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Left-molar approach for direct laryngoscopy: is it easy?

Ozgun Cuvas, Hulya Basar, Nursen Gursoy, Safiye Culhaoglu, and Aynur Demir

Department of Anesthesiology and Intensive Care Medicine, Ankara Training and Research Hospital, Ulucanlar, Ankara 06340, Turkey

Abstract

Purpose. For direct laryngoscopy, we compared midline and left-molar approaches with respect to ease of intubation, using a Macintosh blade. We investigated the relationship between failure of the left-molar approach and preoperative risk factors for difficult intubation.

Methods. With local ethics committee approval, 200 consecutive adult, nonpregnant patients were included in the study. The demographic data, body mass index, Mallampati modified score, interincisor gap, and mentohyoid and thyromental distances were measured preoperatively. First, the Macintosh blade was inserted using the midline approach, and then optimal external laryngeal manipulation (OELM) was applied. Second, the blade was inserted using the left-molar approach. The glottic views were assessed according to the Cormack-Lehane classification before and after OELM in both approaches. In cases where tracheal intubation failed with the left-molar approach, the midline approach was applied again and endotracheal intubation took place.

Results. The grade I glottic view obtained using the midline approach without OELM did not change in 94.3% of the patients with the left-molar approach without OELM; in addition, the grade II glottic view improved to grade I in 52.8% of the patients with the same technique ($P < 0.001$). Although the number of patients with a grade I or II glottic view in the left-molar approach was 197, only 37 patients could be intubated using the left-molar approach. In addition, 59.5% of them were intubated at the second attempt with the left-molar approach, while the incidence of a second attempt was 1.2% with the midline approach ($P < 0.001$). There was no correlation between the preoperative risk factors for difficult intubation and failure of the left-molar approach.

Conclusion. Difficulty in the insertion of the endotracheal tube limits the efficacy of the left-molar approach. It is not possible to predict the failure of intubation with the left-molar approach by considering the preoperative risk factors.

Address correspondence to: O. Cuvas
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Key words Intubation · Endotracheal · Laryngoscopy · Methods

Introduction

Difficulty in visualizing the glottis may cause difficulty or failure in tracheal intubation. One-third of airway-related catastrophes leading to brain damage or death occur as a result of inability to maintain a patent airway [1]. Optimal laryngoscopy requires the proper positioning of the head and neck before attempting the laryngoscopy, the application of optimal external laryngeal manipulation (OELM), and the choice of the appropriate laryngoscope blade. A right-molar approach has been recommended in difficult tracheal intubation if one is using a straight-bladed laryngoscope [2]. However, Yamamoto et al. [3]. have found that a left-molar approach was more effective in improving the direct glottic view when using a Macintosh blade. Arino et al. [4] have suggested that a good laryngeal view with the intubating device did not equate with ease of tracheal intubation.

The aims of the present study were to compare midline and left-molar approaches with respect to the ease of tracheal intubation, using a Macintosh blade, and to investigate the relationship between failure of the left-molar approach and preoperative risk factors for difficult intubation.

Patients, materials, and methods

After obtaining the approval of the ethics committee of our institution and patients' informed consent, 200 consecutive adult, nonpregnant patients, aged more than 18 years, American Society of Anesthesiologists (ASA) physical status 1–2, who were scheduled to receive general anesthesia requiring tracheal intubation for elective surgery were included in the study.

We excluded patients requiring a rapid-sequence induction and those with increased intracranial pressure, hypertension, ischemic heart disease, or ASA status more than 2. We also excluded patients who had loose molar teeth.

Before surgery, each patient received a clinical physical evaluation. We assessed the body mass index (BMI; weight [kg]·height $[m]^{-2}$) and anatomical variables, including oropharyngeal volume (Mallampati modified score), interincisor gap (IIG), mentohyoid distance (MHD), and thyromental distance (TMD). The patient was asked to sit upright with the head in neutral position. Then, while the patient opened the mouth as wide as possible, maximum tongue protrusion was requested. Assessment of the airway was scored by using the method described by Mallampati et al. [5] with the modification described by Samsoon and Young [6]: class 1, soft palate, fauces, uvula, and pillars visible; class 2, soft palate, fauces, and uvula visible; class 3, soft palate and base of uvula visible; and class 4, none of the soft palate visible. The patient was asked to open his/her mouth as wide as possible again, and the distance between the upper and lower incisors (IIG) in the midline (in centimeters) was measured. The patient was asked to lie down in the supine position and extend the head as far as possible, keeping the mouth closed. The straight distance from the inside of the mentum to the superior border of the hyoid bone (MHD) and the straight distance from the inside of the mentum to the thyroid notch (TMD) were measured (in centimeters). A hard-plastic-bonded ruler was used to measure the distances, and each measurement was performed two times by two investigators blinded to each other. Patients' age, height, weight, and sex were also recorded. Preoperative risk factors for difficult intubation included a BMI of more than 32 $kg \cdot m^{-2}$, a Mallampati scale score of more than 2, IIG less than 3.5 cm, MHD less than 4.5 cm, and TMD less than 6.5 cm [7].

In the operating theater, monitoring consisted of pulse oximetry, electrocardiograph, capnograph, automated noninvasive blood pressure measurement (PM 8060 Vitara; Drager, Lübeck, Germany) and peripheral nerve stimulation of the ulnar nerve at the wrist (TOF Guard; Organon Teknika, Turnhout, Belgium). After preoxygenation for 3 min, anesthesia was induced intravenously using fentanyl 1.5 $\mu g \cdot kg^{-1}$ and thiopental 4–5 $mg \cdot kg^{-1}$. The patient's lungs were ventilated with sevoflurane 2% inspired concentration and 50% nitrous oxide in oxygen 6 $l \cdot min^{-1}$ via a circle and a face mask, and we adjusted the ventilatory frequency at 12–15 bpm to maintain end-tidal CO_2 level at 32–35 mmHg. After recording the control value, vecuronium 0.1 $mg \cdot kg^{-1}$ was administered intravenously. After muscle paralysis was complete, as shown by no twitches from a train-of-four stimulus, laryngoscopy was started.

Patients were intubated by one of two anesthesiologists who had at least 7 years' experience in the specialty. Laryngoscopies were carried out under full muscle relaxation with optimal head and neck positioning for intubation [8]. We used a Macintosh no. 3 or 4 standard curved blade. The glottic view was noted using the Cormack-Lehane classification [9]: grade I, full view of the glottis obtained; grade II, only the posterior commissure of the glottis seen; grade III, only the epiglottis seen; grade IV, even the epiglottis could not be seen. We used the technique and order of laryngoscopy described by Yamamoto et al. [3]. First, the blade was inserted to the right of the tongue and the tongue was displaced to the left as a conventional technique (midline approach). After the glottic view had been recorded, OELM was applied by a quick empirical search with the fingers of the laryngoscopist's right hand [8] and the best glottic view was recorded again. Second, the blade was drawn out of the mouth and immediately reinserted from the left corner of the mouth at a point above the left molars, as described by Yamamoto et al [3]: the tip of the blade was directed posteromedially along the groove between the tongue and the tonsil until the epiglottis and glottis came into sight. Before elevating the epiglottis, the tip of the blade was kept in the midline of the vallecula and the blade was kept above the left molars. The best glottic view before and after the application of OELM was recorded. Difficult laryngoscopy was defined as grade III and IV with the application of OELM. Laryngoscopy was applied using the left-molar approach not only in patients with grade III or IV but also in patients with grade I or II glottic views. A maximum two attempts at intubation were tried using left-molar approach. When insertion of the endotracheal tube failed using the left-molar approach, the midline approach was applied again and endotracheal intubation took place. A stylet (intubation stylet; Portex, London, UK) was used at the second attempts in the left-molar and midline approaches. The duration of laryngoscopies and time for intubation to be completed were measured from the moment the blade tip passed the teeth with the first midline approach to the moment when the anesthesiologist reported the tracheal tube passing through the vocal cords. Oxygen saturation of arterial blood and hemodynamic data were monitored during the laryngoscopy. Any complications associated with the laryngoscopy, such as dental injury and oral trauma, were recorded. Surgery was then allowed to proceed as normal. Patients were informed if laryngoscopy or intubation was difficult.

The data were analyzed with the SPSS 11.5 package program (SPSS, Chicago, IL, USA). The Shapiro-Wilk test was used to test the normality of distribution for

Table 1. Demographic data

	Mean ± SD	Minimum-Maximum
Age (years)	41.57 ± 11.07	20.00–65.00
Weight (kg)	71.76 ± 11.15	45.00–100.00
Height (cm)	165.35 ± 8.36	150.00–180.00
BMI ($kg{\cdot}m^{-2}$)	26.29 ± 3.99	16.53–38.29
Sex (M/F)	90/110	
Duration of laryngoscopy (s)	20.49 ± 3.80	8.00–30.00

continuous variables and values were expressed as means ± SD or medians (minimum-maximum) as appropriate. The differences regarding continuous variables were evaluated by Student's *t*-test or the Mann-Whitney *U*-test, where appropriate. The Wilcoxon-Sign Rank test was applied for determining the difference in the glottic view scores between the midline and left-molar approaches, and the approaches with or without OELM. Qualitative data were evaluated by using the χ^2 or Fisher's exact test, where applicable. Crude odds ratios (ORs) and 95% confidence intervals (CIs) for each risk factor which might affect failure of intubation with the left-molar approach were calculated. Then, the ORs and 95% CIs were adjusted for age and sex. Multiple logistic regression analysis was used to detect the predictors of failure of intubation with the left-molar approach. A P value of less than 0.05 was considered statistically significant.

Results

The patients' demographic data are shown in Table 1. The grade I glottic view obtained using the midline approach without OELM did not change in 94.3% of the patients with the left-molar approach without OELM; in addition the grade II glottic view improved to grade I in 52.8% of the patients with the same technique ($P < 0.001$). Difficult laryngoscopy with the midline approach was encountered in 6 patients (3%) and OELM reduced the number of patients with difficult laryngoscopy to 2 (1%; $P < 0.001$; Tables 2 and 3). The glottic view improved from grade III to grade II in 1 of these 2 patients with the left-molar approach and OELM, but it was not possible to intubate the patient using the left-molar approach after two attempts. Blind intubation was accomplished using the midline approach. In the other patient, the glottic view improved from grade IV to grade III with the left-molar approach and OELM, but intubation could not be accomplished using either the left-molar or the midline approach. The patient was intubated using a fiberoptic technique. Of the other 4 patients, the left-molar approach with OELM improved the glottic view from grade II to grade I in 1 patient, but the glottic view did not change in the remaining 3 patients. Only 2 of these 4 patients could be intubated with the left-molar approach; the others were intubated with the midline approach. OELM improved the glottic view in both the midline and left-molar approaches ($P < 0.001$). There was no statistically significant difference between the glottic view obtained with the midline approach + OELM and that obtained with the left-molar approach + OELM ($P = 0.096$); the lack of significance was related to the high number of grade I patients (Table 3). On the other hand, only 37 patients (18.5%) could be intubated using the left-molar approach; the grade obtained with the left-molar approach was grade I in 24 patients and grade II in 13 patients. In addition, 59.5% of the patients were intubated at the second attempt with the left-molar approach, while the incidence of intubation at the second attempt was 1.2% with the midline approach ($P < 0.001$).

Table 2. Efficacy of midline and left-molar approaches for obtaining glottic views in laryngoscopy without OELM

		Left-molar approach				
	Grade	I	II	III	IV	Total
Midline approach	I	133	8	0	0	141
	II	28	25	0	0	53
	III	0	3	2	0	5
	IV	0	0	1	0	1
	Total	161	36	3	0	200

Data values are numbers of patients
OELM, optimal external laryngeal manipulation

Table 3. Efficacy of midline and left-molar approaches for obtaining glottic views in laryngoscopy with OELM

		Left-molar approach + OELM				
	Grade	I	II	III	IV	Total
Midline approach + OELM	I	187	2	0	0	189
	II	5	4	0	0	9
	III	0	1	0	0	1
	IV	0	0	1	0	1
	Total	192	7	1	0	200

Data values are numbers of patients

Table 4. Interincisor gap (IIG), mentohyoid distance (MHD), and thyromental distance (TMD) measurements in the patients in whom intubation with the left-molar approach was successful or unsuccessful

	Unsuccessful left-molar intubation (*n* = 163)	Successful left-molar intubation (*n* = 37)	*P*
IIG (cm)	4.33 ± 0.52	5.36 ± 0.51	<0.001*
MHD (cm)	5.13 ± 0.63	5.53 ± 0.73	0.002*
TMD (cm)	7.27 ± 0.65	7.69 ± 0.96	0.028*

* $P < 0.05$ Statistically significant difference
Data values are means ± SD

Table 5. Risk factors for difficult intubation with the left-molar approach

Variables	Unsuccessful left-molar intubation (*n* = 163)	Successful left-molar intubation (*n* = 37)	Crude OR (95% CIs)	*P*	Adjusted OR (95% CIs)	*P*
Mallampati 1–2	152 (93.3)	31 (83.7)	1.00	0.095	1.00	0.075
Mallampati 3–4	11 (6.7)	6 (16.2)	0.37 (0.13–1.09)		0.36 (0.12–1.11)	
IIG ≥ 3.5	150 (92.0)	37 (100.0)	1.00	0.132	1.00	NA
IIG < 3.5	13 (8.0)	0 (0.0)	—		—	
MHD ≥ 4.5	147 (90.2)	35 (94.6)	1.00	0.536	1.00	0.416
MHD < 4.5	16 (9.8)	2 (5.4)	1.90 (0.42–8.67)		1.88 (0.41–8.60)	
TMD ≥ 6.5	151 (92.6)	36 (97.3)	1.00	0.469	1.00	0.332
TMD < 6.5	12 (7.4)	1 (2.7)	2.86 (0.36–22.72)		2.79 (0.35–22.24)	
BMI ≤ 32	152 (93.3)	34 (91.9)	1.00	0.726	1.00	0.877
BMI > 32	11 (6.7)	3 (8.1)	0.82 (0.22–3.10)		0.90 (0.22–3.59)	

Data values are numbers of patients (incidence) or odds ratios (95% confidence intervals)
Odds ratios (ORs) and 95% CIs were adjusted for age and sex
NA, Not analyzed; IIG, interincisor gap; MHD, mentohyoid distance; TMD, thyromental distance

There were no statistically significant differences in demographic data between the patients intubated with the midline approach and the patients intubated with the left-molar approach, but it was seen that the patients who could be intubated with the left-molar approach had higher IIG, MHD, and TMD measurement values ($P < 0.001$, $P = 0.002$, and $P = 0.028$, respectively) when compared to the values in the patients intubated with the midline approach (Table 4).

Although the IIG, MHD, and TMD measurements differed significantly between the two approaches, there was no correlation between the risk factors for difficult intubation and failure of the left-molar approach. According to multiple logistic regression analysis no predictors were detected for the failure of intubation with the left-molar approach (Table 5). There were no complications associated with the laryngoscopy, such as dental injury or oral trauma.

Discussion

In the present study, although the left-molar approach improved the glottic view, 81.5% of the patients could not be intubated with the left-molar approach, and the incidence of second attempts at intubation was significantly higher with the left-molar approach than with the midline approach.

The efficacy of the left-molar approach with OELM in improving the glottic view was stated by Yamamoto et al. [3]. In their study, the left-molar approach with OELM improved the glottic view from grade III or IV to grade I or II, but although the larynx was visualized with the left-molar approach + OELM, the endotracheal tube was passed along the midline because of the limited space in 13 patients. In their other 7 patients, intubation was accomplished using a fiberoptic technique ($n = 3$), a laryngeal mask airway ($n = 2$), blind intubation ($n = 1$), and a McCoy laryngoscope ($n = 1$). They suggested that to increase the efficacy of the left-molar approach, anesthesiologists should practice by using the technique on patients with a normal airway. So we used the technique in all 200 patients with a grade I, II, III, or IV glottic view, and aimed to investigate the ease of the left-molar approach rather than the improvement of the glottic view.

Successful direct laryngoscopy and tracheal intubation needs a clear view of the laryngeal inlet. In some cases, it is not possible to see the best view of the laryngeal inlet in spite of the adoption of the sniffing position and OELM. We used a Macintosh blade in the present study, as did Yamamoto et al. [3], because the Macintosh blade provides more room in the oropharynx to maneuver the tracheal tube, providing better intubating conditions [4]. The molar approach with the Macintosh blade reduces the distance from the patient's teeth to the larynx and prevents intrusion of maxillary structures into the line of view [3]. In this technique, the tracheal tube has to be inserted through a triangle framed by the flange, the lingual surface of the blade, and the tongue bulging to the right of the blade. The only drawback of the left-molar approach is the bulging of the tongue over the blade, which may obscure the view of the glottis [3]. In the present study, bulging of the tongue did not disturb the direct visualization, but it limited the triangle, making the intubation difficult. It was seen that insertion of the endotracheal tube was not easy, causing the failure of intubation.

We investigated the reason for the low rates of intubation with the left-molar approach in the present study, and noticed that the patients with longer IIG, MHD, and TMD distances could be intubated with the left-molar approach more easily than the others. However, we did not find any correlation between the preoperative risk factors for difficult intubation and failure of intubation with the left-molar approach.

Because the most important aspect of a laryngoscopic intubation is the correct placement of the tracheal tube, a good laryngeal view does not equate with ease of intubation. According to our data, it is impossible to predict failure of intubation with the left-molar approach by considering the preoperative risk factors. On the other hand, the difficulty with intubation using the left-molar approach may be related to unfamiliarity with intubation by this route, and ease of intubation may improve with practice by the operator. There are three case reports about the left-molar approach in the literature: Sato and Shingu [10] have stated that the left-molar approach may be a useful technique when the incisor teeth or teeth on the right side are vulnerable or valuable. Farley et al. [11] have reported a case in which the left-molar approach to conventional laryngoscopy was used to facilitate recognition of laryngeal structures with a fiberoptic laryngoscope. Mentzelopoulos et al. [12] have used left-molar McCoy-balloon laryngoscopy in a patient with arthrogryposis multiplex congenita. This technique may be an alternative method of intubation especially in patient with an obstacle in the right side of their mouth.

In conclusion, the left-molar approach may offer advantages in terms of laryngoscopic view, but the difficulty in the insertion of the tracheal tube limits this technique's efficacy.

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