

Effect of Jaw Thrust and BURP Maneuvers on Glottis Visualization During C-MAC® Videolaryngoscopy

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Abstract

Background: Different techniques are proposed to improve glottis visualization during laryngoscopy, namely backward-upward-rightward pressure (BURP) and jaw thrust; however, with controversial results. The current study aimed at comparing the maneuvers to elicit their efficacy for better glottis visualization in videolaryngoscopy (VL).

Methods: In the current self-controlled, randomized, clinical trial, 104 patients candidate for elective surgery requiring endotracheal intubation were recruited. All participants underwent airway examination, thyromental distance (TMD), limited mouth opening, and head extension were recorded. Laryngoscopy was performed by a single anesthetist using C-MAC® (KARL STORZ, Germany) and a Macintosh blade, size 4. A second anesthetist applied BURP and jaw thrust maneuvers. For each patient 3 images were provided with and without a maneuver in the optimal view. The images were randomly coded. An anesthesiologist blinded to the codes and assignments scored images based on the Cormack-Lehane scoring system.

Results: Both maneuvers significantly improved glottis visualization, but BURP rendered more promising effects. Gender-specific analyses yielded similar results. In subgroups of patients with limited head extension, TMD < 5 cm or limited mouth opening, the findings were significant.

Conclusions: Both BURP and jaw thrust maneuvers resulted in better glottis visualization. Nevertheless, BURP may provide better conditions during laryngoscopy irrespective of airway parameters and should be attempted first.

Keywords: Laryngoscopy, Airway, Anesthesia, Jaw Thrust, BURP, Cormack-Lehane

1. Background

Difficult intubation may predispose patients with life-threatening complications (1-4). To attenuate the incidence of intubation failure, different devices are introduced. Videolaryngoscopes (VL) gained popularity in recent years due to high efficacy and short learning curve (5, 6). These devices are widely used in the operating rooms, emergency departments, and the intensive care units (ICU) (7, 8).

In order to maintain competent view in laryngoscopy, different techniques are proposed including backward-upward-rightward pressure (BURP) and jaw thrust maneuvers (9). There is much debate about the advantages and drawbacks of these maneuvers. In the BURP maneuver, the patient is placed in the sniffing position and the assistant's thumb and middle finger are placed on the cricoid cartilage slowly pushing it backward, upward, and rightward. One of the advantages of this maneuver is the low incidence of airway traumatization, aspiration, and hypoxia. However, its efficacy in all difficult airway scenarios is controversial and its application is limited in anterior airway

trauma. Jaw thrust has drawbacks in patients with limited mouth opening, namely fractures and the ones with spinal cord injuries (10, 11).

The current study aimed at comparing the efficacy of these maneuvers to improve glottis visualization during C-MAC® VL. The Macintosh blade was applied during the VL for safe generalization of the results to routine laryngoscopy.

2. Methods

2.1. Study Population

In the current self-controlled, randomized, clinical trial, 104 patients candidate for elective surgery requiring endotracheal intubation were recruited. The inclusion criteria were ASA (American society of anesthesiologists) physical status I-III, age above 18 years, and body mass index (BMI) less than 30 kg/m² without known facial or airway abnormality. Patients with limitation for intubation time, namely ischemic heart disease, were not included. Exclusion criteria were the incidence of arrhythmia, desaturation (SpO₂ < 90 %) during laryngoscopy, or

laryngoscopy time > 30 seconds. The study was registered in Iranian registry of clinical trials (IRCT) database (registration number: 5,370) and approved by the ethics committee of Iran University of Medical Sciences (code: IR.IUMS.REC.1394.9211174008). According to the application of standard airway maneuvers and excluding the patients requiring prolonged laryngoscopy; no ethical concern was deemed by the authors.

2.2. Study Design and Measurements

All participants underwent airway examination and TMD, limited mouth opening, and head extension were recorded. Demographic and hemodynamic data were recorded as well. After standard monitoring and preoxygenation with 100% oxygen, fentanyl 3 - 5 $\mu\text{g/kg}$ and midazolam 1 mg was administered as premedication. Propofol 1.5 - 2 mg/kg and cisatracurium 0.15 - 0.2 mg/kg were used to induce anesthesia. The patients were placed in the sniffing position and after 4 to 5 minutes of ventilation and convinced full muscle relaxation, laryngoscopy was performed. VL was carried out by a single anesthetist using C-MAC® (KARL STORZ, Germany) and a Macintosh blade size 4. A second anesthetist applied BURP and jaw thrust maneuvers. For each patient 3 images were provided with and without a maneuver in the optimal view. The images were randomly coded. An anesthesiologist blinded to the codes and assignments scored the images based on Cormack-Lehane scoring system.

2.3. Statistical Analysis

Limited and severely limited mouth openings were defined as inter-incisor distance less than 4 and 3 cm, respectively. An angle between full head flexion and full extension < 90° was defined as limited head extension. To analyze the effect of TMD on the efficacy of maneuvers, a cutoff point of 5 cm was considered. Data were presented as mean (standard deviation (SD)). The Cormack-Lehane score was compared with repeated measurements of ANOVA among the 3 dependent groups. P value less than 0.05 was considered statistically significant. The tests were 2-tailed. The statistical package for social science (SPSS) for windows, version 21.0 (Chicago, IL, USA), was used for data analysis.

3. Results

A total of 104 patients including 53 males and 51 females with the mean age of 34 ± 16 years were included. The mean BMI was $26 \pm 4 \text{ kg/m}^2$. Based on predefined criteria, limited head extension was observed in 34 patients and severely limited mouth opening in 7 cases; TMD ≤ 5 cm was reported in 21 patients.

Both maneuvers significantly improved glottis visualization, but the effect of BURP maneuver was more pronounced than that of jaw thrust. Gender-specific analyses yielded similar results. In subgroups of patients with either limited head extension or TMD < 5 cm the findings were similar (Table 1). Similarly, in patients with limited mouth opening, the BURP maneuver was more beneficial than that of jaw thrust and no-maneuver group showed the worst glottis visualization (Table 1).

4. Discussion

The current study findings suggested that both BURP and jaw thrust maneuvers resulted in better glottis visualization. Nevertheless, BURP may provide better conditions during laryngoscopy irrespective of airway parameters including limited mouth opening, TMD, and limitation in head extension. Thus, it should be attempted first.

The BURP maneuver introduced by Knill in 1993 improved glottis visualization during laryngoscopy. The jaw-thrust maneuver elevates the tongue and allows for lifting the epiglottis and enlargement of the laryngeal inlet and the pharynx, which enables the operator to visualize an increased glottic opening resulting in improved success rate of intubation. However, results based on the efficacy of these 2 maneuvers are conflicting. A previous study reported that cricoid pressure alone worsened view in 12.5% of cases, whereas BURP worsened laryngoscopic view in 30% of cases (12). Conversely, other studies reported a better laryngoscopic view with the BURP maneuver.

The application of VL in airway management increased in recent years (5). One advantage of VL is the low incidence of esophageal intubation (3). However, muscle tone reduction in upper laryngopharyngeal structures in general anesthesia results in posterior displacement of tongue, soft palate, and epiglottis causing obstruction during VL (7). Therefore, the application of external airway maneuvers may provide the operator better glottis visualization. Similar to the current study findings, earlier studies suggested that BURP maneuver may improve the view of laryngoscopy, while decreasing complications (9). Conversely, in a study comparing the modified BURP maneuver (a combination of BURP and Sellick maneuver) the view of vocal cord worsened (13). A few studies addressed the efficacy of jaw thrust to improve the glottis visualization (11, 14).

Several measures are suggested as predictors of difficult airway namely short TMD, limited mouth opening, and head extension (15-18). Expectedly, the current study patients with these predictors got higher Cormack-Lehane scores. However, cluster analyses suggested that the presence of such predictors may not influence the comparative efficacy of external airway maneuvers. In all subgroups of

Table 1. The Cormack-Lehane Scores With and Without Maneuvers in Subgroups of Patients^a

	No Maneuver	BURP	Jaw Thrust	P Value
Total (n = 104)	1.96 (0.84)	1.34 (0.57)	1.61 (0.77)	< 0.001
Male (n = 53)	1.96 (0.91)	1.37 (0.57)	1.7 (0.84)	< 0.001
Female (n = 51)	1.96 (0.77)	1.31 (0.50)	1.50 (0.70)	< 0.001
Limited head extension (n = 34)	2.58 (0.85)	1.67 (0.72)	2.05 (1.01)	< 0.001
Limited mouth opening (n = 48)	2.39 (0.89)	1.60 (0.67)	1.89 (0.95)	< 0.001
Severely limited mouth opening (n = 7)	2.42 (0.97)	1.14 (0.37)	1.28 (0.48)	0.006
TMD ≤ 5 cm (n = 21)	2.71 (0.78)	1.61 (0.66)	1.90 (1.04)	0.009

Abbreviation: Thyromental distance.

^aValues are expressed as mean (SD).

participants, the BURP showed superiority over jaw thrust maneuver. Authors believe that further large scale studies in the presumed subgroups of difficult intubation may elucidate the place of each maneuver more specifically.

An earlier study discussed age-related changes of the upper airway by 3-dimensional computed tomography (3D CT scan). The report suggested that upper airway parameters such as volume, surface area, length, and mean cross sectional area increased in concordance with aging (13). The study also suggested that BURP maneuver greatly improved the glottis view in females. In contrast, the current study findings showed slightly better glottis visualization in males.

The strength of this study was the self-controlled design that eliminated the chance of selection bias. Blinded evaluation of all glottis views by 1 anesthesiologist also eliminated the possibility of inter-observer variability. Macintosh blade was employed instead of blades with specific design such as D-Blade. This enabled safe generalization of findings to routine direct laryngoscopy.

Footnote

Conflict of Interest: Authors declared no conflict of interest.

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