Available online at www.iponlinejournal.com

Journal homepage: www.innovativepublication.com/journal/ijca

Original Research Article

Is the Mac doshi blade superior to the conventionally used Macintosh blade with respect to laryngoscopic view and ease of tracheal intubation?

Sai Anand L[1], Malavika Kulkarni[2*], Nisha Sara M Jacob[3], Muralidhar Kulkarni[4], Laxmi Shenoy[5]

[1]Anasthesiology, [2,4]Associate Professor, [3,5]Assistant Professor, [2,3,5]Dept. of Anaesthesia, [4]Dept. of Community Medicine, Kasturba Medical College, Manipal, Karnataka, India

Article Info

Received: 8th July, 2019

Accepted: 13th August, 2019

Published Online: 22nd August, 2019

Keywords: Laryngoscopy, Macintosh blade, Mac Doshi blade, General anaesthesia, Ease of intubation.

Abstract

Introduction: Laryngoscopy forms an important part of general anaesthesia and endotracheal intubation. Laryngoscope blades of different shapes have been designed and studied.

Objective: We compared Macintosh and Mac Doshi blades for laryngoscopic view, time for intubation and cardiovascular response during intubation.

Materials and Methods: Following Institutional ethical committee approval, this prospective randomized study was undertaken in 160 patients scheduled for elective surgery requiring orotracheal intubation assigned into two groups: group M (Macintosh) and group D (Mac Doshi). After intravenous induction, laryngoscopy was performed, and trachea intubated. Ease of glottic visualization and ease of intubation were noted as per Cormack Lehane (CL) scale and Arino scale respectively. The haemodynamic variables were also noted at regular time intervals.

Results: Ease of glottic visualization and intubation assessed through CL grade (P=0.65) and Arino scale (P=0.084) were comparable in both groups using Fisher's exact test. Time to glottic visualization was 8.24±3.03 seconds for Macintosh group and 8.44±3.73 seconds for Mac Doshi group (p=0.7). Time to intubate was 30.29±11.47 seconds for Macintosh and 27.25±7.03 seconds for Mac Doshi group (P=0.046). All haemodynamic parameters were also comparable without clinical significance.

Conclusion: Macintosh blade and Mac Doshi were found to be comparable in terms of ease of glottic visualization and intubation. There was no difference in time taken for glottic visualisation, time for intubation and haemodynamic parameters between the two groups.

Introduction

Laryngoscopy is an integral part of the procedure among patients undergoing general anaesthesia with endotracheal intubation and enables optimal visualisation of the vocal cords for insertion of the endotracheal tube into the trachea. Different anatomical factors have been shown to influence laryngoscopy view of vocal cords. These include, but are not restricted to forward displacement of mandible, prominent or absent teeth and backward displacement of the tongue.[1] This is evidenced by the existence of different types of laryngoscopy blades which have been designed to allow easy intubation in patients with different types of airways. One such laryngoscopy blade is the Mac Doshi laryngoscopy blade. This blade focusses on avoiding oro dental insults. The increase in flange height by 7mm permits better tongue retraction and glottis visualisation.[2] Also the reduced width of flange by 7mm helps in easy blade placement for patients who are edentulous, have missing incisors or have irregular dentition. Hence this prospective randomized clinical trial aimed to compare the laryngoscopy view obtained with Mac Doshi blade against Macintosh blade, the most widely used blade in clinical practice. We also assessed the time taken and ease of endotracheal intubation with each blade and compared the haemodynamic responses to intubation produced by the respective blades.

Materials and Methods

The prospective randomised study was initiated after obtaining approval from the Institutional ethics committee (IEC 777/2016) and registering with the clinical trials registry of India (REF/2017/04/014087). These patients were of either sex aged between 18 and 60 years, with BMI between of 18.5 to 29.9kg/m^2. They were American Society of Anaesthesiologist Physical Status (ASA PS) I or II, scheduled for elective surgery under general anaesthesia, requiring orotracheal intubation. Patients with anticipated difficult airway, cervical spine pathology, increased risk of pulmonary aspiration, buck teeth, pregnant patient, BMI > 30kg/m^2 were excluded. The recruited patients were fasted before surgery, six hours for solids including milk and two hours for clear fluids. Alprazolam was administered orally to all as premedication on the night before surgery. On day of surgery, patients were randomly allocated to one of two

*Corresponding Author: Malavika Kulkarni, Associate Professor, Dept. of Anaesthesia, Kasturba Medical College, Manipal, Karnataka, India
Email: malavika.kulkarni@manipal.edu
http://doi.org/10.18231/j.ijca.2019.089

groups (Group M or Group D) with the help of a computer-generated random numbers table.
Group M: Laryngoscopy and endotracheal intubation with Macintosh blade.
Group D: Laryngoscopy and endotracheal intubation with Mac Doshi blade.
Both the blades are depicted in Fig 1.

Observer 1
Postgraduate student in anaesthesia visited the patient preoperatively and obtained consent from them. He/ she was blinded for the laryngoscope been used and made note of the haemodynamic variables.

Observer 2
Anaesthesiologists with at least three years experience and had performed at least 20 intubations with Mac Doshi laryngoscope blade, performed the direct laryngoscopy. He/she graded the laryngoscopy view using the Cormack and Lehane grade[3] and called out the grade so that the observer 3 may keep time and also graded the ease of intubation using the scale developed by Arino et al.[4]

Observer 3
This person was the time keeper and was a postgraduate student in anaesthesia. He/she started the stopwatch when the laryngoscope is passed the incisors and stopped it when the first sustained $EtCO_2$ trace was obtained or when the time duration crossed 120 seconds, whichever was first and also noted the laryngoscopy grade called out by observer 2.

Patient was induced with fentanyl 1-2mcg/kg and propofol 2mg/kg intravenously. After confirmation of ability to ventilate, vecuronium 0.1mg/kg was administered i.v. for muscle relaxation. Ventilation was manually assisted with isoflurane in 100% oxygen, targeting an end-tidal isoflurane of 0.9-1%. Complete muscle paralysis was ensured by the absence of twitches with train of four (TOF) stimulus using a peripheral nerve stimulator. Laryngoscopy was performed with the head in the 'sniffing position' using the laryngoscope that had been randomised to the patient. The Cormack and Lehane grading[3] of the laryngoscopy view were noted and intubation was performed with high volume low pressure cuffed portex endotracheal tube of internal diameter 7.0-7.5mm for female patients and 8.0-8.5mm for male patients by observer 2. Intubation was initially attempted without the use of a stylet but used after failed first attempt.

Observations
The observations of haemodynamic variables like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), rate pressure product (RPP) were made at the following time points: TB: Pre-induction, T0: Post-induction, T1: One minute after intubation. (one minute after obtaining the first $EtCO_2$ trace), T3: Three minutes after intubation, T5: Five minutes after intubation, T10: 10 minutes after intubation.

Time to glottis visualisation (Tv) was defined as time (in seconds) from introduction of the tip of the laryngoscope past the incisors to the point when the laryngoscopy grade was called out by observer 2.Time to intubation (Ti) was defined as the time (in seconds) taken from introduction of the tip of the laryngoscope past the incisors until $EtCO_2$ trace was obtained.

Failed attempt was defined as the inability to obtain a sustained capnogram within 120 seconds of introduction of the laryngoscope past the incisors or failure to intubate with the assigned blade after a maximum of two attempts using airway manoeuvres such as backward upward and rightward pressure (BURP) or use of stylet or bougie.

All patients were observed for the presence of immediate post-laryngoscopy complications such as trauma to lips, gums or teeth, lacerations and presence of bleeding.

Sample Size and Data Analysis
Sample size was calculated on the basis of Cormack Lehane scale for the comparison of ease of laryngoscopy as the primary outcome of the study between the two blades. It was estimated that 78 subjects would be necessary in each group to obtain an effect size of 0.25 in this parameter between the two groups with 80% power and 5% probability of type I error.

Statistical analysis was done using SPSS version 16.0 (SPSS Inc, Chicago, USA). Parametric data (age, BMI) were analyzed using independent samples t-test, and nonparametric data were analyzed using Mann –Whitney U -test.

Results
A total of 160 patients requiring oro-tracheal intubation under general anaesthesia were recruited for our study and followed up as mentioned in Fig. 2.

The demographic data is given in Table 1. There was no significant difference pertaining to the demographic particulars, baseline characteristics and ASA grading between the two groups.

Ease of Glottic Visualisation
In group M, 44 patients (55%) had grade 1 and 27(33.8%) patients had grade 2a. Eight patients (10%) and one patient (1.2%) had grade 2b and grade3a respectively. In group D, 48 patients (60.8%) had grade 1, 20 patients (25.3%) had grade 2a, 9 patients (11.4%) had grade 2b and 2 patients (2.5%) had grade 3a as depicted in Fig. 3a.

The ease of glottis visualisation was comparable between the two groups with the p value not found to be significant.

Ease of intubation (Arino scale)
Figure 3b show the comparison of ease of intubation between groups M and D using the Arino scale. In Group M, 78 (97.5%) patients had grade 1 and 2(2.5%) patients had grade 3. There were no patients with grade 2 ease of intubation.

The ease of intubation was also comparable between the two groups and p value was not significant. The investigators also did not observe any difference clinically between the two groups.

Time for Glottic Visualisation (Tv)
Time required for glottic visualisation was comparable between the two groups. In Group M mean time was 8.24±3.03s, while in Group D it was 8.44±3.73s with a p value of 0.7

Time taken to intubate (TI)
Time to intubate in Group M was 30.29±11.47 seconds and 27.25±7.03 seconds in Group D. Although the p value of 0.046 is significant, there is no clinical significance to this finding; hence time to intubate is comparable between the Macintosh and the Mac Doshi laryngoscopy blades.

Haemodynamic Characteristics
In Group M, the mean baseline heart rate was 81.81±15.61 bpm and post induction it was 77.41±14.89 bpm while in Group D, the mean baseline heart rate was 82.51±16.61bpm and post induction it was 78.82±14.47 bpm. There was an increase in heart rate at time intervals of 1st and 3rd minutes after intubation in both the groups as depicted in Figure 4a. Following this, there was a gradual fall in heart rate at the 5th and 10th minutes following intubation with mean values of 82.27±15.8 bpm and 80.18±17.05 respectively.

The mean MAP in Group M and Group D at baseline was 99.95±14.98 mmHg and 98.3±17.24mmHg respectively. After induction there was a fall in MAP in both groups followed by increase after intubation as shown in Fig. 4b.

Rate Pressure Product
In Group M, the mean RPP value at baseline was 11223.12±2556.92. After induction the mean RPP was 7828.06±1872.07. After intubation, the RPP did not cross 15000 at any time point in time. Figure 6 show the trend of RPP at different time intervals between the two groups. In Group D, the mean RPP value at baseline was 11573.19±3113.57. After induction the mean RPP was 8439.14±2437.94. As in Group M, here too, the RPP did not rise above 15000 at any point in time after intubation. There was no significant difference in RPP between the two groups (p value 0.68).

Number of Attempts and Manoeuvers
Most patients required only one attempt. Two patients in each group required two attempts and hence it was not clinically significant. The manoeuvers required are shown in Table 2 and was not statistically significant. 13 (16.2%) patients in Group M and 10 (12.7%) patients in Group D required some manoeuvres or the other (BURP, stylet or both).

Adverse Events
None of the patients had immediate post-laryngoscopy complications such as trauma to lips, gums or teeth, lacerations and bleeding.

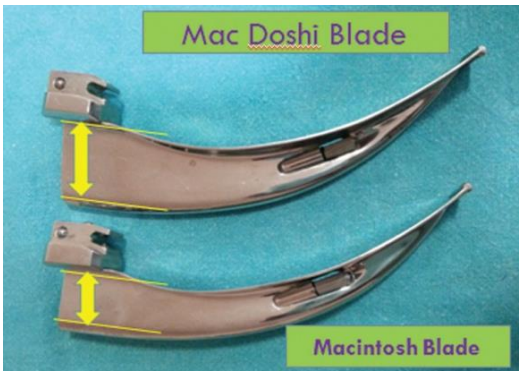

Fig. 1: Macintosh and MacDoshi blade.

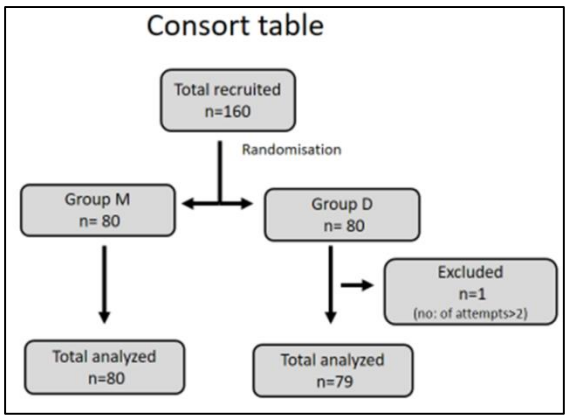

Fig. 2: Consort Diagram

Fig. 3 glottic visualisation and ease of intubaction

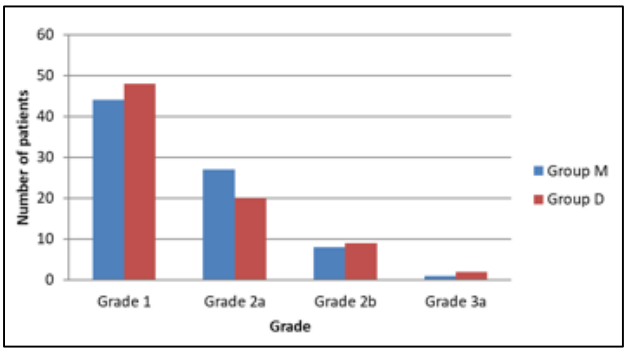

Fig. 3a: Ease of glottic visualization-CL grade.

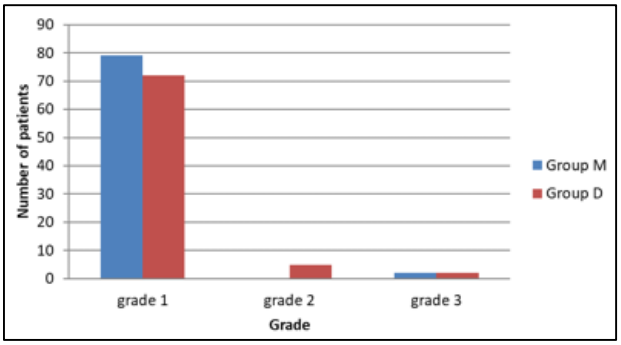

Fig. 3b: Ease of intubation-Arino scale

Fig. 4 comparison of HR and MAP in the two groups

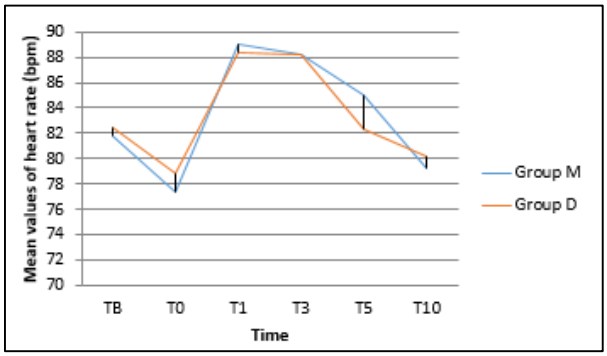

Fig. 4a: Comparison of heart rate

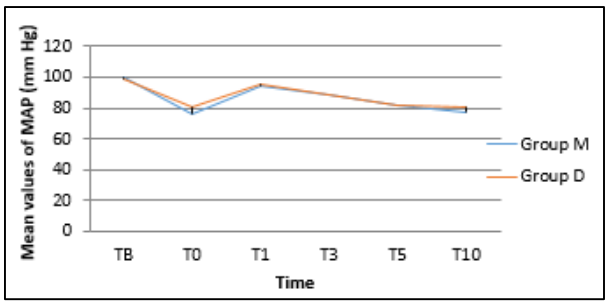

Fig. 4b: Comparison of mean arterial pressure

Discussion

Our study revealed that glottic visualisation was comparable between the two groups with majority of the patients having a CL grade of 1(55% in Group M and 60.8% Group D). In the study conducted by Kulkarni and Tirmanwar et al[5] glottic visualisation as assessed by CL grade (grade 1) was superior with the True View laryngoscope (87%) followed by Miller (83%), McCoy (77%) and lastly Macintosh (63%). Kumar and Viswanathan[6] found that glottic visualisation was better with Miller, McCoy and Mac Doshi, when compared to the Macintosh laryngoscope. They also reported that CL grade was better with straight blades like Miller as compared to curved blades like Macintosh. A comparative study conducted by Sakai T et al[7] found similar results with respect to glottic visualisation in 117 patients using 3 different blades - McCoy, Miller and Macintosh - in each patient.

The difference in results of glottic visualisation with different blades could be explained by the mechanics of laryngoscopy. Crest of the hill effect is seen in curved blades such as Macintosh blade in which the curvature of the blade acts as a visual hill disturbing the line of sight. In straight blades such as Miller, the volume of tissue required to be displaced to obtain a good view is less, while in Macintosh blade to attain same view, tongue must be displaced in to the submandibular space.[6] In our study, the results of glottic visualization are comparable because the Mac Doshi blade is a modification of Macintosh blade with a small increase in web height by 7mm and therefore may have similar mechanics of laryngoscopy.

In our study, we found the time for glottic visualisation to be comparable between the two groups for the same reason as stated above. Kumar and Viswanathan[6] et al found that time for glottic visualisation was longest when using the Miller laryngoscope (15.06±3.59 s) and least with McCoy blade (11.10±1.92 s). The time taken with the Macintosh and Mac Doshi blades were similar (12.06±1.85s and 12.02±1.93s respectively). Ease of intubation was assessed by Arino scale in our study. Intubation was easy in most patients (grade 1) in both the groups (97.5% in Group M and 91.1% Group D). Ease of intubation was grade 2 in five patients (6.32%) in the Mac Doshi group and grade 3 in two patients in each group. However, overall ease of intubation was found to be comparable between the two groups and the difference was not statistically significant (P = 0.084). Kulkarni and Tirmanwar[5] also used the Arino scale for assessing ease of intubation and most patients had a grade 1 score, except in the Miller group. The difference between the groups was statistically significant (P = 0.01). Kumar and Viswanathan[6] used four blades in their study and found that the ease of intubation was highest (Grade 1) in the Mac Doshi and McCoy groups (80% and 88% respectively). However, in the Miller group, only 50% of patients had a grade 1 ease of intubation, making this a significant finding. Therefore the ease of intubation was better with curved blades than with the straight blades. In our study both blades used for comparison were curved blades and the curved blades provide more room to manoeuvre the endotracheal tube into the larynx. Hence we obtained grade 1 score in most of the cases with respect to ease of intubation. The same reason may be attributed for lesser time required to intubate with curved blades.

In our study, time to intubate was 30.29±11.47s in group M and 27.25±7.03s in group D; this difference in time was statistically significant (P = 0.046) but was not clinically significant. Sarkilar et al[8] did a study in 110 patients comparing Macintosh and C-MAC video laryngoscope and found that time for intubation was significantly longer in video laryngoscope group (21.4±14.3 s) as compared to the Macintosh group (16.8±11.2 s).

Manoeuvres used in this study were also comparable between the two groups with 16.2% in group M and 12.7% patients in group D which is similar to the study by Kulkarni and Tirmanwar et al.[5] In our study, there was no clinically significant haemodynamic variations following

laryngoscopy and endotracheal intubation when compared to baseline values in both the groups as there was no undue delay or difficulty in glottic visualisation and endotracheal intubation in both the groups in the present study. This is supported by the evidence that the force applied to the epiglottis and duration of larnygoscopy are determinants of haemodynamic response.[2,9] Although DBP was found to be statistically significant, there is no clinical implication to this finding. Rate pressure product (RPP), an index of myocardial oxygen demand was also assessed and was well below the upper limit of 20,000 which otherwise poses a high risk for myocardial ischaemia and was comparable between the groups with no statistical significance (p = 0.68).

Our research is not devoid of limitations as the study did not include edentulous patients, benefit of either blade in this situation could not be evaluated. We did not include patients with difficult airway; therefore, ease of intubation and laryngoscopy as well as maneuvers required for intubation (BURP, stylet, bougie) could not be assessed in this group. Side-stream capnogram was used and there was a difference in the time taken to capture the first capnogram trace on the screen between different machines, which may have affected the assessment of time taken for intubation. Inspite of these limitations the present study provides sufficient evidence towards the similarity of Macintosh and Mac Doshi blades for laryngoscopy in ASA PS I and II grade patients.

Source of Funding: None.

Conflict of Interest: None.

References

1. Benumof J, Hagberg C. Benumof and Hagberg's airway management. 2nd ed. Philadelphia: Elsevier/Saunders; 2007;7-15
2. Doshi T. MAC Doshi laryngoscope blade: *J Anaesthesiol Clin Pharmacol* 2006.22(2):212.
3. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesth* 1984;39(11):1105–11.
4. Arino JJ, Velasco JM, Gasco C, Lopez-Timoneda F. Straight blades improve visualization of the larynx while curved blades increase ease of intubation: a comparison of the Macintosh, Miller, McCoy, Belscope and Lee-Fiberview blades. *Can J Anesth* 2003;50(5):501.
5. Kulkarni AP, Tirmanwar AS. Comparison of glottic visualisation and ease of intubation with laryngoscope blades. *Indian J Anaesth* 2013;57(2):170-4.
6. Ashok Kumar BK, Viswanathan PN. Comparision of duration of laryngoscopy, laryngeal view and ease of intubation with different laryngoscopy blades. *Int J Recent Trends Sci Technol* 2015;16(2):482-6.
7. Sakai T, Konishi A, Nishiyama T, Higashizawa T, Bito H. [A comparison of the grade of laryngeal visualisation;--the McCoy compared with the Macintosh and the Miller blade in adults]. *Masui* 1998;47(8):998–1001.
8. Sarkılar G, Sargin M, Erdem T, Borazan H, Gök F, Kilicaslan A, et al. Hemodynamic responses to endotracheal intubation performed with video and direct laryngoscopy in patients scheduled for major cardiac surgery. *Int J Clin Exp Med* 2015;8:11477–83.
9. Hodgetts V, Danha RF, Mendonca C, Hillerman C. A randomized Comparison of C-MAC Videolaryngscope Versus Macintosh Laryngoscope for Tracheal Intubation. *J Anesth Clin Res*. 2011 Sep 6 [cited 2018 Aug 15];2(9). Available from: https://www.omicsonline.org/a-randomized-comparison-of-c-mac-videolaryngscope-versus-macintosh-laryngoscope-for-tracheal-intubation-2155-6148.1000163.php?aid=1848

How to cite this article: Anand SL, Kulkarni M, Jacob NSM, Kulkarni M, Shenoy L. Is the Mac doshi blade superior to the conventionally used Macintosh blade with respect to laryngoscopic view and ease of tracheal intubation?. *Indian J Clin Anaesth* 2019;6(3):463-7.