

COMPARISON OF CORMACK LEHANE GRADING SYSTEM AND INTUBATION DIFFICULTY SCORE IN PATIENTS INTUBATED BY D-BLADE VIDEO AND DIRECT MACINTOSH LARYNGOSCOPE: A RANDOMIZED CONTROLLED STUDY

Iva Pažur¹, Branka Maldini^{1,2}, Vedran Hostić¹, Ognjen Ožegić¹ and Melanija Obraz¹

¹Department of Anesthesiology, Intensive Care and Pain Medicine,
Sestre milosrdnice University Hospital Center, Zagreb;

²Osijek School of Medicine, Josip Juraj Strossmayer University, Osijek, Croatia

SUMMARY – D-blade is a relatively new device in the field of videolaryngoscopy, designed for airway management by enabling indirectoscopic glottic view. In our study, we investigated efficiency of D-blade in comparison with direct Macintosh laryngoscope (gold standard). Fifty-two adult patients with normal airway scheduled for elective surgery in general anesthesia were randomly assigned in D-blade video or direct Macintosh group. In the first video group, patients were laryngoscoped and intubated by D-blade, and in the second group laryngoscopy and intubation were performed by Macintosh laryngoscope. Glottic view was evaluated according to Cormack Lehane grading system (C-L), while duration of intubation and easiness of intubation were evaluated according to the intubation difficulty score (IDS). Additionally, hemodynamic parameters were recorded before and after induction. There were no statistically significant between-group differences in time to intubation, easiness of endotracheal tube insertion, C-L, and IDS. In comparison with direct Macintosh laryngoscope, D-blade showed similar but still favorable characteristics. In our opinion, D-blade is a useful device in airway management and should be used in daily anesthesiologist work.

Key words: *Endotracheal intubation; Direct laryngoscopy; Airway management; Videolaryngoscopy*

Introduction

There is an era of ongoing development in the field of laryngoscopy and intubation. New devices such as videolaryngoscopes present challenge in everyday work of anesthesiologist, especially in cases where difficult airway management may be expected¹⁻⁶. Despite growing popularity of these devices, only few studies evaluating D-blade videolaryngoscope performance have been conducted to date⁷⁻¹². The aim of this study

was to compare C-MAC D-blade with Macintosh laryngoscope in terms of glottis view, time to intubation, intubation difficulty score (IDS) and hemodynamic stability in patients with normal airway scheduled for elective surgical procedure. Our hypothesis was that D-blade would provide better visualization of glottis, shorter duration of intubation, and easier intubation according to IDS¹³ as compared to the Macintosh blade.

Materials and Methods

The study was conducted in Sestre milosrdnice University Hospital Center from June 2013 until April 2014 after obtaining the institutional ethics board ap-

Correspondence to: *Iva Pažur, MD*, Department of Anesthesiology, Intensive Care and Pain Medicine, Sestre milosrdnice University Hospital Center, Vinogradska c. 29, HR-10000 Zagreb, Croatia

E-mail: ivapr3@gmail.com

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proval and patient informed consent. Fifty-two patients undergoing elective surgical procedure were randomly assigned to the D-blade or direct Macintosh group. Inclusion criteria were age >18 and physical status I-III according to the American Society of Anesthesiologists (ASA). Exclusion criteria were the presence of three or more predictors for difficult intubation^{14,15}, Mallampati test (modified by Samssoon and Young), interincisor gap (IIG), thyromental (TM) distance, upper lip bite test (ULBT), body mass index (BMI), and known previous difficult airway management. Before surgery, patients were premedicated with 5 mg of midazolam intramuscularly. In the operating room, they had intravenous cannule inserted and standard monitoring applied. After preoxygenation *via* facemask, anesthesia was induced with sufentanyl 0.3 mcg/kg, propofol 2 mg/kg and rocuronium 0.6 mg/kg. After achieving proper muscle relaxation, an attempt at intubation was performed with either the D-blade size 4 using a hockey-stick stylet or the Macintosh blade size 3 or 4 with a standard stylet during which the following parameters were obtained: glottic visualization using the Cormack Lehane (C-L) classification^{16,17} and IDS¹³ determined by seven variables:

- 1) intubation attempts more than one; every advancement of tube toward glottis was considered as an intubation attempt;
- 2) number of anesthesiologists (representing the number of additional persons directly attempting intubation);
- 3) number of alternative techniques used;
- 4) view of glottis according to C-L grading system;
- 5) assessment of lifting force applied during laryngoscopy (0 = little force was applied; 1 = great force was applied during laryngoscopy based on operator impression);
- 6) application of external laryngeal pressure (0 = there was no pressure applied; 1 = pressure was applied during laryngoscopy); and
- 7) mobility of vocal cords (0 = abduction of vocal cords; 1 = adduction of vocal cords).

The IDS 0 signified easy intubation, 1-5 slightly difficult intubations, >5 difficult intubation, and ∞ signified impossible intubation. Women in both groups were intubated by endotracheal tube (ETT) of internal diameter (ID) 7.5 mm, and men in both groups were intubated by ETT of ID 8.5 mm. The duration of intubation was recorded from the time the laryngo-

scope was taken into the hand until the end tidal carbon dioxide (etCO₂) curve was displayed on the monitor. After two failed intubation attempts performed by either Macintosh or D-blade, the study was interrupted and the third intubation was performed by Bonfils stylet or fiberbronchoscope. The anesthesiologist who performed intubation noted glottic view using the C-L grading system immediately after finishing intubation. Blood pressure and heart rate were recorded one minute before and after intubation in both groups.

Sample size

Power analysis was performed to determine the sample size needed. Based on standard deviation of time to successful intubation of 13.6 s¹⁸, analysis indicated a sample size of 24 patients in each group would provide 80% power and 5% level of significance to detect 11s difference between devices. A decision was made to recruit 26 patients *per* group to allow dropouts.

Statistics

Statistical analysis was performed using SPSS v20 (IBM® SPSS® Statistics V20). The χ^2 -test was used to analyze categorical data (gender and ULBT), Mann-Whitney U test for ordinal data (ASA status, Mallampati test, C-L and IDS), and independent-sample t-test for continuous data (age, BMI, TM, IIG, duration of intubation, MAP and heart rate). A value of $p < 0.05$ was considered significant.

Results

Demographic and physical airway data are summarized in Table 1. There were no significant between-group differences according to age, gender, ASA physical status, BMI, and physical airway parameters. There were no between-group differences in glottis view, time to intubation and IDS either (Table 2). There was no glottic view of C-L grade IV in either group, whereas two patients (7.7%) in the Macintosh group were assessed as C-L grade III *versus* none in the D-blade group. All patients were intubated at first attempt. All intubations were determined as easy or slightly difficult. There were no differences in MAP, while heart rate was significantly higher in the D-blade group (Table 3).

Table 1. Patient characteristics (VL-D-blade group and DL-Macintosh group)

	VL group (n=26)	DL group (n=26)	p value
Gender (male), n (%)	13 (50)	15 (57.7)	0.579
Age (yrs), mean (SD)	59 (17)	61 (12)	0.639
ASA, n (%)			
I	1 (3.8)	2 (7.7)	0.595
II	19 (73.1)	19 (73.1)	
III	6 (23.1)	5 (19.2)	
Mallampati test, n (%)			
I	17 (65.4)	18 (69.2)	0.859
II	8 (30.8)	6 (23.1)	
III	1 (3.8)	2 (7.7)	
IV	0 (0)	0 (0)	
Interincisor gap (cm), mean (SD)	4.7 (0.9)	4.7 (1.0)	0.869
Thyromental distance (cm), mean (SD)	8.3 (1.7)	8.6 (1.3)	0.546
Upper lip bite test (yes), n (%)	18 (69.2)	22 (84.6)	0.192
Body mass index (kg/m ²), mean (SD)	27.4 (3.9)	25.3 (6.8)	0.181

Data are presented as number (%) or mean (SD); ASA = American Society of Anesthesiologists; VL = videolaryngoscope; DL = direct laryngoscope

Table 2. Characteristics of laryngoscopy and intubation (VL-D-blade group and DL-Macintosh group)

	VL group (n=26)	DL group (n=26)	p value
Cormack Lehane, n (%)			
1	24 (92.3)	20 (76.9)	0.115
2	2 (7.7)	4 (15.4)	
3	0	2 (7.7)	
4	0	0	
IDS, n (%)			
0	18 (69.2)	17 (65.4)	0.508
1	6 (23.1)	3 (11.5)	
2	2 (7.7)	4 (15.4)	
3	0	2 (7.7)	
Duration of intubation (s), mean (SD)	33.6 (16.7)	34.3 (15.1)	0.883

Data are presented as number (%) or mean (SD); IDS = intubation difficulty score; VL = videolaryngoscope; DL = direct laryngoscope

Table 3. Hemodynamic records one minute before and one minute after induction (VL-D-blade group and DL-Macintosh group)

	VL group (n=26)	DL group (n=26)	p value
Heart rate (beats/min)			
- one min before induction	80.5 (11.5)	73.2 (11.9)	0.029
- one min after induction	79.7 (13.7)	73.9 (15.7)	0.158
MAP (mm Hg)			
- one min before induction	95.3 (8.5)	95.3 (12.8)	0.990
- one min after induction	96.6 (17.2)	93.8 (22.9)	0.610

Data are presented as mean (SD); VL = videolaryngoscope; DL = direct laryngoscope; MAP = mean arterial pressure

Discussion

The results of our study showed that the D-blade did not offer any advantage for intubation in patients with normal airway since no differences were observed in glottic view, time to intubation and IDS between the groups. However, as opposed to our study, previous larger trials⁴⁻⁸ showed better glottic view in patients with normal and difficult airway when using videolaryngoscopy as compared to directoscopy. The simplicity of glottic visualization is not always followed by easy tube insertion and longer intubation time may be required^{1-3,8,19}. In the study by Bhat *et al.*²⁰, significantly shorter intubation time was recorded in video group, although intubation was performed in difficult lateral position. Unlike these results, our study showed non-significant difference in intubation time, and there were no difficulties in tube insertion despite using different stylets in study groups. The secondary endpoint of our study was evaluation of hemodynamic changes in the video and direct groups. Laryngoscopy and endotracheal intubation are very stressful events and can provoke deleterious hemodynamic disturbances²¹. In terms of hemodynamic stability, both study groups were comparable too, except for heart rate at one minute before intubation in D-blade group. Our findings in terms of hemodynamics are not comparable with literature data, which show that less lifting force applied during videolaryngoscopy consequently provokes less stressful response¹⁻³. Additionally, D-blade obvi-

ates the need of alignment of oral, pharyngeal and laryngeal axis¹⁻³ and requires less head and neck manipulations. Siddiqui *et al.*²² found no difference in hemodynamic response between video and direct laryngoscope. Similar results have been reported by Sarkilar *et al.* in patients scheduled for major cardiac surgery¹⁹. We may speculate that the only significant finding of hemodynamic instability one minute before intubation in D-blade group could be attributed to the way of anesthetic drug administration during induction and different positioning for D-blade intubation. Obvious limitations of our study were the small number of patients and the fact that it included only patients with normal airway, thus there was no unexpected difficult intubation. However, even with these limitations of our study, we think that D-blade is a useful device in airway management and further studies with a greater number of patients including those with difficult airway should be conducted.

Conclusion

Intubation with video D-blade was comparable to standard direct Macintosh laryngoscope in terms of glottic visualization, duration of intubation, easiness of intubation and hemodynamics. We recommend the introduction of D-blade in everyday work of anesthesiologists, not only in cases where difficult intubation is expected, but also in patients with normal airway.

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Sažetak

USPOREDBA D-BLADE VIDEOLARINGOSKOPA S DIREKTNIM MACINTOSHEVIM LARINGOSKOPOM PREMA KLASIFIKACIJI CORMACK LEHANE TE LJESTVICI BODOVANJA TEŽINE INTUBACIJE: RANDOMIZIRANO KONTROLIRANO ISTRAŽIVANJE

I. Pažur, B. Maldini, V. Hostić, O. Ožegić i M. Obrac

D-blade je relativno nov uređaj na području videolaringoskopije koji omogućava isključivo indirektan prikaz glotisa. U našem istraživanju uspoređivali smo učinkovitost D-blade-a s direktnim Macintoshvim laringoskopom koji predstavlja zlatni standard. Pedeset dvoje bolesnika s normalnim dišnim putem, predviđeni za elektivnu kiruršku operaciju u općoj anesteziji, randomizirano su dodijeljeni u skupinu video D-blade ili direktnog Macintosha. U prvoj skupini bolesnici su bili laringoskopirani i intubirani video D-blade-om, a u drugoj skupini su bili laringoskopirani i intubirani Macintoshvim laringoskopom. Za procjenu prikaza glotisa koristili smo klasifikaciju Cormack Lehane (C-L), dok smo trajanje intubacije i lakoću intubacije procjenjivali koristeći ljestvicu bodovanja težine intubacije (engl. *intubation difficulty score*, IDS). Hemodinamske parametre smo bilježili prije i nakon indukcije. Između dviju skupina nije bilo statistički značajne razlike u vremenu intubacije, lakoći uvođenja tubusa, klasifikaciji C-L i IDS-u. Prema rezultatima našega istraživanja zaključujemo da u usporedbi s Macintoshvim laringoskopom D-blade pokazuje povoljne karakteristike te bi mogao biti uveden u svakodnevni rad anesteziologa.

Ključne riječi: *Endotrachealna intubacija; Direktna laringoskopija; Zbrinjavanje dišnog puta; Videolaringoskopija*