Original Article

The Accuracy of Tests Used to Predict Difficult Airway and a Comparison of Macintosh Laryngoscope to Video Laryngoscope for Intubation

Tarkan Mıngır[1], Dilek Kitapcıoglu[2], Namigar Turgut[2], Cengiz Yumru[3]
[1]Anesthesiology and Reanimation Clinic, Okmeydani Training and Research Hospital Istanbul, Turkey
[2]Acıbadem University, Istanbul, Turkey
[3]Anesthesiology and Reanimation Clinic, Gaziosmanpasa Taksim Training and Research Hospital Istanbul, Turkey

Kuwait Medical Journal 2015; 47 (3): 201 - 209

ABSTRACT

Objectives: To compare TruView EVO2 video laryngoscope (VL) and Macintosh laryngoscope (ML) as regards their success rates in difficult intubation, hemodynamic response and postoperative complications.
Design: Prospective study
Setting: Training and Research Hospital, Istanbul, Turkey
Subjects and Methods: A total of 60 cases were enrolled to the study. Group ML (N = 30) were intubated using ML and Group VL (N = 30) were intubated using TruView EVO2™ VL.
Main Outcomes Measures: Cormack-Lehane score was used to evaluate the visualization vocal cords and intubation difficulty. The time required for visualization of vocal cords, total intubation time, difficulty in intubation were also recorded.
Results: For all cases, having BMI > 30, Mallampati grade > 3, Cormack-Lehane score > 3, short neck, not being able to touch chin to chest, no mandibular protrusion, distance between incisor teeth < 3 cm and, thyromental distance < 7 cm corresponded to the difficult intubation cases of 46.15%. The time period of visualization of vocal cords was significantly longer in Group VL. Cormack-Lehane > 3 and difficult intubation rate was significantly higher in Group ML. The ratio of ones having Mallampati scores of III - IV and Cormack-Lehane scores of I - II was found 17% in Group ML, while the ratio was 30% for Group VL. In all cases, regarding patients having difficult intubation, the success rate of intubation was found as 79.3%.
Conclusion: High success rates of intubation were seen with both TruView EVO2™ VL and ML. Either ML or VL can be used in case of difficult intubations.

KEY WORDS: difficult airway, Mackintosh laryngoscope, video laryngoscope, vocal cord

INTRODUCTION

"Breathing is the most important sign of life for human beings, starting from the birth, in order to understand, if they are alive or not. During their life, spontaneous or artificially, easy or difficult but, breathing somehow and making them breathe is the fundamental"[1].

Intubation process during anesthesia administration has certain advantages such as maintaining an open airway at all time, respiratory and airway control, decreasing respiratory effort, dead-space and aspiration hazard, providing a surgical comfort by keeping away anesthetist and equipment from the area and, airway control during resuscitation. Nevertheless, laryngoscopy and endotracheal intubation cannot be performed easily in every case and intubation process cannot be successful always because of certain anatomical difficulties and existing systemic diseases (*e.g.*, ankylosing spondylitis, thyrocele *etc.*).

Due to the increase of plasma catecholamine concentration resulting from reflex sympathetic response from the larynx and trachea to mechanical stimulus, laryngoscopy and intubation may cause tachycardia, hypertension, arrhythmia and myocardial ischemia especially in patients with restricted cardiac reserve[2] .

Address correspondence to:
Namigar Turgut, Tepecik Yolu Taşlıçay Sok, No. 3 / 3, Etiler,Istanbul,Turkey. Tel: 00905333607659, E-mail: drnamigar@yahoo.com.tr, mavi.ilke@hotmail.com

In this study, our aim was to measure the predictability of difficult intubation and the accuracy of tests used for this purpose in patients with Mallampati scores of II-IV and posted for elective surgery. The secondary aim of the study was to compare TruView EVO2 video laryngoscope (VL)[3,4] with the commonly used Mackintosh laryngoscope (ML). The VL was developed, especially for difficult intubation cases but could also be used routinely even when no difficulty is anticipated. VL and the ML were compared from the point of view of success rates during difficult intubation, hemodynamic response to laryngoscopy and early-stage postoperative complications.

In cases where intubation was not successful with both the ML and VL, LMA-Fastrach™ was used as a rescue device for intubation.

SUBJECTS AND METHODS

This study was performed in H.M. Training and Research Hospital Anesthesiology and Reanimation Clinic operation rooms (OR), after approval from the Ethics Committee and consent from patients. A total of 60 cases aged between 25 to 82 years, classified as ASA I-II, posted for elective surgery, and having a Mallampati score II-IV along with other parameters indicating the possibility of difficult intubation were enrolled into the study.

Patients classified as ASA III and above risk group, those having history of allergy, uncontrolled respiratory, cardio-vascular and central nervous system disease, hemorrhagic diathesis or those who had undergone head and neck surgery, those taking medications affecting endocrine response and neuromuscular block and, un-cooperative patients were excluded from the study.

Using a computer program, the patients were randomly divided into two groups of 30 persons. Group ML (n = 30) patients were intubated using the ML while patients in Group VL (n = 30) were intubated using the VL.

During the preoperative physical examination, age, gender, length, weight, body mass index (BMI), thyromental distance (TMD), mouth opening or distance between upper and lower incisor teeth (inter-incisor gap or IIG), head and neck movements and their characteristics, the ability to protrude the lower incisor teeth in front of the upper incisor's ability to touch the chin to the chest and the Mallampati scores were recorded. For premedication, 0.5 mg alprazolam tablet was administered orally the night before the operation and 0.1 mg/kg midazolam was administered intramuscularly in the morning just before arriving in the OR. For preoperative standard monitoring, electrocardiogram (ECG) in lead II, non-invasive blood pressure (systolic, diastolic, and mean arterial pressure), and peripheral oxygen saturation (SpO_2) monitors were used in the OR.

Vascular access was secured by a 20 G intravenous cannula and isotonic fluid at the rate of 2 ml/kg/hr was infused as maintenance fluid requirement. For induction of anesthesia, 2 mg/kg propofol, 2 µg/kg fentanyl citrate and 0.60 mg/kg rocuronium bromide were administered. Then, after waiting for 120 seconds, endotracheal intubation was performend. In Group VL, the display unit of TruView™ EVO2 VL was prepared before the process and mounted on the device. The blade was placed in the mouth in midline and the vocal cords were visualized. Endotracheal intubation was performed by watching the images on the screen. The blade was then removed from the mouth. Cormack-Lehane scoring system was used for assessing the view of the vocal cords obtained during laryngoscopy. The scores were recorded as I-II-III-IV. The time from termination of ventilation with mask to visualization of vocal cords was considered as visualization time. The time from the point of vocal cord visualization to end tidal CO_2 value reading was considered as intubation time. The number of attempts for successful intubation were recorded (LMA-FASTRACH™ was used as a rescue device after a failed third attempt). Any complications during intubation (bleeding, tooth damage, *etc.*) were recorded. Operator-assessed subjective difficulty of the intubation and the success of intubation were also recorded.

Anesthesia maintenance was provided by 45% O_2, 55% NO_2 and, 1.5% sevoflurane. During endotracheal intubation, the endotracheal tube (ET) sizes used for female and male patients were 7.0 and 8.0 respectively in the ML group. In the VL group, size 7.0 ET was used for female and size 8.0 armoured ET was used for male patients. Cuffs were inflated to a pressure of 20 - 40 cm H_20 pressure.

Perioperative cardio-vascular and hemodynamic responses (for *e.g.*, heart rate (HR), mean arterial blood pressure (MAP), peripheral oxygen saturation (SpO_2) and, end tidal carbon dioxide ($ETCO_2$) were recorded at baseline, induction, right after the intubation and then at 5th, 10th, 20th, 30th, 40th, 50th, 60th minutes during extubation, and postoperatively, at 5th, 10th, 15th, 20th minutes. At the end of the operation, a fresh gas flow (FGF) of 6 l/min of O_2, was maintained and the patient was administered a reversal agent (atropine and neostigmine). Patients were extubated when signs of complete recovery from neuro-muscular block and wakefulness (at least 8 ml/kg tidal volume with spontaneous respiration, ability to lift up the head and maintain this position for > 5 seconds, ability to generate an inspiratory negative force (> 40 cm H_2O), able to squeeze hand, or lift arm), response time to obeying verbal commands, *i.e.,* from the moment of last anesthetic administration, to responding to simple verbal commands such as "open your eyes" or "squeeze your hand" given every minute, orientation to time and place, *i.e,* be able to say their names, birth dates and where they are and total duration of operation were recorded. During the early postoperative period, leading questions were asked and any difficulty in breathing, stridor, cough, nausea, vomiting, sore throat, hoarseness were recorded.

Statistical analysis

The data obtained was evaluated using SPSS 15.0 (Statistical Package for the Social Sciences) program. In data evaluation, crosstabs were utilized besides descriptive statistics (average, standard deviation). Independent two-sample t-test and Chi-Square test were used for comparing quantitative data. All of the study's findings were tested in 95% confidence interval (CI), and a p-value of < 0.05 was considered significant and bidirectional.

RESULTS

There was no significant difference between groups as regards age, gender, body mass index (BMI) and duration of surgery ($p > 0.05$, Table 1).

Table 1: Comparison of the demographics in groups

Characteristics	Group ML	Group VL
Female	21	27
Male	9	7
Age (mean ± SD) years	46.66 ± 13.93	48.37 ± 13.58
BMI (kg/m^2)	31.23 ± 6.74	30.43 ± 8.14
Duration of the operation (min)	114.76 ± 45.49	115.77 ± 44.07

ML (n = 30), ML= Macintosh laryngoscope group, VL = TruView EVO2™ Video laryngoscope group

There was no significant difference between groups from the point of view of Mallampati scores, TMD, IIG (< 3 cm), thick or thin neck and being able to touch chin to chest ($p > 0.05$, Table 2).

Table 2: Comparison of diagnostic findings in groups

Diagnostic findings	Group ML	Group VL	p-value
Mallampati Score	2.37 ± 0.61	2.53 ± 0.57	0.281
Cormack-Lehane	2.28 ± 1.07	2.10 ± 0.88	0.493
Thyromental distance (cm)	6.43 ± 1.07	6.33 ± 1.27	0.743
Incisor teeth distance < 3 cm	20	20	0.781
Short neck	18	26	0.020*
Thick neck	24	26	0.488
Thin neck	6	4	0.488
Long neck	12	4	0.020*
Is chin to chest possible?	20	18	0.592

*$p < 0.05$, ML = Macintosh laryngoscope group (n = 30)
VL = TruView EVO2™ Video laryngoscope group (n = 30)

Patients with a short neck were more in Group VL ($p = 0.020$) and those with long neck were more in Group ML. ($p = 0.020$, Table 2). The ratio of those having Mallampati scores of 3 - 4 and Cormack-Lehane scores of 1 - 2 was 17% in Group ML and 30% for Group VL. The number of intubation attempts, intubation complication, duration of intubation (in sec) and orientation time was not significantly different between groups ($p > 0.05$). The time taken for visualization of vocal cords (in sec) was significantly higher in Group VL ($p = 0.009$). Vocal cords could not be visualized in seven patients in Group ML. The number of unsuccessful visualization of vocal cords in Group ML was significantly more than Group VL ($p < 0.05$) (Table 3).

Table 3: Comparison of intubation parameters in groups

Intubation	Group ML	Group VL	p-value
The number of attempts	1.53 ± 1.01	1.33 ± 0.48	0.330
Visualization time of the vocal cords (sec)	17.00 ± 23.27	34.50 ± 23.23	0.009**
The time of intubation (sec.)	57.72 ± 81.25	72.87 ± 65.90	0.434
The time of orientation (min.)	131.86 ± 41.24	126.70 ± 43.84	0.643
Complication of intubation	5	4	0.718
Not visualizing vocal cord	7	0	0.005**

ML (n = 30), ML= Macintosh laryngoscope group VL (n = 30) = TruView EVO2™ Video laryngoscope group

Extubation time, response time to verbal commands (in min) and orientation time (in min) was not significantly different between the two groups ($p > 0.05$, Table 4).

Table 4: Comparison of extubation parameters in groups

Parameters	Group ML	Group VL	p-value
The time of intubation	122.72 ± 40.81	117.47 ± 44.05	0.636
Response time to verbal commands (min)	127.62 ± 40.72	123.13 ± 43.89	0.686
The time of orientation (min)	131.86 ± 41.24	126.70 ± 43.84	0.643

$p > 0.05$

Between groups, there was a significant difference in heart rate before operation and at postoperative 10^{th} and 15^{th} minutes ($p < 0.05$). In Group ML, heart rate was found significantly higher before operation and at postoperative 10^{th} and 15^{th} minutes ($p = 0.027$, $p = 0.027$, $p = 0.027$ respectively, Table 5).

MAP, SPO_2, $EtCO_2$ measurements were not significantly different between groups ($p > 0.05$, Table 6, 7 and 8). In case of Cormack-Lehane view > III, difficult intubation rate of Group ML was found

Table 5: Comparison of heart rate (HR) changes in the two groups

Heart Rate	Group ML		Group VL		p-value
	Average	SD	Average	SD	
Preoperative	84.60	14.81	73.97	20.96	0.027*
Induction	86.41	17.05	78.47	14.28	0.057
E.end	85.72	14.66	82.97	15.07	0.479
5th min.	80.90	11.73	78.30	15.08	0.464
10th min.	75.45	9.87	73.93	11.79	0.595
20th min.	75.55	12.61	72.70	10.53	0.349
30th min.	72.10	13.56	73.20	10.97	0.734
40th min.	70.26	12.48	71.97	10.85	0.583
50th min.	67.19	9.60	72.34	12.75	0.099
60th min.	66.15	15.70	72.07	12.93	0.132
Extubation	78.79	13.20	74.60	16.36	0.284
PO 5th min	79.17	11.95	74.03	16.83	0.183
PO 10th min	80.17	12.21	72.93	12.26	0.027*
PO 15th min	79.48	11.49	71.30	10.28	0.006**
PO 20th min	77.97	11.47	72.93	10.77	0.088

p > 0.05, *p < 0.05, **p < 0.01
ML (n = 30) = Macintosh laryngoscope group, VL (n = 30): TruView EVO2™ Video laryngoscope group, E. end = End of intubation, PO 5th min: postoperatively at 5th minute, PO 10th min: postoperatively at 10th minutes, PO 15th min = postoperatively at 15th minute, PO 20th min = postoperatively at 20th minute

Table 6: Comparison of mean arterial pressures (MAP) in groups

Arterial pressures	Group ML		Group VL		p-value
	Average	SD	Average	SD	
Preoperative	98.37	15.20	95.33	26.38	0.587
Induction	98.17	16.11	97.83	15.83	0.935
E. end	98.14	27.17	96.67	19.74	0.812
5th min	91.17	22.77	94.97	17.07	0.471
10th min	89.76	20.10	92.00	18.05	0.654
20th min	92.41	17.83	92.80	13.99	0.926
30th min	87.00	26.12	123.80	165.96	0.243
40th min	95.37	15.94	95.80	16.94	0.922
50th min	99.23	15.45	97.07	14.86	0.599
60th min	101.27	21.36	94.14	22.63	0.236
Extubation	100.07	20.91	97.97	18.19	0.682
PO 5th min	101.83	18.98	98.50	11.24	0.414
PO10th min	99.48	16.20	96.20	19.50	0.485
PO15th min	96.48	14.24	95.27	9.31	0.698
PO 20th min	93.38	15.01	95.37	11.53	0.570

p > 0.05, MAP = mean arterial pressure, SD = Standard deviation; ML (n = 30): Macintosh laryngoscope group, VL (n = 30) = TruView EVO2™ Video laryngoscope group, Preop: Preoperative, E. end = End of the intubation, PO 5th min = postoperatively at 5th minutes, PO 10th min = postoperatively at 10th minutes, PO15th min = postoperatively at 15th minutes, PO 20th min = postoperatively at 20th minutes

significantly higher than that of Group VL (Table 9). For the ratio of difficult intubation, there was not any statistical difference between Group ML and Group VL (47% and 50%, respectively) ($p > 0.05$). The ratio of difficult intubation in all the patients was 48%. The rate of successful intubation was 90 % in all 60 cases. Success rate of intubation ascended to 98.3% by using the LMA Fastrach. Failed intubation rate was found as 1.7 %. Three cases in each group could not be

Table 7: Comparison of oxygen saturations (SpO_2) in groups

Oxygen Saturations	Group ML		Group VL		p-value
	Average	SD	Average	SD	
Preoperative	97.60	2.80	97.97	2.03	0.563
Induction	99.03	1.40	98.80	1.58	0.550
E.end	99.38	1.12	99.47	0.86	0.737
5th min	99.48	1.18	99.50	0.90	0.950
10th min	99.24	1.24	99.43	0.94	0.505
20th min	99.21	1.24	99.37	1.22	0.619
30th min	96.24	16.62	99.30	1.15	0.319
40th min	99.22	1.15	99.43	1.10	0.484
50th min	99.23	1.11	99.34	1.08	0.700
60th min	95.85	17.54	99.28	1.19	0.298
Extubation	99.41	0.98	98.93	1.36	0.127
PO 5th min	98.79	3.24	98.33	3.26	0.590
PO 10th min	99.00	2.05	98.87	1.78	0.790
PO 15th min	99.17	1.47	99.27	1.26	0.792
PO 20th min	99.17	1.63	99.30	1.37	0.745

p > 0.05, MAP = mean arterial pressure, SD = Standard deviation; ML (n = 30): Macintosh laryngoscope group, VL (n = 30) = TruView EVO2™ Video laryngoscope group, Preop: Preoperative, E. end = End of the intubation, PO 5th min = postoperatively at 5th minutes, PO 10th min = postoperatively at 10th minutes, PO15th min = postoperatively at 15th minutes, PO 20th min = postoperatively at 20th minutes

Table 8: Comparison of end tidal carbon dioxide ($ETCO_2$) in groups

$EtCO_2$	Group ML		Group VL		p-value
	Average	SD	Average	SD	
Intubation	32.90	4.70	31.27	3.96	0.155
5th min	30.93	3.63	30.77	3.73	0.865
10th min	30.66	3.00	30.93	3.03	0.725
20th min	30.17	3.64	30.73	2.91	0.515
30th min	40.45	56.20	30.70	3.20	0.347
40th min	29.63	3.61	30.45	3.44	0.388
50th min	29.54	3.43	31.07	4.29	0.153
60th min	29.81	3.20	30.66	3.71	0.371

p-value > 0.05
ML (n = 30) = Macintosh laryngoscope group, VL (n = 30): TruView EVO2™ Video laryngoscope group, Average: Mean, SD: Standard deviation

Table 9: The ratios of difficult intubation (%)

Intubation	Group ML	Group VL	p-value
BMI (body mass index) > 30	61.54	46.67	0.431
Mallampati Score > 3	66.67	66.67	0.999
Cormack-Lehane Score > 3	100.00	66.67	0.038
Incisor teeth distance < 3cm	61.54	46.67	0.431
Thyromental distance < 7cm	50.00	46.15	0.781
Short neck	55.56	50.00	0.717
Thick neck	50.00	53.85	0.786
Thin neck	33.33	25.00	0.778
Long neck	33.33	50.00	0.551
Chin to chest possible	40.00	38.89	0.994
Chin to chest impossible	60.00	66.67	0.746
Mandibular protrusion	40.91	47.62	0.658
No Mandibular protrusion	62.50	55.56	0.772

intubated by the method used. Therefore, the rescue technique of LMA Fastrach was attempted. Five of the cases were intubated by Fastrach, whereas one case could not be intubated even by this method. In Group ML, success rate of intubation was 90% while failed intubation rate was 10%. Identically, for Group VL, success rate of intubation was 90% while failed intubation rate was 10%. In Fastrach method, success rate of intubation was 83%; whereas failed intubation rate was 17 %.

With respect to difficult intubation cases, success rate of intubation was 79.3%. Success rate of intubation in ML Group was 78.6 %, success rate of intubation in VL Group was 80% and, success rate of Fastrach intubation was 83.3%. In Group ML, the success rate of Fastrach was found as 66.6%. In Group ML, 33.3% of the patients could not be intubated. Success rate of Fastrach intubation in VL Group was found as 100%.

With respect to postoperative complications, there was no significant difference between groups ($p > 0.05$). In total, 26 patients had postoperative complications in Group ML (sore throat in two patients; cough in seven patients; nausea in 11 patients; vomiting in five patients and, stridor in one patient), while 31 patients had postoperative complications in Group VL (sore throat in two patients; difficulty in breathing in one patient; cough in eight patients; nausea in nine patients; vomiting in eight patients and, stridor in three patient). The most frequent postoperative complication was nausea. Hoarseness was not at all seen (Table 10).

Table 10: Postoperative complications findings

Complications	Group ML	Group VL	p-value
Postoperative sore throat	2	2	0.972
Postoperative breathing difficulty	0	1	0.321
Postoperative hoarseness	0	0	-
Postoperative cough	7	8	0.824
Postoperative nausea	11	9	0.520
Postoperative vomiting	5	8	0.383
Postoperative stridor	1	3	0.317

$p < 0.05$, ML = Macintosh laryngoscope group, VL = TruView EVO2™ Video laryngoscope group

DISCUSSION

Tracheal intubation is required in many general anesthetics. Efforts for decreasing the inconvenience in difficult airway management have directed researchers to investigating alternative methods. The development presents importance of preoperative airway evaluation in patients. Not only Mallampati score, but all other tests for predicting difficult intubation (measurement of SMD, TMD, IIG *etc,*) when taken together will increase the accuracy of predicting a difficult airway during preoperative airway evaluation.

In this study, out of 60 cases, the difficult intubation rate was 48%; in Group ML the rate was

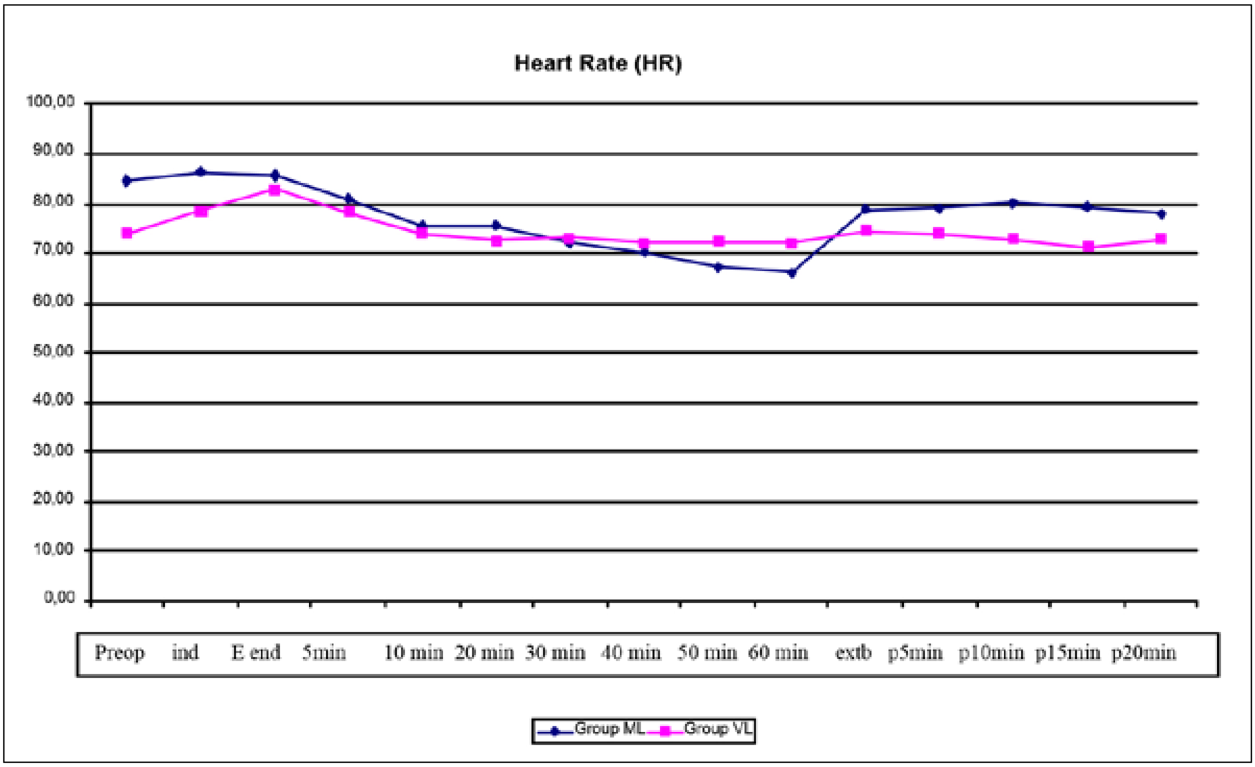

Fig. 1: Comparison of heart rates (HR) in two groups.

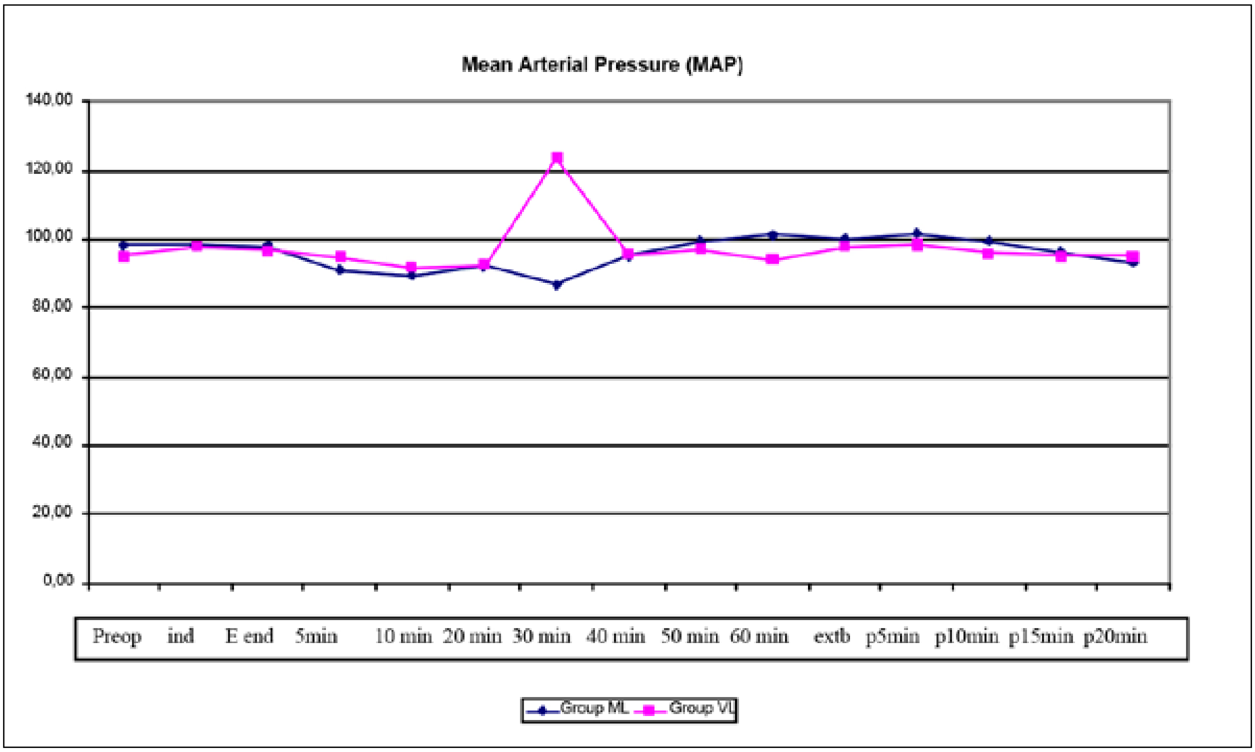

Fig. 2: Comparison of mean arterial pressures (MAP) in two groups

47%, while it was 50% in Group VL. Having BMI > 30, Mallampati > III, Cormack-Lehane > III, short and thick neck, chin-to-chest impossibility, no mandibular protrusion, IIG < 3 cm, TMD < 7cm matched with difficult intubation cases between 46.15% and 100%. Interestingly, in being able to touch chin-to-chest, thin neck and long neck cases, difficult intubation was 25 - 50%. Ishwar *et al*[5]. studied 50 patients whose Cormack-Lehane score was two and more and were predicted to have difficult intubation. In their study,

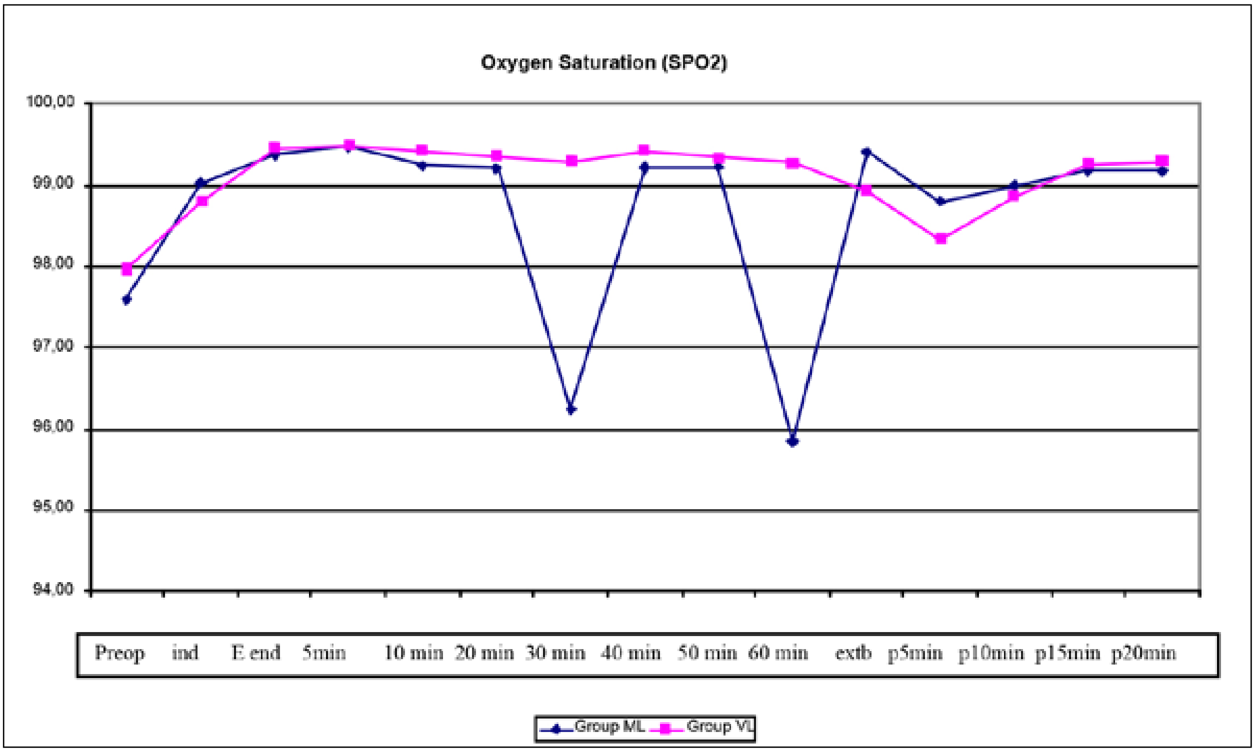

Fig. 3: Comparison of oxygen saturations (SPO_2) in two groups

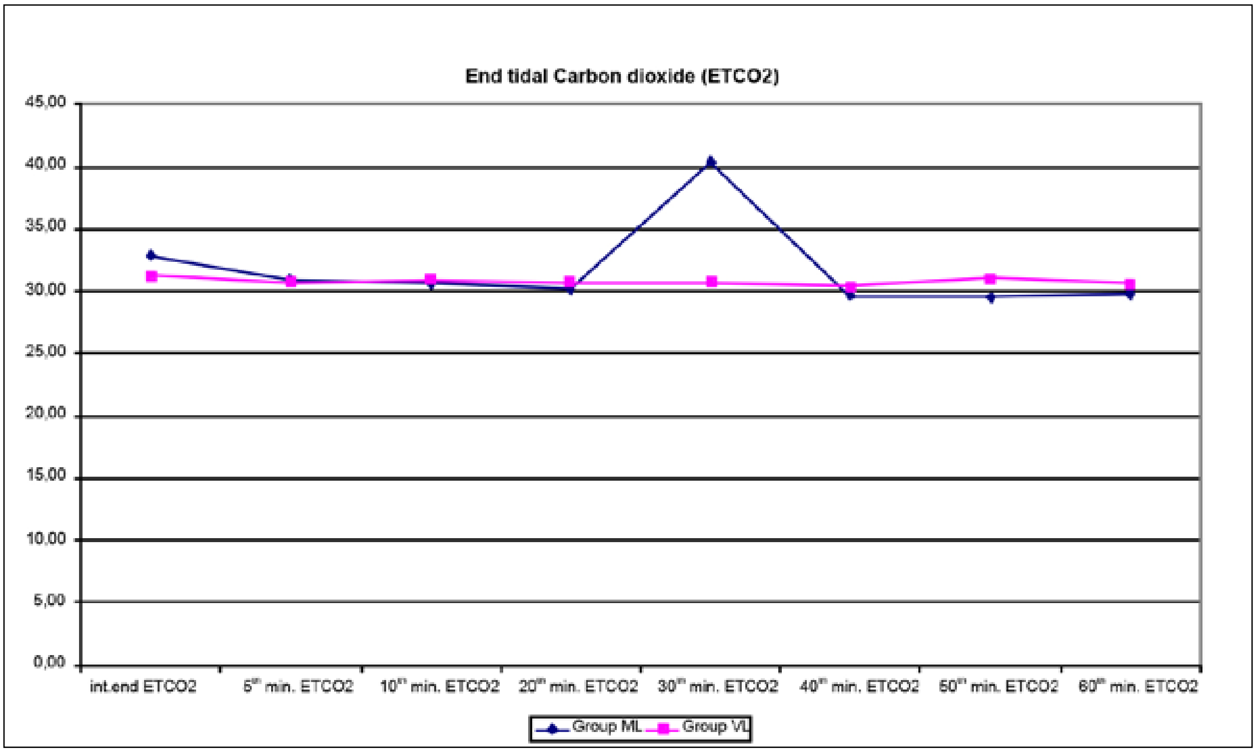

Fig. 4: Comparison of end tidal carbon dioxide ($ETCO_2$) in two groups

they compared TruView™ EVO2 VL and ML during intubation and reported intubation success rate as 88%. Also in their study, Cormack-Lehane score was four with ML while the score was converted to 1 - 2 with TruView™ EVO2 VL in five patients. In our study, the percentage of cases whose Mallampati scores were 3 - 4 and Cormack-Lehane scores 1 - 2 was 47%. Li *et al*[6] reported intubation success rates with ML and TruView™ EVO2 VL 100%. Raveendra *et al*[7] used TruView™ EVO2 VL in 50 patients in their study and reported their success rate as 94% in patients planned to have nasotracheal intubation.

Lili *et al*[8] used TruView™ EVO2 VL in their study, since they could not perform intubation by ML in patients with predicted difficult airway and they reported 100% success rate in all patients. In our study, intubation success rate in Group ML and Group VL was 90%. For Fastrach, which is a rescue method, intubation success rate was 98.3%.

In their study including 170 patients planned to have general anesthesia, Barak *et al*[9] compared Truview blade and Macintosh blade and determined intubation times as 62 sec and 51 sec respectively. In their study, Timanaykar *et al*[10] reported intubation times as 33.06 sec and 23.11 sec for Truview VL and ML respectively. Besides, they also examined the percentage of glottic opening in the same study and they found the values as 97.26% and 83.70%for TruView™ VL and ML respectively. They emphasized the difference as statistically significant. In their study, Li *et al*[6] determined that the intubation time lengthened with ML as compared to TruView™ EVO2 VL, as Cormack-Lehane glottic view score increases. From the point of intubation tube placement time, no statistically significant difference was found between groups in our study.

Hemodynamic response to intubation is higher in direct laryngoscopy. Although LMA Fastrach is a time-consuming operation, its superior hemodynamic stability makes it a suitable choice for patients unsuitable for tolerating the hemodynamic response to intubation[11]. Similarly, Joseph *et al*[12] used TruView™ EVO2 VL and ML for intubation in patients with cervical spine immobilization and showed that hemodynamic response was reduced. In another study, the percentage of glottic opening score with TruView™ EVO2 VL (98%) decreased to 77% with ML. Due to the 42 degree slope in blade, glottic view was obtained by applying approximate external force of 19.6 newton with TruView™ EVO2 VL while the pressure was 32.3 newton with ML in this study. Also, similar to our findings, less peak heart rate and systolic blood pressure values were obtained with TruView™ EVO2 VL[13].

Xue *et al*[14] found that hemodynamic responses to orotracheal intubation performed by GlideScope VL on direct laryngoscopy were similar. Joo *et al*[15] compared hemodynamic responses to "blind intubation with ILMA", "fiber optic assisted intubation with ILMA" and, "endotracheal intubation with direct laryngoscopy" in 40 female patients. They also compared the effects on postoperative morbidities. In their study, they found that intubation success rates were equal in all three groups, MAP values were higher in "endotracheal intubation with direct laryngoscopy" group and there was reduced hemodynamic response to LMA Fastrach.

Postoperative sore throat and hoarseness were found in equal percentages for all three groups. They suggested that LMA Fastrach could be used as a primary airway for oxygenation and ventilation and that it could be an alternative to tracheal intubation with laryngoscopy. In comparing Truview blade and Macintosh blade, they found that soft palate injury and bleeding, dental avulsion, desaturation, postoperative sore throat, nausea and stridor were experienced more in direct laryngoscopy with Macintosh blades during intubation[9,11,16]. TruView EVO2™ VL provides a higher quality image of the vocal cords[9].

Inal *et al*[17] compared TruView EVO2™ VL and Miller laryngoscope in 50 pediatric patients and in their study, they found a correlation between preoperative Mallampati scores and intubation difficulty scales of the patients. TruView EVO2™ VL provided higher quality Cormack-Lehane glottic image scores than those of Miller laryngoscope. In scenarios of easy-moderate-difficult airway of 20 anesthesia simulation mannequins, while success rate of laryngoscopy was similar for intubations with ML Truevuew VO2 VL, GlideScope VL and Airtraq VL in scenarios of easy and moderate airway, Airtraq VL was found unique in providing high quality laryngeal image without tongue compression in difficult airway scenario where they made this type of airway with tongue edema in a mannequin[18].

On the contrary, an absolute need for stlyet for intubations with TruView EVO2™ VL maybe be considered a disadvantage. It was reported that TruView EVO2™ VL did not reduce incidence of intubation failure in patients with Cormack-Lehane grade 2 - 3[14]. In our study, although vocal cords were displayed in all the patients considered having difficult airway and planned to intubate with TruView EVO2™ VL, three patients in this group could not be intubated successfully. Because of solid structure of stylet in TruView EVO2 VL, the ETT could not be directed towards vocal cords displayed on the screen. Changing the solid structure of stlyet could improve the success of Truview EVO2 VL in patients with difficult airway. Since TruView EVO2 VL has an oxygen insufflation facility to keep secretions away from the optical lens, vocal cord image is sharper than that of ML.

CONCLUSION

In general anesthesia administration, airway should be evaluated comprehensively and assessment of different tests together will increase the predictability of difficult airway. In case of a difficult airway prediction, we should be prepared for difficult airway management and difficult intubation. TruView EVO2 VL and ML have high success rates of intubation and where difficult intubation is encountered, intubation could be attempted by both of these devices. Since difficult intubation may occur in cases with no predicted airway difficulty, alternative airway devices (such as VL, Fastrach *etc.*) should be used frequently during routine anesthesia so that the anesthesiologist's experience with these devices will be increased. An anesthetist using these alternative airway management devices easily will enhance the chances of successful airway management in difficult intubation cases.

REFERENCES

1. Guzeldemir ME. www.gata.edu.tr. ZorVentilasyon-ZorEntubasyon.doc
2. Boralessa H, Senior DF, Whitwamn JG. Cardiovascular response to intubation. A comparative study of thiopentone and midazolam. Anaesthesia 1983; 38:623-627.
3. Saxena A, Madan M, Shrivastava U, *et al*. Role of the Truview EVO2 laryngoscope in the airway management of elective surgical patients: A comparison with the Macintosh laryngoscope. Indian J Anaesth 2013; 57:276-281.
4. Matsumoto S, Asai T, Shingu K. Truview video laryngoscope in patients with difficult airways. Anesth Analg 2006; 103:492-493
5. Sıngh I, Khaund A, Gupta A. Evaluation of Truview EVO2 laryngoscope in anticipated difficult intubation: A comparison to Macintosh laryngoscope Indian J Anaesth 2009; 53:164-168.
6. Li JB, Xıong YC, Wang XL, *et al*. An evaluation of the TruView EVO2 laryngoscope. Anaesthesia 2007; 62:940-943.
7. Raveendra US, Mehandale SG, Shetty SR, Kamath MR. Evaluation of the TruView EVO2 Laryngoscope for nasotraheal intubation. Saudi J Anaesth 2012; 6:398-402.
8. Lili X, Zhiyong H, Jianjun S. A comparison of the GlideScope with the Macintosh laryngoscope for nasotracheal Intubation in patients with ankylosing spondylitis. J Neurosurg Anesthesiol 2014; 26:27-31. doi: 10.1097/ANA.0b013e31829a0491.
9. Barak M, Philipchuck P, Abecassis P, Katz Y. A comparison of the Truview® blade with the Macintosh blade in adult patients. Anaesthesia 2007; 62:827-831.
10. Timanaykar R, Anand L, Palta S. A randomized controlled study to evaluate and compare Truview blade with Macintosh blade for laryngoscopy and intubation under general anesthesia. J Anesthesiol Clin Pharmacol 2011; 27:199-204.

11. Chang CH, Bai SJ, Kim MK, Nam SB. The usefulness of the laryngeal mask airway Fastrach for laryngeal surgery. Eur J Anaesthesiol 2010; 27:20-23. doi: 10.1097/EJA.0b013e3283317dac.
12. Joseph J, Sequeria T, Upadya M. Comparison of the use of McCoy and TruView EVO2 laryngoscopes in patients with cervical spine immobilization. Saudi J Anaesth 2012; 6:248-253.
13. Tutuncu AC, Kaya G, Tunali Y, Altintas F, Dilmen OK. A comparison of the TruView EVO2 and Macintosh laryngoscope blades. Clinics (Sao Paulo). 2011; 66:709-711.
14. Xue FS, Zhang GH, Li XY, *et al*. Comparison of hemodynamic responses to orotracheal intubation with the GlideScope video laryngoscope and the Macintosh direct laryngoscope. J Clinic Anesth 2007; 19:245-250.
15. Joo H S, Rose D K. The intubating laryngeal mask airway with and without fiberoptic guidance. Anesth Analg 1999; 88:662-666.
16. Carlino C, Pastore JC, Battistini GM, Cancellieri F. Training resident anesthesiologists in adult challenging intubation comparing Truview EVO2 and Machintosh laryngoscope: a preliminary study. Minerva Anestesiol 2009; 75:563-567. epub 2009 May 21.
17. Inal MT, Memis D, Kargı M, Oktay Z, Sut N. Comparison of TruView EVO2 with Miller laryngoscope in paediatric patients. Eur J Anesthesiol 2010; 27:950-954.
18. Darshane S, Ali M, Dhandapani S, Charters P. Validation of a model of graded difficulty in Laerdal SimMan: functional comparisons between Macintosh, Truview EVO2, Glidescope video laryngoscope and Airtraq. Eur J Anaesthesiol 2011; 28:175-180. doi: 10.1097/EJA.0b013e328340c383.