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Original article

COMPARATIVE EVALUATION OF VIDEO LARYNGOSCOPY AND CONVENTIONAL LARYNGOSCOPY DURING TRACHEAL INTUBATION

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Abstract

Introduction: Video laryngoscopy (VL) is relatively new technique, and has become a pivotal advancement in tracheal intubation, offering enhanced visualization of vocal cords and improving success rates.

Aim of the study: This study aimed to compare the efficacy of video laryngoscopy *versus* conventional laryngoscopy in adult patients requiring tracheal intubation for elective ENT surgeries.

Material and methods: This study involved 300 adult patients classified as ASA 1 and 2, aged 18 to 70, scheduled for elective ENT surgeries at a University Clinic in Skopje. Patients were divided into two groups: one underwent intubation using conventional Macintosh laryngoscopy, while the other utilized video laryngoscopy. Key parameters measured included intubation time, glottic visualization using the Cormack-Lehane score, number of intubation attempts, and instances of glottic trauma.

Results: The mean intubation time was significantly shorter in the VL group (26.09 seconds) compared to the ML group (34.01 seconds) ($P < 0.001$). The VL group exhibited superior glottic visualization, with 105 patients achieving Cormack-Lehane Score I *versus* 45 in the ML group ($P = 0.001$). Complications were notably lower in the VL group; only 3 instances of blood on the laryngoscope were reported compared to 10 in the ML group ($P < 0.017$).

Conclusion: Video laryngoscopy significantly enhances tracheal intubation success rates, reduces intubation time, and minimizes the risk of complications compared to conventional laryngoscopy, establishing it as a preferred technique in managing difficult airways.

Keywords: tracheal intubation, conventional laryngoscopy, video laryngoscopy, intubation techniques

Introduction

The video laryngoscopy intubation technique, compared with the direct laryngoscopy intubation technique, has diminished the number of unsuccessful difficult intubations in adult patients. There is no published data demonstrating that video laryngoscopy produced by one company is better than that produced by another, except for video laryngoscopy using the C-MAC Macintosh blade[1]. Data additionally suggest that video laryngoscopy compared to conventional laryngoscopy facilitates tracheal intubation, shortens the time required for

tracheal intubation in patients with difficult airways, results in better glottic visualization, and reduces glottic trauma[2].

Materials and method

A total of 300 patients classified as ASA 1 and 2, aged 18 to 70 years (both female and male), were included in this study. Adult patients requiring surgery at the University Clinic for Ear, Nose, and Throat Surgery in Skopje were selected. Only patients with a SARI score (Simplified Airway Risk Index) greater than 4 were scheduled for general anesthesia for ear, nose, or throat surgery. Patients were divided into two groups: the first group underwent intubation using conventional laryngoscopy, and the second group underwent intubation using video laryngoscopy. We recorded the time necessary for successful tracheal intubation. The study was conducted over a period of 3 years.

The aims of our study were:

1. To compare the time necessary for successful tracheal intubation when using two techniques: video laryngoscopy and direct laryngoscopy.
2. To compare the percentage of glottis opening scores between the two comparable techniques.
3. To count the number of intubation attempts using both techniques and compare them.
4. To evaluate any glottic trauma if occurred using these two techniques of tracheal intubation.

This was a prospective study conducted after receiving approval from the Ethics Committee of the Faculty of Medicine, Ss. Cyril and Methodius University in Skopje. Written informed consent was obtained from patients participating in this study. Three hundred patients aged 18 to 70, with a SARI score of 4 or higher, who were scheduled to undergo elective surgery at the University Clinic for Ear, Nose, and Throat Surgery between 2022 and 2025, and who would consequently be administered general anesthesia, were planned to be included in the study. Patients were randomized into a group to be intubated using a size 3 or 4 Macintosh laryngoscope blade (ML Group) or a group to be intubated using a video laryngoscope (VL Group). The size of the laryngoscope used was left to the discretion of the anesthesiologist conducting the procedure.

Table 1. Demographic data and SARI index of patients

Parameter	ML Group ($n = 150$)	VL Group ($n = 150$)	*P*
Age (years) (mean ± SD)	47.80±14.52	47.73±14.36	.947
BMI (kg cm-^{2}) (mean ± SD)	28.10±5.23	28.12±5.57	.880
Neck circumference (cm) (mean ± SD)	37.43±4.30	37.39±4.44	.943
Sex (F/M) (n) (%)	86(61%)/64 (39%)	85 (60%)/65(40%)	.885
Smoker (no/yes) (n)	90/60	94/57	.653
Alcohol consumer (no/yes) (n)	111/39	112/38	.836
Comorbidity (no/yes) (n)	81/69	82/68	.887
SARI score (mean ± SD)	4.61±1.89	4.89±2.11	.488
Intubation time (seconds) (mean ± SD)	34.01±22.08	26.09±15.70	.001*
ASA classification			
I-(n)	I-61	I-67	.644
II-(n)	II-69	II-61	
III-(n)	III-20	III-22	

**P<0.05,* ML-Macintosh laryngoscope, VL-Video laryngoscope, SD-Standard deviation, BMI-Body mass index, F-Female, M-Male, SARI score, ASA-American Society of Anesthesiologists classification

Patients with ASA score higher than III and those undergoing emergency surgery were excluded from the study. The SARI is a scoring index consisting of 7 parameters measured on a scale of 0-12: (1) mouth opening, (2) thyromental distance, (3) Mallampati classification, (4) neck movement, (5) ability to prognathe, (6) body weight, and (7) history of previous difficult intubation[3].

The SARI score, or a multivariate score like the El Ganzouri Risk Index assessment (EGRI), is beneficial in providing a comprehensive airway assessment for formulating appropriate intubation strategies[4].

The SARI was used as a bedside estimation score to increase patient safety before intubation by assessing the likelihood of a difficult airway[5]. A SARI score of 7 and higher suggests that intubation may be difficult[6-8].

The protocol for intubation consisted of the following steps: the time to establish the tracheal tube was recorded. After the intubation, the number of attempts and the incidence of difficult intubation, as well as complications like airway trauma, were evaluated. Cormack–Lehane (CL) scoring was used to evaluate the glottic view. Each patient was administered 0.02 mg/kg^{-1} of midazolam in the preoperative preparation room. Patients were intubated after face mask ventilation with 100% oxygen for 3 minutes. They were administered 2.5 mg/kg^{-1} of propofol i.v., 1.5 $\mu g/kg^{-1}$ of fentanyl i.v., and 0.5 mg/kg^{-1} of rocuronium i.v. for induction of anesthesia. Patients were administered 2% of sevoflurane and a 0.1^{-1} µg/kg/min remifentanil infusion for maintenance of anesthesia.

Size 7, 7.5, and 8 tracheal tubes were used for intubation. The most important indicator of successful intubation was observing that the tube had passed between the vocal cords and entered the trachea. Capnography after 3 consecutive ventilator breaths indicated that the tube was in the trachea. The time to achieve intubation was defined as the duration from placing the laryngoscope into the patient's mouth until 3 consecutive end-tidal curves were obtained in capnography.

The blade types used in the VL Group were M3 and M4, with M4 being used more frequently in patients with a history of difficult intubation. In the ML Group, blades 3 and 4 were used. Patients who had previously experienced difficult intubation were prioritized for the video laryngoscope group. In both groups, the intubation procedure was performed by inserting a stylet into the endotracheal tube during intubation.

Statistical Analyses

The Shapiro-Wilk test, Mann-Whitney U test, Kruskal-Wallis test, and Dunn's tests were used. Correlation between numerical variables was tested with the Spearman's rank correlation coefficient test, and correlation between categorical variables was tested with the chi-squared test. The Windows version of the Statistical Package for the Social Sciences was used for the analyses, and $P < .05$ was regarded as significant.

Results

No statistically significant difference was found when comparing demographic data between the two groups of patients. A significant difference was observed in intubation times. The mean intubation time was found to be significantly lower in the videolaryngoscope group compared to the Macintosh laryngoscope group. Although the number of patients with difficult intubation was high in the videolaryngoscope group, when we evaluated their glottic view, the Cormack-Lehane score was found to be significantly lower.

The number of patients with Cormack-Lehane Score I (CL-I) in the VL Group was 105, while 40 were CL-II, and 5 were CL-III. The number of patients with CL-I in the ML Group was 45, while 75 were CL-II, and 30 were CL-III. There were no CL-IV patients in either group (p=.001).

The results regarding the number of intubation attempts for the patients in the VL group and ML group were as follows: in the VL group, 135 patients were intubated on the first attempt, while 15 required a second attempts and no patients required a third attempt. In the ML group, 130 patients were intubated on the first attempt, 15 required a second attempt, and 5 required a third attempt. The numbers of intubation attempts required were not statistically significant.

SARI scores in both groups of patients are presented in Table 2.

There was a statistically significant difference in the number of patients with difficult intubation in the VL Group, as patients with suspected and existing difficult intubation were prioritized for video laryngoscopy. No statistically significant difference was observed between SARI scores.

Table 2. SARI scores in both groups of patients

Variable		ML Group ($n = 150$) (n)	(%)	VL Group ($n = 150$) (n)	(%)	*P*
Mouth opening (cm)	>3.5	125	83%	121	81%	.713
	<3.5	25	17%	29	19%	
Thyromental distance (cm)	>6.5	121	81%	127	85%	.751
	<6.5	29	19%	23	15%	
Mallampati score	M1	31	21%	27	18%	.421
	M2	51	34%	60	40%	
	M3	68	45%	63	42%	
Body weight (kg)	<90	138	92%	135	90%	
	>90	12	8%	15	10%	
Maximal neck movement (°)	>90	78	52%	72	48%	.619
	<90	76	53%	74	47%	
Propensity for prognathism	Definite	96	64%	54	46%	0.075
	None	54	36%	96	64%	
History of difficult intubation	None	116	76%	84	26%	.044*
	Questionable	34	33%	66	67%	
SARI	None <7	150	100%	98	98%	.095
	Yes >7	0	0	2	2%	

The SARI score information for the patients in both groups are presented in Table 3.

There was no statistically significant difference between SARI scores between the two groups of patients. A statistically significant difference was observed in the number of patients with difficult intubation in the VL group.

Table 3. SARI scores in both groups of patients

Variable		ML Group ($n = 150$) (n)	(%)	VL Group ($n = 150$) (n)	(%)	*P*
Mouth opening (cm)	>4	36	76%	114	64%	.713
	<4	114	24%	74	76%	
Thyromental distance (cm)	>6.5	106	70%	110	73%	.751
	<6.5	44	30%	40	37%	
Mallampati score	M1	37	25%	33	22%	.421
	M2	52	35%	61	41%	
	M3	61	40%	56	37%	
Body weight (kg)	<90	117	78%	112	75%	
	>90	33	22%	35	25%	
Maximal neck movement (°)	>90	72	48%	76	51%	.619
	<90	78	52%	74	49%	
Propensity for prognathism	Yes	96	64%	84	56%	0.075
	No	54	36%	66	44%	
SARI	=5	125	83%	123	82%	.095
	>5	25	17%	27	18%	

In the VL group, 138(92%) patients had no intubation-related complications, 3(2%) patients had blood in the oropharynx, 3(2%) patients had blood on the laryngoscope, and was 5(3%) patients had mucosal damage to the pharynx and intraoral mucosal damage. There was one patient with esophageal intubation. In the ML group, 121(81%) patients had no intubation-related complications, there were no patients with blood in the oropharynx, 10(7%) patients had blood on the laryngoscope, 9(6%) patients had mucosal damage to the pharynx and intraoral mucosal damage, and 8(5%) patients had esophageal intubation. The p-value showed statistical significance between the two groups of patients (p<.017).

Intubation-related complications in the ML group and VL groups are shown in Table 4.

Table 4. Intubation-related complications in the ML group and VL

Intubation-related complications	**ML group (150)**	**VL group (150)**	*p*
Blood in the oropharynx	2(1.3%)	3(2%)	
Blood on the laryngoscope	10(7%)	3(2%)	
Pharyngeal and intraoral mucosal damage	9(6%)	5(3%)	
Esophageal intubation	8(5%)	1(1.5%)	

ML-Macintosh laryngoscope, VL- Video laryngoscope, *p<0.5

The number and ratio of complications due to intubation were lower in the video laryngoscope group compared to the Macintosh laryngoscopy group.

Discussion

Video laryngoscopy improves tracheal intubation success by enhancing the glottic view in cases with a SARI score greater than 4. Maneuvers such as the "sniffing" position and external movement of the larynx with cricoid pressure were used to improve the field of view during direct laryngoscopy. Numerous randomized controlled studies have been conducted comparing video laryngoscopy with direct laryngoscopy in patients predicted to have a difficult airway. Various meta-analyses based on these studies have shown that, compared to direct laryngoscopy, video laryngoscopy provides a clearer view of the larynx, increases the frequency of successful intubation, and enhances the likelihood of successful intubation on the first attempt[9].

In their prospective study, Abdallah *et al*., found that the Airtraq video laryngoscopy ensured easier intubation than Macintosh laryngoscopy. The average time to achieve intubation was 14.18 seconds in the Macintosh laryngoscope group and 11.5 seconds in the videolaryngoscope group. They found that video laryngoscopy facilitates intubation and results in fewer complications[10].

Zhu *et al.,* compared a KingVision video laryngoscopy (non-channelled) with a McGrath MAC videolaryngoscope and a Macintosh laryngoscope in patients with difficult intubation requiring nasotracheal intubation. They demonstrated that the videolaryngoscope groups had a higher percentage of first intubation success, better glottic view, and lower incidence of complications[11].

Cavus *et al.,* evaluated video laryngoscopy in both normal and difficult intubations and concluded that videolaryngoscope increases the success of endotracheal intubation in patients for whom a difficult airway is either anticipated or not by providing a better glottic view[12].

Hoshijima *et al.,* conducted a systematic review and meta-analysis of 18 randomized controlled trials to compare the C-MAC videolaryngoscope with the Macintosh laryngoscope for tracheal intubation in the adult population, showing that the videolaryngoscope offered a better glottic view and required less external laryngeal manipulation compared to the Macintosh laryngoscope[13].

Liu *et al.,* compared video laryngoscopy and direct laryngoscopy for endotracheal intubation in non-difficult airways, including 360 patients. The percentage of patients with a level I-II total glottic exposure in the videolaryngoscope group was 100%, while it was 63.5% in the direct laryngoscopy group. The single attempt success rate of intubation was 96.1% in the video laryngoscopy group and 90.1% in the direct laryngoscopy group[14].

As technology develops, improvements in videolaryngoscopes make them easier to use and provide a clearer and more readily obtainable glottic view. This advancement leads to a reduction in the time to achieve intubation and a decrease in intubation-related complications. The video laryngoscopy therefore provides a clinically significant improvement in intubation conditions and is recommended for difficult airway management. Despite being primarily used in cases where difficult intubation is expected, video laryngoscopy can also be utilized in all cases requiring tracheal intubation.

Conclusion

In patients undergoing endotracheal intubation for general anesthesia, video laryngoscopy was found to be superior to Macintosh laryngoscopy. It enlarges the glottic view, shortens the intubation time, facilitates the intubation process, and has a lower risk of complications.

The glottic view was better in the videolaryngoscope group. This group had a shorter intubation time, and intubation was also facilitated, resulting in less trauma. Therefore, to reduce complications in cases requiring tracheal intubation, particularly in unpredictable, difficult airways, video laryngoscopy is recommended.

Conflict of interest statement. None declared.

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