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A comparison of C-MAC videolaryngoscope and Macintosh laryngoscope in intraocular pressure changes, throat pain, intubation time and hemodynamic variables

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ABSTRACT

Objective: The aim of the current study was to compare intraocular pressure (IOP), hemodynamic parameters and throat pain in the use of C-MAC videolaryngoscope and the Macintosh laryngoscope under general anesthesia requiring endotracheal intubation.

Methods: Seventy-eight patients aged 18-65 years, ASA (American Society of Anesthesiologists physical status). I-II, who underwent elective surgery under general anesthesia were scheduled in the study. The groups were allocated as Group M (Macintosh laryngoscope) and Group VL (videolaryngoscope). Standard anesthesia technique was used in both groups. To assess the depth of anesthesia which was kept between 40 and 60, a Bispectral Index Monitor Model 2000 (Aspect Medical Systems, Inc, Newton, MA) was used throughout the study. We recorded hemodynamic variables, oxygen saturation before induction, at the 3rd and at the 10th minutes after intubation. The duration of intubation was recorded as the time from the laryngoscope entering the mouth to removal with end-tidal carbon dioxide on the monitor. IOP was measured before induction, and at the 3rd and 10th minutes after intubation. Inhalation agent was given after intubation. 78 patients were included in the study. We recorded cough after extubation, and postoperative sore throat was evaluated by an anesthesiologist who was blinded to the group allocations at 10 minutes and at 24 hours postoperatively.

Results: There was no significant difference between the groups regarding age ($p > 0.05$), mean body mass index ($p = 0.157$), mean ASA ($p = 0.475$), mean bispectral index values ($p = 0.084$) and mean operating time ($p = 0.068$). The mean duration of intubation was determined to be statistically significantly longer in Group M than in Group VL ($p = 0.0001$). There was no statistically significant difference between the groups regarding Modified Mallampati Score ($p = 0.571$) and Cormack Lehane Score ($p = 0.819$). The mean IOP at 3rd minute after intubation was determined to be statistically significantly higher in Group M ($p = 0.0001$). There was no statistically significant difference between the groups in regarding cough after extubation ($p = 0.549$), throat pain at 10 minutes ($p = 0.662$) and at 24 hours postoperatively.

Conclusions: C-MAC videolaryngoscope can be recommended as the first choice in patients with high IOP requiring general anesthesia with endotracheal intubation.

Keywords: Airway management, videolaryngoscope, intraocular pressure

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Videolaryngoscopes are the new generation devices which were introduced into the difficult intubation algorithm by the American Society of Anesthesiologists (ASA) in 2013 [1].

Videolaryngoscopes are known to be superior to traditional direct laryngoscopy in cases of difficult airway, glottic visualisation is obtained more easily and less airway trauma is seen [2]. C-MAC (Karl Storz, Tutlingen, Germany) is a new portable videolaryngoscope which is used in difficult airways [3]. There are 2, 3, and 4 numbered D blades. In the light source of the blade of the C-MAC videolaryngoscope, there is a camera which is connected to a video screen monitor. In addition to passing soft tissues by visualisation, the camera is helpful in defining the glottic appearance [1].

There are studies which have compared the hemodynamic response and increase in IOP in intubation using direct Macintosh laryngoscope and various videolaryngoscopes and airway devices [4-6]. However, to the best of our knowledge there is no study comparing the effect on the increase in IOP of C-MAC videolaryngoscope and Macintosh laryngoscope. The aim of the current study was to compare IOP, hemodynamic parameters and throat pain in the use of C-MAC videolaryngoscope and the MacIntosh laryngoscope.

METHODS

Approval for the study was granted by the Ethics Committee of Dışkapı Yıldırım Beyazıt Training and Research Hospital, University of Health Sciences (decision no 32/27 dated 22/11/2016, Clinical trial Identifier: NCT03279172).The study included after written consent, 78 adulttotal of 78 patients, aged 18-65 years of American Society of Anesthesiologists physical status I-II, who were to undergo elective surgery under general anaesthesia. Patients were excluded if they had a known allergy, elevated IOP, glaucoma, a history of eye surgery or if it was considered that intubation would be difficult.

Protocol

Before induction the patients were randomly allocated by computer to one of two groups. The groups were named as Group M where the Macintosh laryngosope was used and Group VL where the videolaryngoscope was used. Standard anaesthesia was used in both groups and BIS monitorisation was applied. A record was made of IOP, hemodynamic changes and oxygen saturation at 3 and 10 minutes after intubation. IOP was measured before induction, and at the 3rd and 10th minutes after intubation. Inhalation agent was given after intubation. 78 patients were included in the study.

Throat pain was evaluated by questioning the patient at 10 minutes and 24 hours after waking from general anaesthesia. The duration of intubation was recorded as the time from the laryngoscope entering the mouth to removal with end-tidal carbon dioxide on the monitor.

Statistical Analysis

Statistical analyses of the study data were made using NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA). In the evaluation of the data, descriptive statistical methods were used (mean, standard deviation) and in the comparison of paired groups, the Independent t-test was applied. In the comparison of qualitative data, the Chi-square test was used. A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

No statistically significant difference was determined between the groups in respect of age distribution ($p > 0.05$), mean body mass index ($p = 0.157$), mean ASA ($p = 0.475$), mean bispectral index values ($p = 0.084$) and mean operating time ($p = 0.068$). The mean duration of intubation was determined to be statistically significantly longer in Group M than in Group VL ($p = 0.0001$) (Table 1).

No statistically significant difference was determined between the groups in respect of cough after extubation ($p = 0.549$) and throat pain at 10 mins postoperatively ($p = 0.662$). No throat pain was observed in either group at 24 hours postoperatively (Table 2). No statistically significant difference was determined between the groups in respect of complications after extubation ($p = 0.601$).

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Table 1. Mean values of age, gender, BMI, ASA, intubation and operating time in both groups

		Group M	Group VL	*p* value
Age (years)		44.1 ± 12.23	48.44 ± 11.75	0.115[a]
Gender	**Male**	21 (53.85%)	20 (51.28%)	0.821[b]
	Female	18 (46.15%)	19 (48.72%)	
BMI		26.18 ± 2.69	26.9 ± 1.6	0.157[a]
ASA	**1**	24 (61.54%)	27 (69.23%)	0.475[b]
	2	15 (38.46%)	12 (30.77%)	
BIS		46.15 ± 4.39	48.15 ± 5.61	0.084[a]
Intubation time (mins)		41.49 ± 10.3	27.74 ± 7.2	**0.0001**

Group M = Macintosh laryngoscope, Group VL = videolaryngoscope, ASA = American Society of Anaesthesiologists, BMI = Body Mass Index, BIS = Bispectral Index
[a] Independent Samples *t* Test, [b] X^2 Test

Modified Mallampati Score (p = 0.571) or the Cormack Lehane Score (p = 0.819) (Table 3).

No statistically significant difference was determined between the groups in respect of the mean IOP value after induction and at 10 mins after intubation ($p > 0.05$). The mean IOP at 3 mins after intubation was found to be statistically significantly higher in Group M than in Group VL (p = 0.0001). After induction and at 3 and 10 mins after intubation, no statistically significant difference was determined between the groups in respect of the mean arterial pressure ($p > 0.05$), mean heartrate ($p > 0.05$) and mean peripheral oxygen saturation values ($p > 0.05$) (Table 4).

Table 2. The mean modified Mallampati score and Cormack Lehane scores of the groups

		Group M	Group VL	*p* value
Modified Mallampati Score	**Class 1**	24 (61.54%)	22 (56.41%)	0.571[a]
	Class 2	15 (38.46%)	16 (41.03%)	
	Class 3	0 (0.00%)	1 (2.56%)	
Cormack Lehane Score	**1st degree**	21 (53.85%)	22 (56.41%)	0.819[b]
	2nd degree	18 (46.15%)	17 (43.59%)	

Group M = Macintosh laryngoscope, Group VL = videolaryngoscope
[a] Independent Samples *t* Test, [b] X^2 Test

Table 3. IOP, mean arterial pressure, heart rate, and peripheral oxygen saturaton values of the groups

		Group M	Group VL	*p* value
Intraocular pressure	**After induction**	11.77 ± 3.84	12.41 ± 4.19	0.483
	3 mins after intubation	23.56 ± 8.23	16.26 ± 5.3	**0.0001**
	10 mins after intubation	16.72 ± 6.74	14.18 ± 5.01	0.063
Mean arterial presssure (mm Hg	**After induction**	81.15 ± 19.23	75.26 ± 15.2	0.137
	3 mins after intubation	88.90 ± 17.96	81.67 ± 19.07	0.089
	10 mins after intubation	83.67 ± 19.07	75.97 ± 17.55	0.061
Heart rate (bpm)	**After induction**	67.82 ± 14.67	67.15 ± 15.49	0.846
	3 mins after intubation	77.82 ± 10.94	73.31 ± 15.11	0.135
	10 mins after intubation	71.82±9.14	66.42±16.55	0.064
Peripheral oxygen saturation	**After induction**	98.77 ± 0.9	98.79 ± 0.92	0.902
	3 mins after intubation	99.05 ± 0.61	99.08 ± 0.62	0.854
	10 mins after intubation	99.31 ± 0.52	99.33 ± 0.53	0.830

Data are shown as mean ± standard deviation. Group M = Macintosh laryngoscope, Group VL = videolaryngoscope, IOP = intraocular pressure

Table 4. Mean values for cough after extubation, postoperative throat pain at 10 mins and 24 hours after extubation and complications aftter extubation

		Group M	Group VL	*p* value
Cough following extubation	**None**	27 (69.23%)	28 (71.79%)	0.549
	Mild	12 (30.77%)	10 (25.64%)	
	Moderate	0 (0.00%)	1 (2.56%)	
Throat pain at postoperative 10 mins	**None**	10 (25.64%)	13 (33.33%)	0.662
	Mild	18 (46.15%)	12 (30.77%)	
	Moderate	8 (20.51%)	6 (15.38%)	
	Severe	3 (7.69%)	2(5.13%)	
Throat pain at postoperative 24 hrs	**None**	0 (0.00%)	0 (0.00%)	-
Complications following extubation	**None**	28 (71.79%)	27 (69.23%)	0.601
	Moderate	11 (28.21%)	11 (28.21%)	
	Severe	0 (0.00%)	1 (2.56%)	

Group M = Macintosh laryngoscope, Group VL = videolaryngoscope

DISCUSSION

The traditional Macintosh laryngoscope is known to cause an increase in hypertension, tachycardia and IOP. These are unwanted changes in glaucoma and open globe damage. Apart from pharmacological agents directed at limiting the increase in IOP after laryngoscopy and intubation, various other approaches have been researched [7, 8]. In a study which compared the use of Macintosh laryngoscope with LMA, intubating LMA and McCoy laryngosope, the use of Macintosh laryngoscope was found to have a greater increase on sympathetic stimulation and IOP [5]. Ahmad *et al* [5] compared the use of GlideScope videolaryngoscope and Macintosh laryngoscope and reported that a lower increase in IOP and hemodynamic response was seen with the GlideScope videolaryngoscope. This result was attributed to there being less need for airway manipulation at the level of the mouth and pharyngeal and laryngeal axes to obtain clear visualisation of the glottis in intubation made with the GlideScope videolaryngoscope and there being less cervical neck movement and force applied to elevate tissues for glottis visualisation and there was therefore less stimulation of the sympathetic system [5]. The results of a study by Mahjoubifar *et al*. [7] supported this conclusion. In another study which compared the use of Airtraq laryngosope with the MacIntosh laryngoscope, a significantly lower increase in IOP and hemodynamic response to laryngoscopy and intubation was reported for the Airtraq laryngoscope [4]. Another study which compared the use of GlideScope videolaryngosope with the Macintosh laryngoscope reported that the hemodynamic parameters were better in the group where GlideScope videolaryngoscope was used [9].

Karaman *et al*. [10] compared the use of McGrath videolaryngoscope and MacIntosh laryngoscope in intubation and a lower increase in IOP was reported with the use of videolaryngoscope. In the current study, no statistically significant difference was determined between the two groups in respect of hemodynamic parameters. However, the increase in IOP was found to be significantly lower in the group where C-MAC videolaryngoscope was used.

The incidence of postoperative throat pain after endotracheeal intubation has been reported as 21%-65%. Although a minor complication, it increases morbidity and patient discomfort. It is a potential cause of airway trauma, mucosal oedema, congestion and aseptic inflammation [11]. In a study by Amini *et al*. [9] comparing the use of GlideScope videolaryngoscope and MacIntosh laryngoscope, the rates of throat pain were found to be similar. Cirilla *et al*. [12] reported that the risk of postoperative throat pain did not significantly affect the choice of intubation technique with MacIntosh or GlideScope videolaryngoscope. The results of the current study support the previous findings in literature. At 24 hours postoperatively, no throat pain was observed in any

patient. The difference between the groups at 10 mins postoperatively was not statistically significant.

Different results have been obtained in studies comparing the duration of intubation with videolaryngoscope and Macintosh laryngoscope. Serocki *et al*. [13] reported that the intubation time was significantly longer with the use of videolaryngoscope, whereas Smereka *et al*. [14] found intubation time to be significantly shorter with the use of videolaryngoscope. In the current study, the intubation time was determined to be significantly shorter in the group where videolaryngoscope was used. The experience of the practitioner can be considered to be a determinant on this issue.

CONCLUSION

In patients with high IOP who are to be applied endotracheal intubation under general anaesthesia, the use of C-MAC videolaryngoscope can be recommended as the first choice. After induction and at 3 and 10 mins after intubation, no statistically significant difference was determined between the groups in respect of the mean arterial pressure, mean heart rate and mean peripheral oxygen saturation values. No statistically significant difference was determined between the groups in respect of cough after extubation and throat pain at 10 mins postoperatively. No throat pain was observed in either group after 24 hours postoperatively. The mean duration of intubation was determined to be statistically significantly longer in Group M than in Group VL.

Authors' contributions

COC: Study design, data analysis, writing the first draft of the paper, data collection; GBA: Study design, patient recruitment; ES: Study design, patient recruitment, statiscal analysis; JE: Language editing, data collecting, literature search; ASD: Patient recruitment, data collection

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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