [4].

The GlideScope® is an established videolaryngoscope with a highly angulated blade form, which offers an obligate indirect epiglottis view [5]. Several authors [6–9] have investigated widely during clinical anesthesia. In most articles, authors found it enabled laryngoscope to view better than both conventional direct laryngoscopy and Macintosh videolaryngoscopy in patients with predicted difficult airway [6]. The C-MAC® videolaryngoscope made by KarlStorz was introduced with conventional Macintosh blades, which was used appropriate for routine airway intubation [10]. In order to manage difficult airway, the C-MAC® system has recently launched the highly angulated D-Blade [11]. The GlideScope® and C-MAC®(D) videolaryngoscope belong to the same type which have angulated blade. Either of them may be the only videolaryngoscope available in anesthesiology department in some hospitals in China.

There are few studies investigating videolaryngoscopes for intubation with DLTs. The potential advantages of GlideScope® for DLT insertion include a better view of vocal cords, a clear view of the DLT when it passes the vocal cords, and an external video screen for teaching purposes and assistant providing external laryngeal pressure [12]. But at present it is still controversial if GlideScope® videolaryngoscope is benefit for double lumen endotracheal intubation [12, 13], while C-MAC®(D) for double lumen endotracheal intubation is rarely reported [14].Therefore, this study compared the usage of GlideScope®, C-MAC®(D) videolaryngoscope and Macintosh laryngoscope in assisting double lumen endotracheal tube intubation in normal airways.

Methods

Approval for the study was granted by Shanghai Renji Hospital Ethics Committee(Ethical number: 2016[036]). Written informed consents were obtained from patients undergoing elective intra-thoracic surgeries required double-lumen intubation. The present trial was registered at http://www.chictr.org.cn (the registration number is ChiCTR1900025718, principal investigator: Z.L.H., date of registration: Septembere 06, 2019).

Including criteria were adult patient between 18–75 years old, ASA I–II, BMI < 35 kg/m^2, with Mallampati score of 1 or 2. All the Mallampati scores were assessed by the same observer. Exclusion criteria included presence of any predictors of difficult intubation, including Mallampati score > = 3, decreased inter-incisor distance (< 3 cm), short thyromental distance (< 6 cm), and reduced neck extension(< 80°from neck flexion), cervical spine instability, having a history of difficult endotracheal intubation or difficult mask ventilation, severe pulmonary ventilation dysfunction or risk of pulmonary aspiration. 90 patients were randomly allocated to GlideScope, C-MAC(D) or Macintosh group. This was done by a closed envelope technique using a computer generated block randomization method in blocks of 15. Before study, the computer randomization was performed and the allocation result was put in individual numbered and sealed envelopes. The researcher responsible for recruitment was unknown of the allocation result. After the patient was consented for the study, the allocation was revealed. All endotracheal intubations were performed by five anesthesiologists with ten years working experience skilled in videolaryngoscope.

Leftside or rightside 32Fr/35Fr Mallinckrodt™ DLT (Mallinckrodt Medical, Athlone, Ireland) was selected for female patients and 35Fr/37Fr DLT for male patients depended on whether their height was below or above 155 cm for female and 165 cm for male respectively. If operation side was the left, right-side DLT was used, otherwise left-side DLT was selected. In order to facilitate intubation, the distal 10–12 cm concavity of the DLT (with the stylet in situ) was moulded along the blade convexity in each group. The tracheal and the bronchial cuffs of the DLT were lubricated with surgilube sterile.

No premedication was given before induction. Standard monitor including Electrocardiogram (ECG), invasive arterial blood pressure, pulse oximetry saturation (SpO_2) and end-tidal carbon dioxide were established before induction of anesthesia. After pre-oxygenation with 100% oxygen, patients were induced with intravenous midazolam 0.05 mg.kg^{-1}, propofol1.5 mg.kg^{-1}, fentanyl 5 μg.kg^{-1}, rocuronium 0.6 mg.kg^{-1} was given to facilitate tracheal intubation. Ninety seconds after rocuronium administration, intubation with the DLT was performed by the laryngoscope allocated. DLT was inserted with the distal concavity facing anteriorly until the bronchial lumen cuff passed the vocal cord. The stylet then removed, the rotation was performed while tube was advanced. The left DLT rotated 90° counterclockwise while the right DLT rotated 90°clockwise to facilitate the tip entered the left or right main bronchus. Hemodynamic changes were monitored during induction. If systolic blood pressure was below 80 mmHg, ephedrine 5 mg was administrated intravenously, atropine 0.5 mg was given when heart rate was below 50 beats per minute. After the tip of the DLT was located in the targeted bronchial, the tracheal cuff was inflated and ventilation of the lungs started. Fibreoptic bronchoscopic assessment of adequate bronchial cuff placement was followed by DLT placement.

The time of DLT insertion was recorded as the time when the laryngoscope passed between the patient’s lips until three complete cycles of end-tidal carbon dioxide was displayed on the monitor. Success at the first attempt at intubation was also recorded by the same observer. The difficulty of DLT insertion and delivery were assessed by the operator, using NRS ranging from 0 to 10. The NRS results were grouped into 0 = ‘none’, 1–3 = ‘mild’, 4–6 = ‘moderate’ and 7–10 =‘severe’. C/L degree was classified as four degrees ($I/II_A/II_B/III$), and assessed by the operator. If it was not class I, external laryngeal pressure were provided by an assistant. The time taken for fibreoptic bronchoscopy was defined as the time from endobronchial intubation until fibreoptic bronchoscopic confirmation of adequate placement; The operator examined for blood on blades’ surface after it was removed from mouth. Hemodynamic parameters (mean arterial blood pressure and heart rate) were recorded 10 minutes before and 1, 3 and 5 minutes after intubation. After the assessment by fibreoptic bronchoscopy, the oral cavity, pharynx, larynx and teeth were examined by an independent investigator, who was unaware of the type of laryngoscope used for signs of laceration or bleedings. One day after surgery an independent investigator interviewed patients to assess the presence of sore throat and the incidence of hoarseness of voice.

Statistical analysis

Based on previous studies [13, 14], we determined that the mean intubation time for the Glidescope was 45.6 s with a standard deviation of 10.7 s, the C-MAC(D) videolaryngoscope was 32.27 s with a standard deviation of 11.13 s [12]. Factoring possible drop-outs, we recruited 30 patients in each group, with an alpha value of 0.05 and a beta value of 0.2.

Data are expressed as median (IQR[min-max]), mean ± sd, or absolute numbers, as required. Statistical analysis was performed using SPSS 13.0. The Kruskal-waillis test was used to analyse independent samples (the time for successful intubation, the times of intubation attempts and the success at the first attempt, C/L degree, NRS of DLT delivery and insertion). The Chi-square test and the Student-New Man-keuls test were used to analyse demographic data and the incidence of complications. For the analysis of hemodynamic response to intubation, a repeated-measures analysis of variance was used. Statistical significance was considered at $P < 0.05$.

Results

A flow diagram of the study is shown in Fig. 1. Out of 90 patients recruited, 89 completed the study. One patient in Glidescope group was excluded since the videolaryngoscope was not available. Characteristics of patients and intubation conditions were similar in all three groups (Table 1).

Table 1
Characteristics and intubation conditions of patients assigned to GlideScope, C-MAC(D) or Macintosh group

	GlideScope group (n = 29)	**C- MAC(D) group (n = 30)**	**Macintosh group (n = 30)**
Age(yr)	58.45±8.80	57.20±9.60	54.57±11.78
BMI(kg/m^2)	23.33±3.29	22.82±2.67	24.32± 3.78
Male/Female (n)	11/18	18/12	20/10
ASA I/II (n)	17/12	18/12	20/10
DLT left/right (n)	17/12	21/9	21/9
Malampati I/II (n)	17/11	17/13	19/11
Inter–incisor distance (cm)	4.29±0.60	4.43±0.77	4.53±0.88
Thyromental distance (cm)	7.77±0.78	7.97±0.79	7.72±0.75
Neck extension > 90^0 (n)	29	30	30

The success at the first attempt was 24(80%) with Macintosh, 11 (38%) with GlideScope ($p = 0.001$), and 16 (53%) with C-MAC(D) ($p = 0.028$). No difference between GlideScope and C-MAC(D) was found($p = 0.235$). C/L degree(I/II$_A$/II$_B$/III) was 14/14/1/0 with GlideScope, 26/4/0/0 with C-MAC (D)($p = 0.006$), and 9/9/5/7 with Macintosh ($p = 0.008$). P value between C-MAC(D) and Macintosh was 0.000. Therefore external laryngeal pressure was used most often in Macintosh group(Table 2).

Table 2
Details of intubation with a double-lumen tube using the GlideScope, C-MAC(D) or Macintosh group

	GlideScope group(n = 29)	C-MAC(D) group(n = 30)	Macintosh group(n = 30)	P value
Number of intubation attempts (1/2/3)	11/12/6	16/11/3	24/3/3 [aab]	0.010
The success of the first attempt at intubation (n)	11(37.93%)	16(53.33%)	24(80.00%) [aab]	0.004
Cormack-Lehane degree($I/II_A/II_B/III$)	14/14/1/0 [cc]	26/4/0/0	9/9/5/7 [aabb]	0.000
Number of external laryngeal pressure (n)	4(13.79%) [c]	0(0)	14(46.67%) [aabb]	0.000
Number of DLT misplacement (n)	4(13.79%)	9(30.00%)	5(16.67%)	0.252
Fibreoptic time (s)	54.07±25.46	63.13±23.77	57.43±21.8	0.309
Oral bleeding (n)	1(3.45%)	1(3.33%)	0(0)	0.594
Hoarseness (n)	0(0)	0(0)	1(3.33%)	0.370
Sore throat (n)	1(3.45%)	3(10%)	1(3.33%)	0.441
Dental trauma (n)	0(0)	0(0)	0(0)	
Atropine (n)	0(0)	0(0)	0(0)	
Ephedrine (n)	1(3.45%)	1(3.33%)	0(0)	0.594
aa: $p < 0.01$ between Glidescope and Macintosh				
bb: $p < 0.01$ between C-MAC(D) and Macintosh				
b: $p < 0.05$ between C-MAC(D) and Macintosh				
cc: $p < 0.01$ between Glidescope and C-MAC(D)				
c: $p < 0.05$ between Glidescope and C-MAC(D)				

There was no difference in the number of DLT misplacement and fibreoptic time. Blood was observed on the laryngoscopes in one patient in Glidescope group and C-MAC(D) group respectively. We found a low incidence of oral bleeding, sore throat, and dental trauma in all three groups, and they showed no difference. One patient each required ephedrine in the GlideScope and C-MAC(D), but no patient required atropine in all three groups (Table 2).

The DLT insertion time was 96(51[62–376]s with GlideScope, 73(26[48–419])s with Macintosh (p = 0.003) and 72.5(46 [47–467])s with C-MAC(D) (p = 0.022). There was no difference between Macintosh and C-MAC(D) ($p = 0.610$)(Fig. 2).

NRS of DLT delivery was 2(1.75[0–3]) with Macintosh, 5(3[1–9]) with GlideScope($p = 0.000$), and 3(2[0–6]) with C-MAC(D)($p = 0.001$). P value between GlideScope and C-MAC(D) was 0.000. NRS of DLT insertion was 1(2[0–10]) with Macintosh, 3(3[0–9]) with GlideScope($p = 0.001$), and 3 (1.75[0–6]) with C-MAC(D)($p = 0.026$). P value between GlideScope and C-MAC(D) was 0.039(Fig. 3).

Heart rate increased 1 minute after intubation in all three groups and increased 3 minutes after intubation in C-MAC(D) (Fig. 4). Mean arterial pressure decreased 3 minutes after intubation in all three groups (Fig. 5). There was no difference between groups with respect to the hemodynamic response to intubation.

Discussion

The GlideScope® videolaryngoscope (Verathon Medical, Bothwell, UT, USA) was the first obligate indirect videolaryngoscope with a pronounced anterior angulation of 60° of its blade [5]. The C-MAC®(D) videolaryngoscope (Karl Storz GmbHand Co.KG, Tuttlingen, Germany) shows a pronounced angulation of 40°. In contrast to the GlideScope, the D-Blade's camera and light socket is located nearer (40 mm) to the blades tip, which is bended for another 20°[15].

In our study, compared with GlideScope® and C-MAC®(D) videolaryngoscope, using of Macintosh laryngoscope to assist DLT intubation was associated with a shorter insertion time, a higher success rate at the first attempt, less difficulty score of DLT delivery and insertion, higher C/L degree and using external laryngeal pressure more often.

With the attached cables and the angulated blade form, both videolaryngoscopes often presented to be more delicate than with the conventional Macintosh laryngoscope when they were introduced into the mouth and further advanced. As both videolaryngoscopes have highly angulated blade, manipulation inside oropharyngeal space is restricted. When proceeding in a relatively steep angle through the glottis opening, the DLT may get caught at the arytenoids or the ventral tracheal wall. Using of the both videolaryngoscopes requires the operators' hand-eye coordination. Operator should look for epiglottis and vocal cords on the screen, then manipulate the DLT to enter into the mouth and past the vocal cords into trachea, which extend the insertion time.

Although the advantages of GlideScope® and C-MAC®(D) for DLT insertion include an improved view of the vocal cords, a clear view of the DLT when it passes the vocal cords, and an external video monitor for assisting staff providing external laryngeal pressure and teaching purposes, the disadvantages include increased blade angulation and thickness cause difficulty in manipulating the DLT to enter into the mouth and past the vocal cords into the trachea [12] which decrease the success rate of the first attempt. At the same time, forward movement of videolaryngoscopic lens and requirement of the operators' hand-eye coordination increase the difficulty in the success of the first attempt at intubation. Although Macintosh laryngoscope showed a higher C/L degree which was unfavorable to endotracheal intubation, it could got an improved glottis view by external laryngeal pressure. So it had a higher success rate of the first attempt in this study.

As the thicker blade of GlideScope and larger DLT diameter, difficulty DLT manipulation and difficulty in fitting the device and entering into the patient’s mouth were the most common reasons for GlideScope intubation failures, as previously reported [12]. Large camber blade and forward movement of lens of C-MAC(D) increased difficulty of DLT delivery and insertion. DLT delivery and insertion score was lower for Macintosh compared with GlideScope and C-MAC(D). Our findings support the common view that when using non-channelled hyper-angulated videolaryngoscopes, tube delivery and advancement into the trachea are the most difficult steps [16].

There was no difference about the selection of left or right DLT and the incidence of DLT entring into the wrong bronchus among three groups, which indicated that misplacement had no obvious relation with different laryngoscopes. The original preformed shape of the anterior concavity of the DLT was slightly altered to conform to the greater angulation of the Dblade and Glidescope before intubation which might increase the misplacement of DLT. But this could be easily rectified when using the fiberoptic bronchoscope.

Although postoperative sore throat and hoarseness are common complications after using a DLT [17]. We found a low incidence of oral bleeding, hoarseness of voice, sore throat and dental trauma in all three groups in our study. Probably there are 2 reasons. First, the DLT were adequately lubricated and operated by an experienced anaesthesiologist. Second, 90 rotation aligned the axis of the tracheal lumen with the patient’s tracheal axis, facilitating the passage of the tracheal cuff through the vocal cords. This reduced the incidence of the vocal cord injury. Hsu et al [13] showed the method to rotate the DLT anticlockwise 180°to facilitate passage of the bronchial cuff, after the tracheal cuff passed through the vocal cords, an additional 90°clockwise rotation was performed to align the tube with the left main bronchus. The number of rotation was less in our study than that in the Hsu’s, which might be the reason for the low incidence of hoarseness of voice and sore throat. We found the hemodynamic changes were no different among three groups which indicated that videolaryngoscope did not reduce the stress response caused by DLT intubation.

Conclusion

There are a few limitations in our study. First, the intubating anesthesiologist or the independent observer was unblinded from the randomization of videolaryngoscope. This could have led to bias. However, the primary outcome, and most of the other outcomes were well defined and objective. Second, in this study the operators were five anesthesiologists who had enough experience and intubation techniques including the use of DLTs for thoracic anesthesia and the use of the GlideScope® and C-MAC®(D), not including young anesthesiologists who were lack of experiences, which was a possible source of bias. Third, patients recruited in this study were with expected normal airways. It was less possible to make a comment on whether these findings would be consistent with the DLT intubation with difficult airways.

Finally, our study did not include videolaryngoscopes with standard Macintosh shaped blade. However, based on this preliminary technical communication, further studies are warranted to perform.

Therefore, GlideScope® and C-MAC®(D) videolaryngoscopes may not be recommended as the first choice for routine DLT intubation in patients with predicted normal airways.

Abbreviations

DLT： Double lumen endotracheal tube

NRS： Numerical rating scale

C/L degree：Cormack-Lehane degree

ECG：Electrocardiogram

SpO_2：Pulse oximetry saturation

Declarations

Ethics approval and consent to participat

A randommized, prospective, controlled trial was approved by Shanghai Renji Hospital Ethics Committee(Ethical number: 2016[036]). Written informed consents were obtained from participants before inclusion. The present trial was registered at http://www.chictr.org.cn (the registration number is ChiCTR1900025718, principal investigator: ZLH, date of registration: Septembere 06, 2019).

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated during the current study are not publicly available due the regulation of data management of Renji Hospital, School of Medicine, Shanghai Jiaotong University, but are available from the corresponding author on reasonable request.

Competing Interests

The authors have declared that no competing interest exists.

Funding

No Fundings.

Author information

Author notes

Ping Huang and Renlong Zhou contributed equally to this work.

Affiliations

Department of Anesthesiology, Renji Hospital, School of Medicine, Shanghai Jiaotong University, Shanghai 200001, China.

Contributions

ZLH and SJW were responsible for the conception and design of the study. PH and RLZ were responsible for analysis of data and manuscript. PH and ZXL were responsible for performing the experiement and the collection of data. Furthermore, YNH made substantial contribution in writing and revising the manuscript. All authors have read and approved the final manuscript.

Corresponding author

Correspondence to Shanjuan Wang and Zhenling Huang.

Acknowledgement

We wishes to acknowledge Yanyan Song (Department of statistics, School of Medicine, Shanghai Jiaotong University, Shanghai 200125, China), and Anqi Lv(Division of Anesthesiology and Perioperative Medicine, Singapore General Hospital, Singapore 169608) for their assistance in preparing and instructing this manuscript.

References

1. Campos JH. Lung isolation techniques for patients with difficult airway. Curr Opin Anaesthesiol, 2010,23:12-7.
2. NgI, Hill AL, Williams DL, Lee K, Segal Randomized controlled trial comparing the McGrath videolaryngoscope with the C-MAC videolaryngoscope in intubating adult patients with potential difficult airways. Br J Anaesth, 2012,109:439-43.
3. Ahmed-Nusrath A. Focus on: ophthalmic anesthesia videolaryngoscopy. Curr Anaesth Crit Care 2010;21:199-205.
4. Niforopoulou P, Pantazopoulos I, Demestiha T, Koudouna E , Xanthos T Video-laryngoscopes in the adult airway management: a topical review of the literature. Acta Anaesthesiol Scand, 2010;54:1050-61.
5. Serocki G, Neumann T, Scharf E, Dörges V, Cavus Indirect videolaryngoscopy with C-MAC D-Blade and GlideScope: a randomized, controlled comparison in patients with suspected difficult airways.

Minerva Anestesiol. 2013;79:121-9.

6. Serocki G, Bein B, Scholz J, Dorges V. Management of the predicted difficult airway: a comparison of conventional blade laryngoscopy with video-assisted blade laryngoscopy and the GlideScope. Eur J Anaesthesiol. 2010;27:24-30.
7. Stroumpoulis K, Pagoulatou A, Violari M, Ikonomou I, Kalantzi N, Kastrinaki K, et al. Videolaryngoscopy in the management of the difficult airway: a comparison with the Macintosh blade. Eur J Anaesthesiol. 2009;26:218-22.
8. Sun DA, Warriner CB, Parsons DG, Klein R, Umedaly HS, Moult M. The GlideScope Video Laryngoscope: randomized clinical trial in 200 patients. Br J Anaesth. 2005;94:381-4.
9. Griesdale D EG, Liu D, McKinney J, Choi PT. Glidescope® video-laryngoscoppy versus direct laryngoscopy for endotracheal intubation: a systematic review and meta-analysis. Can J Anesth. 2012;59:41-52.
10. Cavus E, Thee C, Moeller T, Kieckhaefer J, Doerges V, Wagner K. A randomised, controlled crossover comparison of the C-MAC videolaryngoscope with direct laryngoscopy in 150 patients during routine induction of anesthesia. BMC anesthesiol. 2011;11:6-13.
11. Williams K, Carli F, Cormack RS. Unexpected, difficult laryngoscopy: a prospective survey in routine general surgery. Br J Anaesth. 1991;66:38-44.
12. Russell T, Slinger P, Roscoe A, McRae K, Rensburg A randomised controlled trial comparing the GlideScope and the Macintosh laryngoscope for double-lumen endobronchial intubation. Anaesthesia. 2013, 68, 1253-8.
13. Hsu HT, Chou SH, Wu PJ, Tseng KY, Kuo YW, Chou CY, Cheng Comparison of the GlideScope videolaryngoscope and the Macintosh laryngoscope for double-lumen tube intubation. Anaesthesia. 2012;67(4):411-5.
14. ShahSB, Bhargava AK, Hariharan U, MittalAK, Goel N, Choudhary A Randomized Clinical Trial Comparing the Standard McIntosh Laryngoscope and the C-Mac D blade Video laryngoscope™ for Double Lumen Tube Insertion for One Lung Ventilation in Onco surgical Patients. Indian J Anaesth. 2016,60:312-8.
15. BatuwitageB, McDonald A, Nishikawa K, Lythgoe D, Mercer S, Peter Charters Comparison between bougies and stylets for simulated tracheal intubation with the C-MAC D-blade videolaryngoscope. Eur J Anaesthesiol. 2015;32:400-5.
16. Levitan RM, Heitz JW, Sweeney M, Cooper RM. The complexities of tracheal intubation with direct laryngoscopy and alternative intubation devices. Ann Emerg Med. 2011;57:240-7.
17. Park SH, Han SH, Do SH, Kim JW, Rhee KY, Kim JH. Prophylactic dexamethasone decreases the incidence of sore throat and hoarseness after tracheal extubation with a double-lumen endobronchial tube. Anesth Analg. 2008;107:1814-8.

Figures

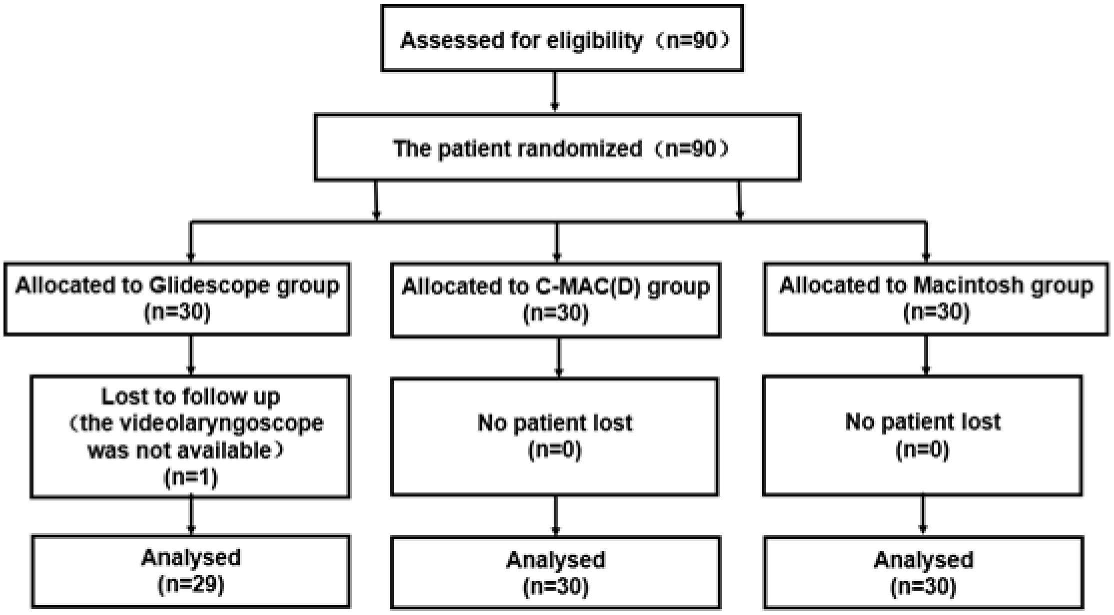

Figure 1

Flow chart of participant selection for double lumen endotracheal intubation in patients with predictied normal airways.

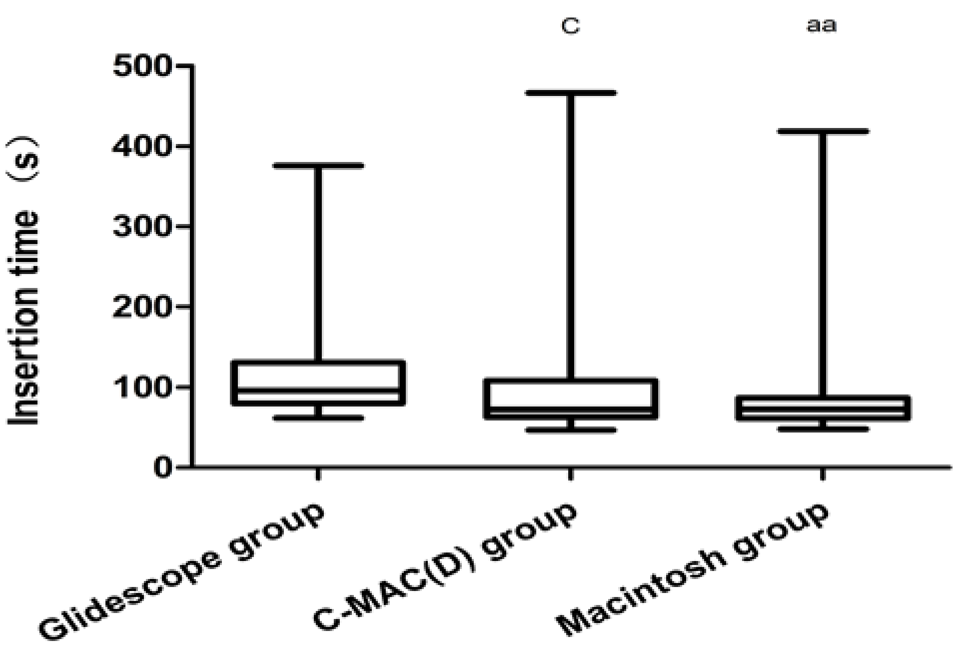

Figure 2

The time taken for bronchial insertion with GlideScope was significantly longer compared with those taken for Macintosh and C-MAC(D). GlideScope vs C-MAC(D) vs Macintosh: 96(51[62–376])s vs 72.5(46[47-467])s vs 73(26[48-419])s. aa P<0.01, between GlideScope and Macintosh group; c P<0.05, between GlideScope and C-MAC(D) group.

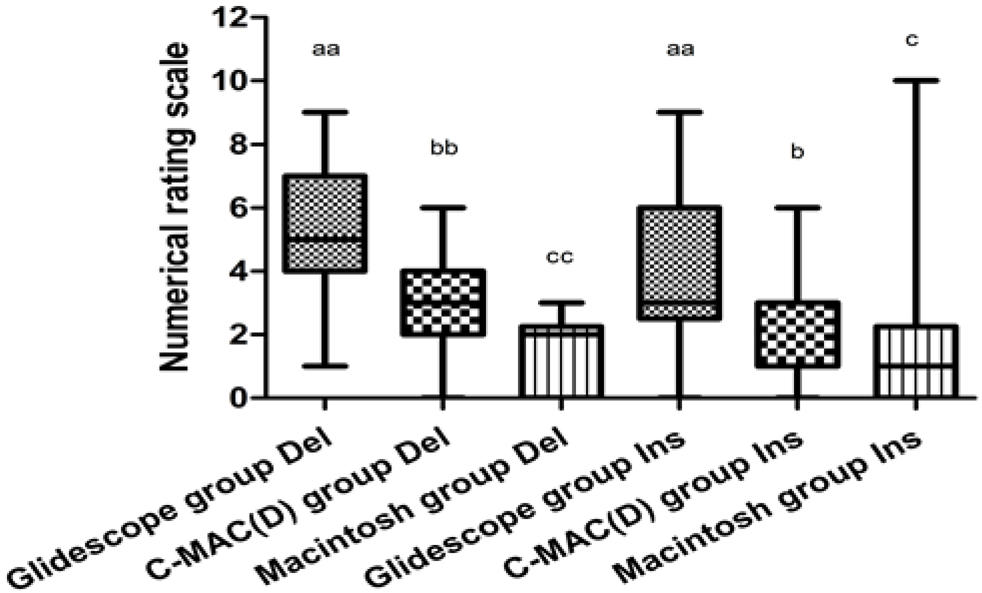

Figure 3

Del and Ins respented ‘Delivery’ and ‘Insertion’. As for NRS(scored from 0 to 10), difficulty score of DLT delivery was 5 (3[1-9]) with GlideScope, 3(2[0-6]) with C-MAC(D)(p=0.000), 2(1.75[0–3]) with Macintosh(p=0.000). C-MAC(D) vs Macintosh (p=0.001). Difficulty score of DLT insertion was 3(3[0-9]) with GlideScope, 3(1.75[0-6]) with C-MAC(D)(p=0.039) and 1(2[0-10]) with Macintosh(p=0.001). C-MAC(D) vs Macintosh p=0.026. aaP<0.01, between GlideScope and Macintosh group; bbP<0.01, between C-MAC(D) and Macintosh group; bP<0.05, between Glidescope and C-MAC(D) group; ccP<0.01,between C-MAC(D) and Macintosh group; cP<0.05, between C-MAC(D) and Macintosh group.

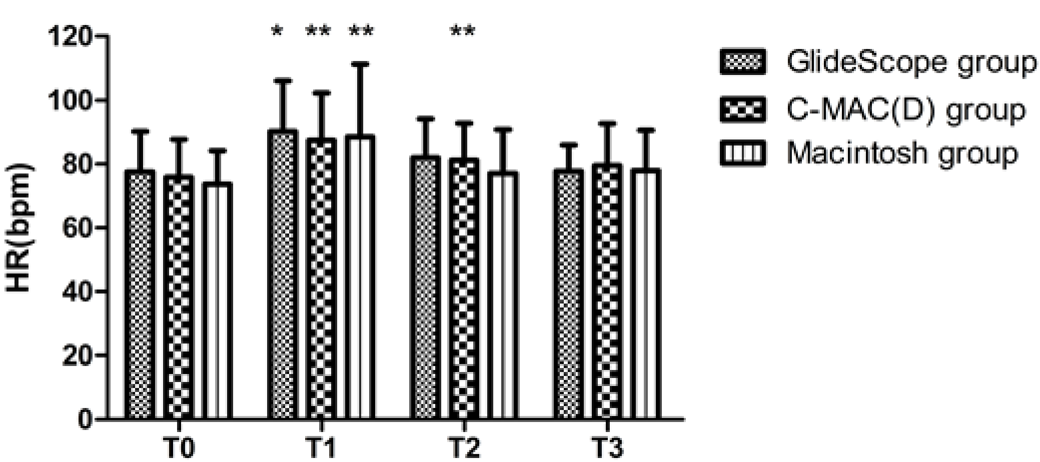

Figure 4

T0 represented the basic heart rate 10 minutes before study. T1, T2 and T3 represented respectively 1 minute, 3 minutes and 5 minutes after intubation. Heart rate increased 1 minute after intubation in all three groups and increased 3 minutes after intubation in C-MAC(D) group. Compared with T0, GlideScope *P<0.05, C-MAC(D) **P<0.01, Macintosh **P<0.01 in T1, C-MAC(D)**P<0.01 in T2.

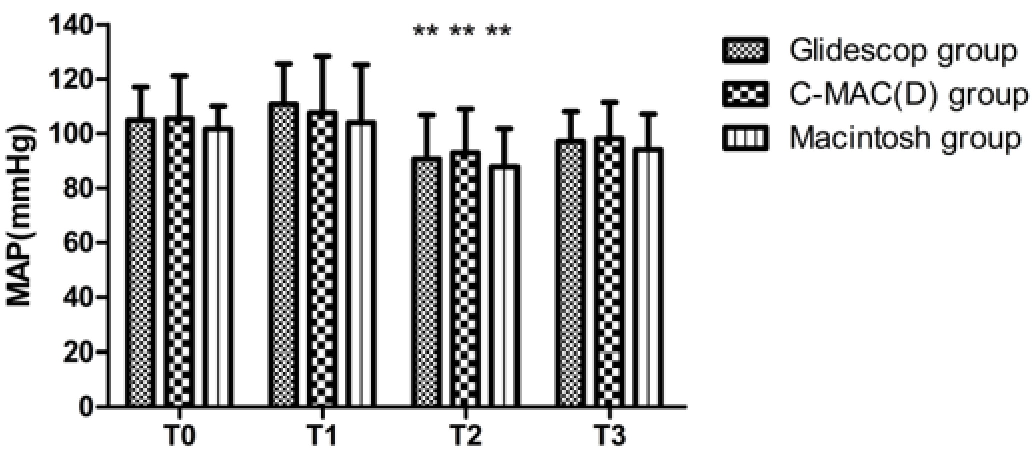

Figure 5

T0 represented the basic mean arterial pressure 10 minutes before study. T1, T2 and T3 represented respectively 1 minute, 3 minutes and 5 minutes after intubation. Mean arterial pressure decreased 3 minutes after intubation in all three groups. Compared with T0, three groups **P<0.01 in T2.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CONSORTChecklist.pdf