Clinical Communication

Comparison of C-MAC videolaryngoscope with Macintosh laryngoscope for nasotracheal intubation by the novice anaesthesiologist

INTRODUCTION

The Macintosh laryngoscope (MAC) is the most commonly used device for directly visualising the structures of the larynx and facilitating tracheal intubation.[1] Videolaryngoscopes (VLs) improve the visualisation of the glottis and the rate of successful oral intubation[2] and are useful aids in teaching the laryngoscopy technique to novices. The view on the screen can help the teacher guide the novice and provide verbal feedback,[3] resulting in a higher chance of success during the intubation attempt. This has also been seen with tracheal intubations with VL in infants and neonates.[4]

Studies have demonstrated that a VL improves the laryngeal view and can ease intubation difficulty, particularly in novices when compared with MAC in routine orotracheal intubations.[5,6] There are no studies in the literature on nasotracheal intubation (NTI) performed by novices comparing the use of MAC versus (vs) VL. Hence, we conducted this study to compare the efficacy of the C-MAC VL C-blade with the MAC for NTI by novices in patients undergoing head and neck cancer surgeries.

The primary objective of our study was to compare the time for intubation using the C-MAC VL vs MAC. The secondary objectives compared in each group included the rate of successful intubation, number of attempts for successful intubation, percentage of difficult intubations, Cormack–Lehane (CL) grade at laryngoscopy, optimisation manoeuvres needed and the occurrence of trauma to lips, oral mucosa or blood on the laryngoscope.

METHODS

This prospective parallel arm, randomised controlled study was undertaken post approval from the institutional ethics committee (IEC/0318/2023/001 dated 31 March 2018) and registration with the Clinical Trials Registry-India (CTRI/2018/05/013771). Patients included in the study were American Society of Anesthesiologists (ASA) grade I and II between 18 and 60 years of age with Mallampati grade I and II, requiring NTI for elective head and neck cancer surgeries, after seeking written informed consent. Patients with an anticipated difficult airway, previously documented difficult intubation or previous head and neck surgery were excluded because the intubation was to be performed by a novice. Patients were randomised using computer-generated permuted block randomisation with a 1:1 ratio to intubation using the C-MAC VL (VL group) or the MAC blade (MAC group) [Figure 1].

This study was conducted at an apex Indian cancer centre for a period of 3 months from August 2018 to October 2018, where head and neck cancer surgeries account for over 20% of the total surgeries. It is a routine practice for residents including novices to perform NTI as part of their routine work and training under the supervision of a consultant and hence no consent was sought from them for participation in the study. Novices were defined as anaesthetic residents who had done a minimum of five oral intubations using the MAC blade and five oral intubations using the C-MAC C-blade and less than five nasal intubations with either device. This definition ensured that the intubators were not complete novices to intubation, but had minimal experience with NTI.

Standard general anaesthesia was induced after topical nasal vasoconstriction with xylometazoline, with 8 L/min supplemental oxygen using nasal cannula provided from the beginning of laryngoscopy till confirmation of a simple polyvinyl chloride (PVC) cuffed endotracheal tube placement.

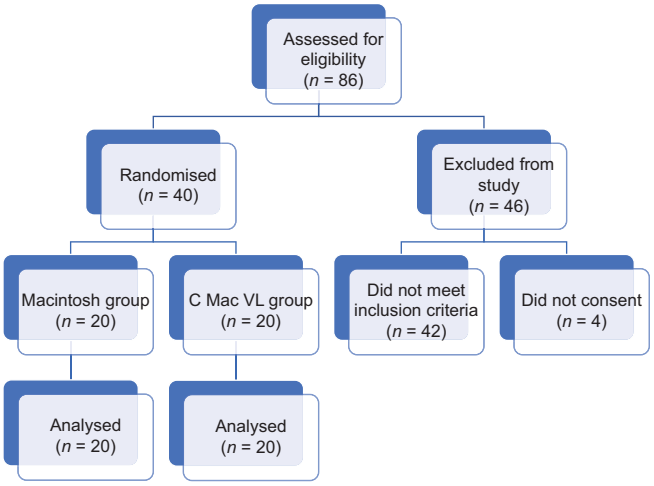

Figure 1: Consorted standards of Reporting Trials (CONSORT)

A research nurse (independent observer) recorded all outcomes. The primary outcome was the time to intubation (TTI). This was defined as the time (seconds) from the beginning of laryngoscopy until confirmation of endotracheal tube placement with a capnograph. In case of repeated attempts, the time recorded was until successful endotracheal intubation. Success at intubation was defined as endotracheal intubation within two attempts. The number of attempts for successful intubation, the need for optimisation manoeuvres [backward, upward, rightward, posterior (BURP) manoeuvre], CL grading, occurrence of trauma to the oral mucosa, lip laceration or blood on the laryngoscope were documented. The percentage of difficult intubations in each group was graded and recorded according to the intubation difficulty score (IDS) as proposed by Adnet[7] *et al*. and a score of 5 or greater was considered as moderate to major difficulty.

Patient safety was ensured by direct supervision of the novice by the consultant, exclusion of patients with anticipated difficult airways, apnoeic oxygenation with a nasal cannula (8 L/min) until intubation and limiting the number of intubation attempts by novices to two.

Sample size calculations were based on a pilot study. To detect a decrease in intubation time by 20 s using the C-MAC video laryngoscope, at a two-sided 5% level of significance and 80% power, 20 pairs of intubations were needed. Categorical variables were compared using the Pearson's Chi-square test. Continuous variables were expressed as median [interquartile range (IQR)] and compared using an unpaired t-test if the data followed a normal distribution and a Mann–Whitney U test if the data were not normally distributed. The statistical software used for the analysis was the Statistical Package for the Social Sciences (SPSS) [International Business Machines (IBM) Corporation USA] version 21.

RESULTS

A total of 40 patients posted for elective head and neck cancer surgeries, requiring NTI were included in the study, and their baseline airway assessment parameters were recorded [Table 1]. None of the patients were found to have limited neck extension, previous radiotherapy, limited mouth opening or thyromental distance <6 cm.

Thirty-nine out of 40 patients underwent successful NTI. In one patient, nasal intubation caused trauma and false passage and was abandoned and converted to orotracheal intubation.

The TTI by novices in the VL group had a median value of 97.5 s (69.7–134.5) compared to 94 s (56–106) in the MAC group ($P = 0.318$). The VL and MAC groups were comparable for need of optimisation manoeuvres; 4 patients in MAC group and 1 patient in VL group had IDS >5 [Table 2]. There were two incidents of mucosal lip injury in the MAC group and one incident of nasal airway trauma in the C-MAC group.

DISCUSSION

In our study, we found that there was no difference in TTI for nasal intubations with VL and MAC laryngoscope. The VL group had less need for optimisation manoeuvres and a lower IDS, although this was not statistically significant, with a P value of 0.34.

VL has been used by novice anaesthesiologists for orotracheal intubation with contrasting results in a few studies. Liu[8] compared McGrath vs MAC laryngoscope for orotracheal intubation by inexperienced anaesthetists demonstrating that for orotracheal intubation in patients with a normal airway, McGrath compared with the MAC allows superior glottis views, greater ease of intubation, less complications and haemodynamic changes with statistically non-significant difference in intubation time.

Kwak[9] carried out a randomised study in experienced anaesthetists showing that TTI was shorter in the McGrath VL group as compared to the conventional MAC group (34.4 ± 13.7 vs 44.9 ± 15.6 s). Rajan[10] *et al*. compared the C-MAC VL D blade to the MAC laryngoscope to aid NTI and found TTI to be much shorter in the VL group (24 vs 68 s). Jiang[11] *et al*. did a systematic review and meta-analysis and found that the VL improves the first attempt success rate, laryngeal visualisation and shortens time to intubation during NTI.

In the present study, we tried to find out whether the use of VL makes NTIs easier and quicker to learn for the novice anaesthetist as compared to the conventional MAC laryngoscope. We found no statistically significant difference between the VL and MAC groups in terms of the number of successful intubations, and the requirement of BURP. This is because the study was not powered to elicit this difference. But we found that

Table 1: Patient demographics and airway assessment

Characteristics	Macintosh laryngoscope group (Mean±SD)	C-MAC VL group (Mean±SD)	*P* using *t*-test
Age (years) Mean±SD	45.25±8.729	47.70±8.234	0.367
Gender (Male:Female)	15:5	14:6	0.763
Height (cm) Mean±SD	163.65±11.57	160.95±8.01	0.396
Weight (kg) Mean±SD	62.75±9.16	61.10±11.76	0.624
BMI (kg/m^2) Mean±SD	23.77±5.24	23.49±3.51	0.84
ASA I	16	14	0.716
ASA II	4	6	0.716
Airway assessment	Macintosh laryngoscope (*n*=20)	C-MAC VL (*n*=20)	
Mallampati classification III or IV	-	2	
Limited tongue protrusion	-	2	
Obesity	1	-	
Buck teeth/missing incisors	1	2	
Nil significance	18	14	

ASA: American Society of Anesthesiologists; BMI: Body mass index; SD: Standard deviation; VL: Videolaryngoscope. Values for characteristics other than Age, Height, Weight and BMI stand for number of patients (n)

Table 2: Comparison between the Macintosh laryngoscopes and C-MAC VL

	Macintosh Laryngoscopes (*n*=20)	C-MAC VL (*n*=20)	*P*
Time to intubation (seconds) Median (IQR)	94 (56-106)	97.5 (69.7-134.5)	0.318
Successful intubation	16	18	0.661
Intubation difficulty score (IDS/Adnet score >5)	4	1	0.342
Intubated in 1st attempt	15	17	0.407
Optimisation manoeuvre	15	11	0.185
Use of adjunct Magill forceps	5	3	0.6948
CL grade I view	With optimisation=11 Without optimisation=4	With optimisation=6 Without optimisation=8	0.648
Trauma	2	1	1

IQR: Interquartile range; CL: Cormack-Lehane; VL: Videolaryngoscope. Values for parameters other than Time to intubation stand for number of patients (n)

patients in the C-MAC group had lower IDS (1 vs 4) in the C-MAC VL group, compared to the MAC group.

The strength of our study is that it was a randomised trial with a well-defined valid clinical primary outcome, the TTI. The TTI is influenced both by glottic view and ease of intubation, and also has significance clinically. We used the IDS to quantify ease of intubation, which is a well-defined comprehensive numeric score. A few studies[2,6] have compared VL vs MAC for orotracheal intubations in novices, whilst ours compares for NTI for which evidence is lacking.

The limitations are that we could not blind the assessor to the type of device but this remains a common challenge in all VL-related studies. We tried to minimise this bias by the use of objective endpoints and the presence of an independent assessor.

CONCLUSION

The study concludes that the use of the C-MAC VL for NTI is not superior to the conventional MAC in the hands of the novice anaesthesiologist.

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Conflicts of interest

There are no conflicts of interest.

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REFERENCES

1. Lewis SR, Butler AR, Parker J, Cook TM, Schofield-Robinson OJ, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: A cochrane systematic review. Br J Anaesth 2017;119:369-83.
2. Bakshi SG, Vanjari VS, Divatia JV. A prospective, randomised, clinical study to compare the use of McGrath(®), Truview(®) and Macintosh laryngoscopes for endotracheal intubation by novice and experienced anaesthesiologists. Indian J Anaesth 2015;59:421-7.
3. Saran A, Dave NM, Karnik PP. Efficacy and safety of videolaryngoscopy-guided verbal feedback to teach neonatal and infant intubation. A prospective randomised cross over study. Indian J Anaesth 2019;63:791-6.
4. Myatra SN, Doctor JR. Use of videolaryngoscopy as a teaching tool for novices performing tracheal intubation results in greater first pass success in neonates and infants. Indian J Anaesth 2019;63:781-3.
5. Eismann H, Sieg L, Etti N, Friedrich L, Schröter C, Mommsen P, *et al*. Improved success rates using videolaryngoscopy in unexperienced users: A randomized crossover study in airway manikins. Eur J Med Res 2017;22:27-36.
6. Goksu E, Kilic T, Yildiz G, Unal A, Kartal M. Comparison of the C-MAC video laryngoscope to the Macintosh laryngoscope for intubation of blunt trauma patients in the ED. Turk J Emerg Med 2016;16:53-6.
7. Adnet F, Borron SW, Racine SX, Clemessy JL, Fournier JL, Plaisance P, *et al*. The intubation difficulty scale (IDS): Proposal and evaluation of a new score characterizing the complexity of endotracheal intubation. Anesthesiology 1997;87:1290-7.
8. Liu ZJ, Yi J, Guo WJ, Ma C, Huang YG. Comparison of McGrath series 3 and macintosh laryngoscopes for tracheal intubation in patients with normal airway by inexperienced anesthesiologists: A randomized study. Medicine (Baltimore) 2016;95:e2514. doi: 10.1097/MD.0000000000002514.
9. Kwak H-J, Lee S-Y, Lee S-Y, Cho S-H, Kim H-S, Kim J-Y. McGrath video laryngoscopy facilitates routine nasotracheal intubation in patients undergoing oral and maxillofacial surgery: A comparison with macintosh laryngoscopy. J Oral Maxillofac Surg 2016;74:256-61.
10. Rajan S, Kadapamannil D, Barua K, Tosh P, Paul J, Kumar L. Ease of intubation and hemodynamic responses to nasotracheal intubation using C-MAC videolaryngoscope with D blade: A comparison with use of traditional Macintosh laryngoscope. J Anaesthesiol Clin Pharmacol 2018;34:381-5.
11. Jiang J, Ma D-X, Li B, Wu A-S, Xue F-S. Videolaryngoscopy versus direct laryngoscopy for nasotracheal intubation: A systematic review and meta-analysis of randomised controlled trials. J Clin Anesth 2019;52:6.

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