Original Article

DOI: 10.7860/JCDR/2024/73543.20408

Oral Endotracheal Intubation with Restricted Glottis View using C-MAC D Blade®: A Randomised Controlled Trial

Anaesthesia Section

VAIDARBHI RASIKBHAI PATEL[1], NIRALI NIMESHKUMAR PANCHAL[2], SANKET HIRENBHAI MEHTA[3], MADHAVI SANJAY CHAUDHARI[4], BHUMIKA PRADIPKUMAR PATHAK[5], MAYUR KIRAN SHINDE[6]

ABSTRACT

Introduction: The perspective of airway management has undergone a considerable transformation since the advent of Video Laryngoscopes (VL). VL has rapidly been accepted as an intubation tool in a variety of clinical scenarios. This heralds a wide array of VL models with their own strengths and weaknesses. The C-MAC D blade® is one such VL with an angulated blade that provides an excellent glottis view, but negotiating the Endotracheal Tube (ETT) past the glottis opening and into the trachea might be difficult. No study till date was done on the C-MAC D blade® with different glottis views for intubation.

Aim: To compare the Total Time of Intubation (TTI) with restricted glottis view and full glottis view with C-MAC D blade® as the primary aim, along with the first attempt intubation rate and complications during intubation.

Materials and Methods: The present prospective single-centre randomised controlled trial was conducted in the Department of Anaesthesiology, Shree Krishna Hospital, PSMC, Karamsad, Gujarat, India, from September 2021 to August 2022. A total of 42 patients were randomly divided into two groups: group-F (n=21), which had a full glottis view, and group-R (n=21), which had a restricted glottis view. Randomised glottis views were achieved with the C-MAC D blade® VL during oral endotracheal intubation in both groups. Video recordings of the intubations were made, and TTI, first attempt success rate and complications during intubation were noted. Statistical analysis was done with an independent sample t-test to compare the two groups of continuous variables using STATA version 14.2.

Results: The mean age in group-F was 45.86±10.83 years and in group-R was 47.76±9.14 years. The male-to-female ratio in group-F was 10:11 and in group-R was 9:12. Overall, the first-attempt successful intubation rate with the C-MAC D blade® in both groups was 90.48%. However, it was higher in group-R (95.24%) compared to group-F (85.71%). TTI was less in group-R compared to group-F (36.19±11.11 vs 45±15.89 seconds, p-value=0.0438). Group-R had lower incidence of postoperative sore throat (14.29% vs 57.14%, p-value=0.004) compared to group-F.

Conclusion: Total time of intubation was less with a restricted glottis view compared to a full glottis view with C-MAC D blade® VL. Additionally, the restricted view had a higher first attempt intubation rate. Postoperative sore throat was significantly lower in the restricted view, with a lesser incidence of oropharyngeal trauma compared to the full glottis view.

Keywords: Airway management, General anaesthesia, Intratracheal, Laryngoscopy

INTRODUCTION

Canadian surgeon, Dr. Johmmn Pacey introduced the first video laryngoscope in 2001, since then a new journey in the field of airway management has started [1]. The last two decades have witnessed a wide range of VLs with different configurations and varied cost are available in the market. All VLs have digital camera and light source at the tip of the blade that transmit image either on an eyepiece or monitor, providing an indirect wider view of the larynx without the need for alignment of the oral-pharyngeal-laryngeal axis [2]. Most international airway guidelines recommend using VL as the first device for successful first attempt intubation [3,4]. The Coronavirus Disease 2019 (COVID-19) pandemic has dramatically increased the use of VL as a first-line device for tracheal intubation because it increases the face-to-face distance, so less aerosol exposure to attending anaesthesiologists [5]. Early use of VL was recommended in advisories from several anaesthesiology societies during the COVID-19 pandemic [6,7]. As a tertiary healthcare centre in rural India, the authors only have a C-MAC D blade® videolaryngoscope, which was primarily used for difficult intubations. However, during the COVID-19 pandemic, it was used for all routine tracheal intubations.

The C-MAC D blade® VL is half-moon-shaped with an angulation of 40° and an elliptically tapered blade shape rising distally [8]. Due to its angulated blade, it provides a clear view of the glottis without the need for axis alignment, but inserting the Endotracheal Tube (ETT) through the glottis opening is sometimes difficult, required some technical modifications. Practical methods and manoeuvres were given for successful intubation with the C-MAC D blade®, but no study has done till date [9].

The primary aim of the current study was to evaluate the time to intubation in relation to a full glottis view versus a restricted glottis view using the C-MAC D blade® VL in non difficult oral endotracheal intubation. The secondary objectives were to study the time taken to obtain laryngeal view, first attempt success rate, rate of switch over to direct laryngoscopy and complications during intubation.

MATERIALS AND METHODS

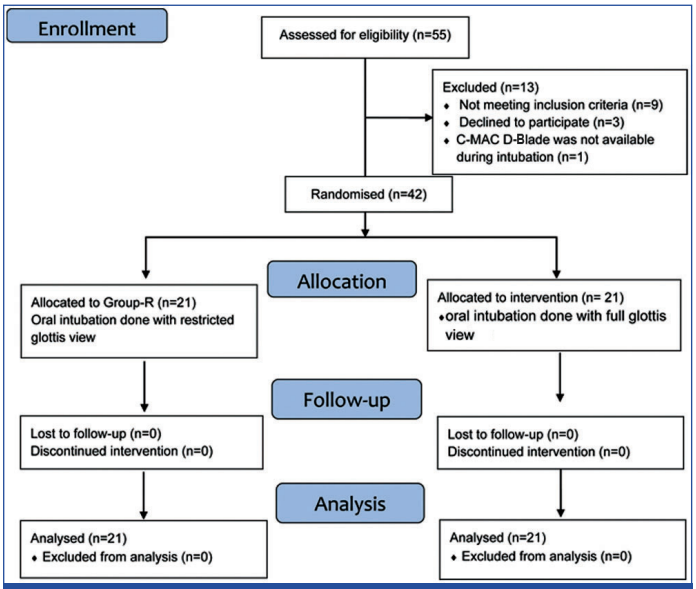
The present prospective single-centre randomised controlled trial was conducted in the Department of Anaesthesiology, Shree Krishna Hospital, PSMC, Karamsad, Gujarat, India, from September 2021 to August 2022. The study commenced after obtaining approval from the Hospital Ethics Committee (IEC/BU/130/faculty/3/200/2021) and Clinical Trials Registry India (CTRI) registration (CTRI/2021/09/036250). The principles of the Declaration of Helsinki were followed during the study.

Sample size calculation: In the absence of local and regional estimates of the Standard Deviation (SD) of intubation time of restricted glottis view and full glottis view with C-MAC D blade®,

a moderate effect size of 0.9 was assumed for sample size calculation. Considering an effect size of 0.9, a sample size of 21 per group was required to attain 80% power, allowing for a 5%type-I error.

Inclusion criteria: Patients aged 18-65 years of either gender, with American Society of Anaesthesiologists Physical Status I-III (ASA PS I-III), El-Ganzouri Risk Index (EGRI) between 1 to ≤7 [10], Body Mass Index (BMI) between 18.5-35 kg/m^2, required oral endotracheal intubation for general anaesthesia were included in the study.

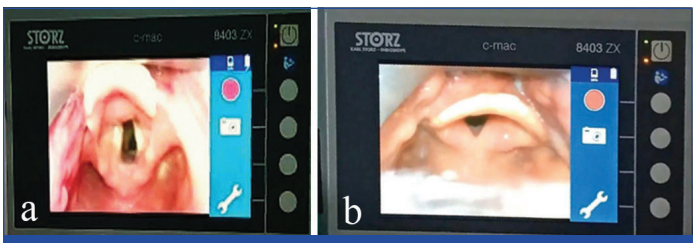
Exclusion criteria: Patients required rapid sequence intubation, awake or fiberoptic intubation, nasal intubation, non Polyvinyl Chloride (PVC) ETT intubation, pregnant patients, or those with documented past difficult intubation were excluded from the study. A total of 55 patients were assessed for eligibility, and 42 patients were enrolled [Table/Fig-1].



[Table/Fig-1]: Consolidated Standards of Reporting Trails (CONSORT) flow diagram for the study participants.

Study Procedure

Patients were randomly allocated into two groups with a 1:1 allocation ratio through balanced randomisation using computer-generated random numbers from WinPepi software. Subjects were divided into group-R {restricted glottis view, Cormack and Lehane (CL) grade-2a} and control group-F (Full glottis view, CL grade-1) [Table/Fig-2] [11]. Allocation was carried out using an opaque sealed envelope method by the statistician. The investigator (CM) enrolled participants, and written informed consent was taken by enrolled participant. Other investigators, except CM, opened the envelopes and performed laryngoscopy using the C-MAC D blade® according to the group allocation. Investigator CM, the anaesthesiologist who conducted the case, the video recorder, and the data entry person were blinded to the group allocation.



[Table/Fig-2]: (a) Full glottis view and; (b) Restricted glottis view with C-MAC D blade.

The study procedure was as follows: Standard monitoring was applied, including non invasive blood pressure, electrocardiography, pulse oximetry, peripheral nerve stimulator on the ulnar nerve and capnography, and baseline parameters were noted. An intravenous line was secured. At this time, the study investigator, who was going to perform bag and mask ventilation and later video laryngoscopy, opened the opaque envelope to reveal the allotted group, but it was not announced to others in the operating room. Preoxygenation was done by a study investigator. The attending anaesthesiologist chose and administered the type and dosage of the induction agent and neuromuscular blocking drugs. On abolition of all four twitches of the train of four on the peripheral nerve stimulator were abolished, the study investigator performed laryngoscopy using a C-MAC D blade® and obtained the desired glottis view according to randomisation. In group-R, the study investigator obtained restricted glottis view (CL-2a) and in group-F, full view of the glottis (CL-1). The study investigators were experienced with at-least 20 intubations with C-MAC D blade®. Once the randomsed view was obtained, oral intubation was performed with ETT with an internal diameter of 7 mm for female and 8 mm for male patients, preloaded with stylet shaped according to the D blade® curve. Once the tip of the ETT passed beyond the vocal cords, stylet was removed, and ETT was advanced further until the black mark passed the vocal cords. ETT cuff was inflated and attached to the anaesthesia breathing circuits, and intermittent positive pressure ventilation was started. End-tidal CO_2 and SpO_2 were recorded. The study investigator checked for procedure-related injuries to the lips, teeth and oral cavity, and then handed over the patient to the attending anaesthesiologist. An assistant recorded a video of the laryngoscopy displayed on the C-MAC monitor from the mobile device, and all parameters were obtained from this video recording after the procedure. Once the surgery was over, all patients were shifted to the post-anaesthesia care unit and assess them for the presence or absence of hoarseness of voice and postoperative sore throat.

In the present study, 1st attempt failure was defined as the removal of D blade® from the oropharynx and reinsertion, intubation time extended >120 seconds, and change in glottis view opposite to randomisation. The 2nd attempt for intubation with the D blade® was not time-bound. After two unsuccessful endotracheal intubations or during the procedure if SpO_2 fell below 90%, the study investigator followed the Institutional difficult intubation protocol.

The TTI (time from D blade® insertion past the upper incisors to passing the black mark of ETT through the glottis under direct vision on the C-MAC monitor) was a primary outcome, while time taken to obtain glottis view, percentage of first attempt successful endotracheal intubation, incidence of oropharyngeal trauma, trauma to teeth, hoarseness of voice, postoperative sore throat and desaturation (SpO_2 <94%) were assessed as secondary outcomes.

STATISTICAL ANALYSIS

Descriptive statistics {Frequency (%), mean (SD)} were used to portray the baseline profile of the study population. An independent sample t-test was used to compare two groups of continuous variables. The Chi-square test and Fisher's exact test were used to determine the association between categorical variables and the study group. The analysis was performed using STATA (14.2). Statistical significance was set at a p-value <0.05.

RESULTS

The total of 55 subjects were assessed for eligibility, and 42 subjects were enrolled in the present study. All studied patients were analysed and followed-up. The mean age in Group-F was 45.86±10.83 years and in Group-R was 47.76±9.14 years. The male-to-female ratio in Group-F was 10:11 and in Group-R was 9:12. The two groups were comparable regarding age, gender, BMI, EGRI score and ASA PS with no significant differences (p-value >0.05) [Table/Fig-3]. The Time to Intubate (TTI) in group-R was 36.19±11.11 seconds, and in group-F was 45±15.89 seconds. TTI was significantly less in group-R compared to group-F (p-value=0.0438) [Table/Fig-4]. The time to obtain a randomised glottis view was comparable in both groups (16.04±1.10 vs 14.52±1.67) [Table/Fig-4]. All patients were intubated

with a C-MAC D blade®. The overall first attempt successful intubation rate in both groups with C-MAC D-Blade was 90.48%, but in group-R, it was higher (95.24%) compared to group-F (85.71%), although the difference was not statistically significant (p-value=0.293) [Table/Fig-4]. In group-R, 3 (14.29%) patients, and in group-F, 12 (57.14%) patients had postoperative sore throat. A statistically significant lower incidence of postoperative sore throat in the restricted glottis view group (p-value=0.004) was obtained. None of the study participants had a desaturation during intubation. In group-F, one patient had trauma to teeth, two had oropharyngeal injuries, and two had hoarseness of voice, respectively. None of the patients in group-R had such complications [Table/Fig-5].

Variables		Group-F (n=21)	Group-R (n=21)	p-value
Age (years) (Mean±SD)		45.86±10.83	47.76±9.14	0.54*
Gender (n)	Male	11	9	0.116**
	Female	10	12	
BMI in kg/m^2 (Mean±SD)		24.23±3.85	24.23±4.01	0.81*
EGRI score (Mean±SD)		3.48±1.33	4.24±1.48	0.08**
ASA PS, n (%)	I	1 (4.56)	1 (4.56)	0.8**
	II	8 (38.10)	6 (28.57)	
	III	12 (57.14)	14 (66.67)	

[Table/Fig-3]: Demographic profile.
BMI: Body mass index; EGRI score: El-Ganzouri risk index score; ASA PS: American Society of Anesthesiology physical status (US English) instead of American society of anaesthesiologists physical status; SD: Standard deviation
*Independent sample t-test **Chi-square test

Parameters		Group-R (n=21)	Group-F (n=21)	p-value
Numbers of attempt for successful intubation, n (%)	1st attempt	20 (95.24)	18 (85.71)	0.293*
	2nd attempt	1 (4.76)	3 (14.29)	
Time taken to obtained randomised glottis view (seconds)	Mean (SD)	14.52 (1.67)	16.04 (1.10)	0.45**
Total Time of Intubation (TTI) (seconds)	Mean (SD)	36.19 (11.11)	45 (15.89)	**0.0438****

[Table/Fig-4]: Comparison of numbers of attempt for successful intubation, time taken to obtained randomised glottis view and Total Time of Intubation (TTI).
SD: Standard deviation *Chi-square test **Independent t-test; The p-value in bold font indicates statistically significant value

Complications	Group-R (n=21), n (%)	Group-F (n=21), n (%)	p-value (Fisher's exact test)
Oropharyngeal injury	0	2 (9.52)	0.488
Trauma to teeth	0	1 (4.76)	>0.999
Hoarseness of voice	0	2 (9.52)	0.488
Postoperative sore throat	3 (14.29)	12 (57.14)	**0.004**
Desaturation (SpO_2 <94%)	0	0	-

[Table/Fig-5]: Complications during intubation with C-MAC D blade.

DISCUSSION

In the present study, non difficult oral endotracheal intubation with a restricted glottis view using the C-MAC D blade® had reduced Time to Intubation (TTI), a higher incidence of first attempt successful intubation, and had reduced incidence of postoperative sore throat. The VLs have gained popularity as they eliminate the need for alignment of the oral-pharyngeal-laryngeal axis for glottis visualisation. They are useful for limited mouth opening, neck mobility issues and anticipated difficult airways, give indirect view on the screen and also others to share their knowledge during airway management. Hindrance with their use for routine intubation include availability in heterogeneous designs with variable learning curves and costs. Additionally, passing the Endotracheal Tube (ETT) through the glottis opening can be difficult despite improved glottis visualisation [12,13].

In the prospective study by Michailidou M et al., comparing VL and Direct Laryngoscopy (DL) on trauma patients, 40% of VL failures were due to the inability to pass the ETT despite a good laryngeal view, compared to a 21% failure rate with DL [14]. Another similar randomised study by Aziz MF et al., comparing C-MAC with DL in difficult airway cases on 300 patients found that 54% of VL failures were due to the inability to pass the ETT with a good glottis view, compared to 35% with DL [15]. This hurdle for passing the ETT is higher with angulated blade VLs [12]. Myatra SN et al., elaborated in their narrative review that to use VL for routine airway management, one must be familiar with the available VLs, and further research is needed to identify the ideal view required for hassle-free tracheal tube delivery [1].

Many research studies have been conducted comparing the C-MAC D blade® with other laryngoscopes or videolaryngoscopes in normal or difficult airways, with the primary objective being to assess the Cormack-Lehane (CL) grade after laryngoscopy [16-19]. Being an angulated video laryngoscope, the C-MAC D blade® definitely improves the CL grade compared to other non angulated laryngoscopes, but none of the literature mentions how different manoeuvres or blade positions improve the success rate of intubation and shorten the TTI. One such manoeuver is withdrawing the tip of the D blade® would be withdrawn from the vallecula to achieve a restricted glottis view (CL-2a grade) for intubation [9].

The present study was conducted to observe the effect of a restricted glottis view (CL-2a) versus a full glottis view (CL-1) using the C-MAC D blade® videolaryngoscope during oral endotracheal intubation. The first attempt successful intubation rate in both groups was 90.5%. A total of 20 (95.5%) patients in group-R were successfully intubated in the first attempt compared to 18 (85.7%) patients in group-F. In the current study, the study investigators were able to obtained full glottis view (CL I) in all patients in group-F. In the study by Gu Y et al., where they compared a restricted laryngeal view with a full laryngeal view using the GlideScope VL, which is also an angulated videolaryngoscope, 99% of patients were intubated in restricted view compared to 95% in the full view [20]. In the study by Aziz MF et al., the first attempt successful intubation rates were 98.1% for attending anaesthesiologists were 98.1 % and by resident anaesthesiologists using C-MAC D blade® [19]. In the first clinical evaluation of the C-MAC D blade® by Cavus E et al., the first attempt successful intubation rate in routine patients was 93.3%, and as a rescue device, it was 70% [21]. Same as the present study by Kılıçaslan A et al., there was a 100% success rate with C-MAC D blade®, but first attempt intubation rate was 85% in simulated difficult airways. In their study, all patients were intubated with a full glottis view (CL I) [22].

The TTI was 36.19±11.11 seconds in restricted glottis view (group-R) as compared to 45±15.89 seconds in full glottis view (group-F) with the C-MAC D blade®. Thus, TTI was significantly shorter in the restricted view as compared to the full view. Time to achieve a randomised view was comparable in both groups. No such in-vitro or in-vivo studies available with the C-MAC D blade®, but one study had been done on the GlideScope, which features a 60-degree angulated blade. In the study by Gu Y et al., the median TTI was less in restricted exposure as compared to full glottic exposure with the GlideScope VL {27 (22-36) sec vs 36 (27-48) sec, respectively} [20]. A randomised controlled study by Serocki G et al., showed that Glidoscope and C-MAC D blade® VL, when using manual inline axial stabilisation for tracheal intubation, were equally efficacious in patients with cervical spine injury/pathology [23]. In the randomised comparative study by Mohan A et al., using the C-MAC D blade® VL and McCoy blade laryngoscope with manual inline stabilisation, the intubation time was 38.25±4.22 seconds. In their study, 32 patients had CL I grade, and 16 out of 60 patients had CL IIa grade [24]. In the study of Kılıçaslan A et al., comparing the Macintosh, C-MAC, and C-MAC D blade® in normal airway, mean TTI was 30 seconds

with C-MAC D blade®, which was higher compared to the other two laryngoscopes. Anaesthetists rated the C-MAC D blade® as more difficult to use compared to the Macintosh and C-MAC. Intubation was performed with CL grade-1 using the C-MAC D blade® in all patients, which could be the reason for such results [22].

Various proposed theories suggest how a restricted glottis view helps achieve easier, shorter, and higher first-attempt successful endotracheal intubation. According to the alignment approach suggested by Goodine C et al., there was a misalignment between the glottis opening and the ETT tip in a full glottis view (CL-I). When the D blade® is lifted to achieve a CL-I grade, the larynx moves more anteriorly, while the ETT tip remains more posterior, even though the curvature of the ETT matches that of the D blade®. In a restricted glottis view (CL-IIa), the D blade® is slightly withdrawn proximally from the vallecula, allowing the larynx to drop, aligning the glottis opening with the ETT tip. This adjustment might explain the faster first-attempt success rate in intubation [25].

Also, if the D blade® is kept more proximal to the epiglottis, as in a restricted view, it provides a wider view of the larynx and surrounding structures. This wider view aids in redirecting and advancing the ETT [9,26]. A present study supports an in-vitro study of GlideScope on an airway model by Dupanovic M and Jensen R. They concluded that a CL grade-2a view was preferable for GlideScope-directed intubation, while a CL grade-1 laryngoscopy view rendered intubation difficult [27].

In group-F, two patients experienced oropharyngeal trauma and hoarseness of voice, while one had trauma to the teeth. while no patients from group-R had such complications. The restricted view (group-R) had less incidence of postoperative sore throat (14.29%) compared to the full view (group-F) with 57.14%. Less lifting force required for restricted view potentially leads to less soft tissue inflammation, which could be the reason of significantly lower incidence of postoperative sore throat [28].

Additionally, Tosh P et al., noted a reduced incidence and severity of postoperative sore throat, hoarseness and coughing with the C-MAC D blade®. but they had not mentioned about glottis view achieved during intubation [29].

Limitation(s)

Further study is required for applicability of the study results in patients with predicted difficult airways and BMI >35 kg/m^2, as these populations were excluded considering safety of participants. Further research is required for generalisability of the present study's findings to other types of videolaryngoscopes.

CONCLUSION(S)

In the present study, the use of a restricted glottis view (CL grade 2a) with the C-MAC D blade® videolaryngoscope demonstrated a significant reduction in TTI compared to the full glottis view (CL grade 1). Additionally, the restricted glottis view was associated with a higher rate of successful first-attempt intubation. The restricted view also resulted in a lower incidence of postoperative sore throat compared to the full view. This suggests that a restricted glottis view may be less traumatic and could potentially minimise post-intubation complications. Furthermore, no desaturation occurred in either group, and fewer complications such as oropharyngeal trauma and hoarseness of voice were observed in the full glottis view. By adopting the restricted glottis view manoeuvre, the D blade® can help streamline non difficult intubation processes and reduce potential complications, showcasing its versatility beyond its primary role in managing complex airways.

REFERENCES

[1] Myatra SN, Patwa A, Divatia JV. Videolaryngoscopy for all intubations: Is direct laryngoscopy obsolete? Indian J Anaesth. 2022;66:169-73.
[2] 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(11):CD011136.
[3] Myatra SN, Shah A, Kundra P, Patwa A, Ramkumar V, Divatia JV, et al. All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in adults. Indian J Anaesth. 2016;60(12):885-98.
[4] Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, et al. Difficult Airway Society intubation guidelines working group. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth. 2015;115(6):827-48.
[5] Hall D, Steel A, Heij R, Eley A, Young P. Videolaryngoscopy increases 'mouth-to-mouth' distance compared with direct laryngoscopy. Anaesthesia. 2020;75:822-23.
[6] Malhotra N, Bajwa SJS, Joshi M, Mehdiratta L, Trikha A. COVID operation theatre- advisory and position statement of Indian Society of Anaesthesiologists (ISA National). Indian J Anaesth. 2020;64:355-62.
[7] World Federation of Societies of Anaesthesiologists. Coronavirus-guidance for anaesthesia and perioperative care providers [Internet]. London: WFSA; 2020. [Cited 2020 May 28]. Available from: https://www.wfsahq.org/resources/coronavirus.
[8] Aziz MF, Bayman EO, Van Tienderen MM, Todd MM; StAGE Investigator Group, Brambrink AM. Predictors of difficult videolaryngoscopy with GlideScope® or C-MAC® with D-blade: Secondary analysis from a large comparative videolaryngoscopy trial. Br J Anaesth. 2016;117(1):118-23.
[9] Shah SB, Hariharan U, Bhargava AK. C Mac D blade: Clinical tips and tricks. Trends in Anaesthesia and Critical Care. 2016;6:06-10.
[10] Gupta R, Gupta N, Kumar V, Garg R, Bharati SJ, Mishra S, et al. El-Ganzouri multivariate risk index based airway management in head and neck cancer patients: A retrospective analysis of 1000 patients in a tertiary care center. J Anaesthesiol Clin Pharmacol. 2022;38(1):97-103.
[11] Cook TM. A new practical classification of laryngeal view. Anaesthesia. 2000;55(3):274-79. Doi: 10.1046/j.1365-2044.2000.01270.x. PMID: 10671848.
[12] Paolini JB, Donati F, Drolet P. Review article: Video-laryngoscopy: Another tool for difficult intubation or a new paradigm in airway management? Can J Anaesth. 2013;60:184-91.
[13] Hwang SM. A good laryngeal view does not guarantee perfectly successful tracheal intubation. Korean J Anaesthesiol. 2016;69:111-12.
[14] Michailidou M, O'Keeffe T, Mosier JM, Friese RS, Joseph B, Rhee P, et al. A comparison of video laryngoscopy to direct laryngoscopy for the emergency intubation of trauma patients. World J Surg. 2015;39(3):782-88.
[15] Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative effectiveness of the C-MAC video laryngoscope versus direct laryngoscopy in the setting of the predicted difficult airway. Anaesthesiology. 2012;116(3):629-36.
[16] Agrawal N, Saini S, Gupta A, Kabi A, Girdhar KK. Comparison of C-MAC D-Blade with Macintosh laryngoscope for endotracheal intubation in patients with cervical spine immobilization: A randomised controlled trial. Trends Anaesth Crit Care. 2021;37:35-41.
[17] Kamath S, Shenoy A. Comparison of the 'D blade' with conventional blade of c-mac® for endotracheal intubation in patients with simulated limitation of cervical movements. Ind J Resp Care. 2012;1(2):144-48.
[18] Rida F, Fouada H, Mahmouda EN, Abdelb AM, Aboshanab H. Endotracheal intubation using direct laryngoscopy with Macintosh blade versus C-MAC videolaryngoscopy (Macintosh blade and D-blade). Res Opin Anaesth Intensive Care. 2017;4(1):01-06.
[19] Aziz MF, Abrons RO, Cattano D, Bayman EO, Swanson DE, Hagberg CA, et al. First-attempt intubation success of video laryngoscopy in patients with anticipated difficult direct laryngoscopy: A multicenter randomised controlled trial comparing the C-MAC D-Blade versus the glidescope in a mixed provider and diverse patient population. Anaesth Analg. 2016;122(3):740-50.
[20] Gu Y, Robert J, Kovacs G, Milne AD, Morris I, Hung O, et al. A deliberately restricted laryngeal view with the GlideScope® video laryngoscope is associated with faster and easier tracheal intubation when compared with a full glottic view: A randomised clinical trial. Can J Anaesth. 2016;63:928-37.
[21] Cavus E, Neumann T, Doerges V, Moeller T, Scharf E, Wagner K, et al. First clinical evaluation of the C-MAC D-Blade videolaryngoscope during routine and difficult intubation. Anaesth Analg. 2011;112(2):382-85.
[22] Kılıçaslan A, Topal A, Erol A, Uzun ST. Comparison of the C-MAC D-Blade, Conventional C-MAC, and Macintosh Laryngoscopes in Simulated Easy and Difficult Airways. Turk J Anaesthesiol Reanim. 2014;42(4):182-89.
[23] Serocki G, Neumann T, Scharf E, Dörges V, Cavus E. Indirect videolaryngoscopy with C-MAC D-Blade and GlideScope: A randomised, controlled comparison in patients with suspected difficult airways. Minerva Anestesiol. 2013;79(2):121-29.
[24] Mohan A, Venkatesh RR, George SK, Paul AA, Alfred VM, Ninan LG. Randomised comparative study between C-MAC D Blade and McCoy blade laryngoscope for intubation with manual inline axial stabilisation. J Clin Diagn Res. 2020;14(1):UC06-UC09.
[25] Goodine C, Sparrow K, Asselin M, Hung D, Hung O. The alignment approach to nasotracheal intubation. Can J Anaesth. 2016;63(8):991-92.
[26] Sinha R, Ray BR, Sharma A, Pandey RK, Punj J, Darlong V, et al. Comparison of the C-MAC video laryngoscope size 2 Macintosh blade with size 2 C-MAC D-Blade for laryngoscopy and endotracheal intubation in children with simulated cervical spine injury: A prospective randomised crossover study. J Anaesthesiol Clin Pharmacol. 2019;35(4):509-14.
[27] Dupanovic M, Jensen R. Optimizing GlideScope laryngoscopy: An in vitro study on an airway model. Anaesthesiology. 2007;106:886-88.

[28] Gordon JK, Bertram VE, Cavallin F, Parotto M, Cooper RM. Direct versus indirect laryngoscopy using a Macintosh video laryngoscope: A mannequin study comparing applied forces. Can J Anaesth. 2020;67(5):515-20.

[29] Tosh P, Kadapamannil D, Rajan S, Narayani N, Kumar L. Effect of C-MAC Video laryngoscope-aided intubations using D-Blade on incidence and severity of postoperative sore throat. Anaesth Essays Res. 2018;12(1):140-44.

PARTICULARS OF CONTRIBUTORS:
1. Senior Resident, Department of Anaesthesiology, GMERS Medical College, Navsari, Gujarat, India.
2. Professor, Department of Anaesthesiology, Pramukhswami Medical College, Bhaikaka University, Karamsad, Anand, Gujarat, India.
3. Associate Professor, Department of Anaesthesiology, Pramukhswami Medical College, Bhaikaka University, Karamsad, Anand, Gujarat, India.
4. Professor, Department of Anaesthesiology, Pramukhswami Medical College, Bhaikaka University, Karamsad, Anand, Gujarat, India.
5. Professor, Department of Anaesthesiology, Pramukhswami Medical College, Bhaikaka University, Karamsad, Anand, Gujarat, India.
6. Biostatistician, Department of Community Medicine, Bharati Vidyapeeth (Deemed to be University) Medical College, Pune, Maharastra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Nirali Nimeshkumar Panchal,
Professor, Department of Anaesthesiology, Pramukhswami Medical College (PSMC), Bhaikaka University, Karamsad, Anand-388325, Gujarat, India.
E-mail: dr.niralipanchal@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 15, 2024
- Manual Googling: Aug 22, 2024
- iThenticate Software: Sep 07, 2024 (9%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Jun 13, 2024**
Date of Peer Review: **Jul 29, 2024**
Date of Acceptance: **Sep 10, 2024**
Date of Publishing: **Dec 01, 2024**