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EXTERNAL LARYNGEAL PRESSURE BY LEFT LITTLE FINGER AS AN AID TO FACILITATE VISUALIZATION OF THE LARYNX DURING ENDOTRACHEAL INTUBATION IN CHILDREN

الضغط الخارجي على الحنجرة بواسطة خنصر اليد اليسرى كعامل مساعد في تسهيل مشاهدة الحنجرة أثناء التنبيب الرغامي عند الأطفال

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ملخص البحث

هدف البحث: يمكن الحصول على أفضل مشاهدة للحنجرة عبر إجراء مناورة تحريك خارجية من قبل طبيب التخدير لتحسين رؤية المزمار وتسهيل إجراء تنبيب الرغامي. تهدف هذه الدراسة إلى تقييم فعالية استخدام إصبع الخنصر الأيسر في تحسين رؤية الحنجرة أثناء التنبيب الرغامي عند الأطفال الصغار.

طرق البحث: أجريت الدراسة في مستشفى البصرة التعليمي خلال الفترة بين شباط 2013 وحتى تشرين الأول 2013، تم اختيار مجموعة من الأطفال دون سن الخامسة من الخاضعين لعمليات جراحية انتخابية تحت التخدير العام مع التنبيب الرغامي، واقتصرت الاختيار على الصنف الأول وفق تصنيف الجمعية الأمريكية لأطباء التخدير ASA-I. تم تقييم مشاهدة المزمار عبر تنظير الحنجرة المباشر. تم وضع كل حالة في مجموعتين: الأولى A يكون تحريك الحنجرة بواسطة مساعد المخدر بتطبيق ضغط خارجي وتوجيه الحنجرة، بينما يتم في المجموعة الثانية B تحريك الحنجرة بواسطة إصبع الخنصر لليد اليسرى لطبيب التخدير للحصول على أفضل مشاهدة للحنجرة، مع تحديد الوقت اللازم للحصول على أفضل مشاهدة في كلتا المجموعتين.

النتائج: من بين 320 طفلاً شملتهم الدراسة، لوحظ وجود درجات متغايرة من مشاهدة المزمار عند 75 مريضاً شملهم التحليل، حيث لوحظت الدرجة IIb عند 54 مريضاً، الدرجة III عند 19 مريضاً والدرجة IV عند مريضين. لوحظت الدرجة الأولى من المشاهدة عند 72 مريضاً في المجموعة B مقابل 54 مريضاً في المجموعة A ($p > 0.05$). كان الزمن اللازم للوصول للدرجة I من المشاهدة أقل وبشكل هام في المجموعة B مقارنةً بالمجموعة A ($p > 0.05$).

الاستنتاجات: تم في هذه الدراسة إجراء مناورة حركية على المزمار لتحسين وضع المشاهدة باستخدام الإصبع الصغير لليد اليسرى في الحالات صعبة المشاهدة من خلال تنظير الحنجرة التقليدي. ينصح باستخدام الإصبع الصغير في حالات صعوبة معاينة الحنجرة بغض النظر عن درجة رؤية الحنجرة وهو ما يجعل عملية التنبيب أكثر سهولة وأماناً.

ABSTRACT

Objective: The best laryngeal view can be obtained when external laryngeal manipulation is undertaken by the anesthesiologist to improve glottis visualization and enhance endotracheal intubation. This study aimed

to evaluate the effectiveness of using anesthesiologist own left little finger to optimize laryngeal view during endotracheal intubation in small children.

Methods: The study was conducted in Basra Teaching Hospital over a period from February 2013 to October 2013. Children below 5 years, ASA class I undergoing

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elective surgical procedures under general anaesthesia with endotracheal intubation were included in the study. The glottis view was assessed by direct laryngoscopy. The same patient was assigned into two groups; group A are those whose larynx is manipulated with the aid of an assistant using external pressure and direction on the larynx, while in group B, external laryngeal manipulation was undertaken by the anesthesiologist's left little finger to aid visualization of the larynx and the time to obtain the best view was recorded in both groups.

Results: *Out of 320 patients, seventy five patients who were included in the analysis have variable glottis view grading, a grade IIb was obtained in 54 cases, III in 19 cases, and grade IV in 2 cases. Grade I view was obtained in seventy two patients in group B vs 54 patients in group A ($p < 0.05$). The time spent to obtain grade I view was significantly less in group B than in group A ($p < 0.05$).*

Conclusions: *In this study, the glottis was manipulated to obtain an optimal view using the left little finger for patients in whom the epiglottis could not be visualized with standard laryngoscopy to improve the laryngoscopic view. Furthermore, the use of this technique routinely in every patient regardless of grade makes the technique more easy and familiar.*

INTRODUCTION

Airway control has a particular attention in anesthesia. It is important to preserve, secure and protect airway during induction, maintenance and recovery from anesthesia.¹ The most common method used to secure and maintain airway is endotracheal intubation. Ensuring safe and successful endotracheal intubation requires clear view of the glottis.² Cormack and Lehane³ in 1984, described a grading system for visualization of the larynx: Grade I indicates visualization of most or all of the glottis; Grade II indicates a partial view (the posterior aspect) of the glottis; Grade III indicates epiglottis only; and Grade IV indicates palate only/no epiglottis, (Figure 1). A modified version that subdivided Grade 2 was initially described in 1998,^{4,5} Grade I (full view of the vocal cords), Grade IIa (partial view of the vocal cords), Grade IIb (only

the arytenoids and epiglottis seen), Grade III (only epiglottis visible) and Grade IV (neither the epiglottis nor glottis seen). Difficult laryngoscopy corresponds to Grade IIb or more view⁶⁻⁸ and denotes a laryngoscopic view that is relatively common and is often associated with difficulty passing a tracheal tube.⁸ This may be predicted by airway assessment prior to anesthesia using Mallampati oropharyngeal Classification (Class 1 to 4), inter-incisor gap, range of head extension and mento-hyoid distance,⁹ however small children are not cooperative enough to allow preanesthesia assessment therefore it is difficult to evaluate the airway and predict difficulty with laryngoscopy. Glottic visualization can be improved by laryngeal manipulation which can be performed using three different maneuvers: External Laryngeal Manipulation (ELM), the Backward, Upward, Rightward Pressure (BURP) and cricoid pressure (Sellick) maneuver. In ELM,¹⁰ the anesthesiologist manipulates the thyroid cartilage using his right hand with pressure directed posteriorly and cephalad and when optimal visualization occurs an assistant assumes responsibility for maintaining laryngeal pressure while the anesthesiologist passes the tube into the trachea. With the BURP^{11,12} maneuver, an assistant manipulates the thyroid cartilage dorsally, 2 cm cephalad until mild resistance is met and 0.5-2 cm laterally to the right; during the manipulation, the anesthesiologist observes the optimal view and then passes the tube into the trachea. Sellick's¹³ maneuver utilizes backward pressure against the cricoid cartilage originally used to prevent gastric regurgitation during rapid sequence induction and also improves glottic visualization. In this study, ELM utilizes the anesthesiologist own left little finger which yielded satisfactory outcome.

METHODS

The study was conducted in Basra Teaching Hospital over a period from February 2013 to October 2013. Three hundred and twenty children below 5 years ASA class I undergoing elective surgical procedure under general anesthesia with endotracheal intubation were included in the study. Patients were fasted for 4 hours prior to anesthesia. Routine investigations carried out. In the operating room induction of anesthesia was performed according to anesthesiologist preference.



Figure 1. External laryngeal manipulation performed by an assistant.

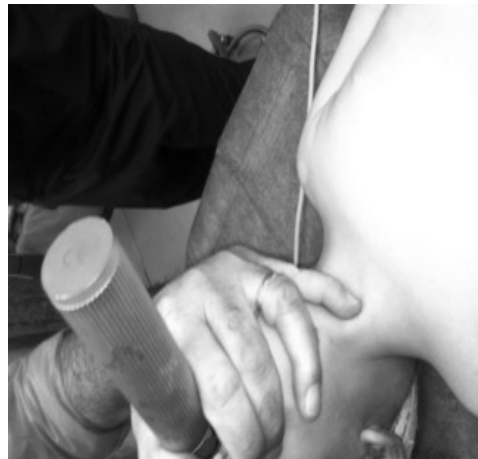


Figure 2. External laryngeal manipulation undertaken by the anesthesiologist utilizing left little finger.

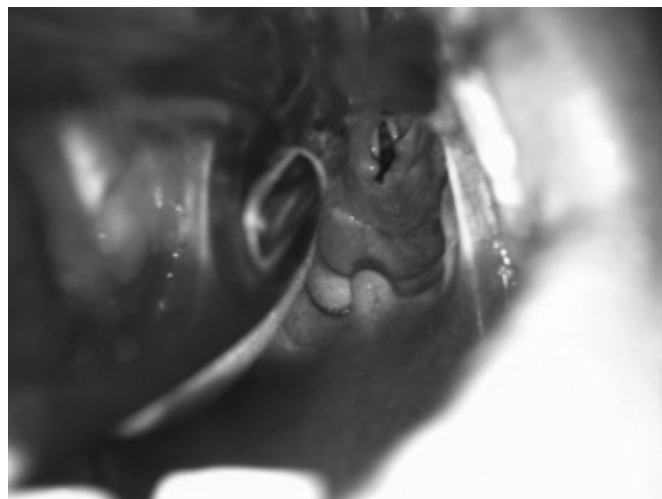


Figure 3. The best laryngeal view obtained by ELM.

Direct laryngoscopy was performed using Macintosh blade pediatric size. A baseline view of glottis was documented based on modified Cormack and Lehane grading. In patients with grade I or grade IIa view of glottis tracheal intubation was completed with no further manipulation of the airway and they were excluded from analysis. If the view of glottis was Grade IIb or more, external laryngeal manipulation was applied in two consecutives to obtain the best view: first by an assistant (group A) as shown in Figure 1. And following a period of mask ventilation, external laryngeal manipulation was undertaken by the anesthesiologist utilizing own left little finger (group B) as shown in Figure 2. The best view obtained (Figure 3) was documented and the time spent was recorded in both groups. The results are presented as Mean $\pm$ SD, number and percentage. Student-t test and X² test used for variables. Significance was considered at p-value <0.05.

RESULTS

Three hundred and twenty children ASA class I aged below 5 years requiring tracheal intubation for elective surgery were enrolled into the study. The demographic data of the patients are summarized in Table 1. In 210 patients (65.62 percent), a grade I while in 35 patients (10.93%) a grade IIa view at laryngoscopy was obtained and the trachea was intubated with no further manipulations. A grade IIb was obtained in 54 cases, III in 19 cases, and grade IV in 2 cases, so the total will be 75 patients who were included in this analysis (Table 2).

The best view (Grade I) was obtained in 48 patients

(64%) in group A and in 72 patients (97.3%) in group B (p=0.002) which is statistically significant. The mean time to good exposure was 15 $\pm$ 4 seconds in group A versus 6 $\pm$ 1 seconds in group B (p=0.007), this is also statistically significant. In group A the view was improved to grade IIa in 24 patients (32%) over 19 $\pm$ 3 second to grade IIb in 3 patients (4%) over 21 $\pm$ 6 seconds. The figures in group B were: grade IIa obtained in 2 patients (2.7%) with mean time 9 $\pm$ 2 sec, no patients remain with more than IIa. In all patients the trachea was intubated without additional adjuncts with no reported complications.

Patients	1-2y	2-3y	3-4y	4-5y	Total
10-12 kg	1	-	-	-	1
12-14 kg	6	-	2	-	8
14-16 kg	4	10	2	6	22
16-18 kg	-	12	12	2	26
18-20 kg	-	10	5	3	18
Total	11	32	21	11	75

Table 1. Demographic data of patients included in the study.

DISCUSSION

Pediatric airway is grossly different from adults. They have proportionately large head, the larynx is situated more cephalad, the tongue occupies a proportionately large part of oral cavity, epiglottis is large, floppy and difficult to lift using conventional laryngoscopic technique.^{1,2,15-18} The main concern during tracheal intubation in children is to use age-

Grade	Baseline		Group A			Group B		
	No.	%	No.	%	Mean time	No.	%	Mean time
I	210	65.6%	48	64%	15 $\pm$ 4 sec.	72	97.3%	6 $\pm$ 1sec.
IIa	35	10.9%	24	32%	19 $\pm$ 3 sec.	3	2.7%	9 $\pm$ 2 sec.
IIb	54	16.8%	3	4%	21 $\pm$ 6 sec.	0	0	0
III	19	6%	0	0	0	0	0	0
IV	2	0.7 %	0	0	0	0	0	0
Total	320	100%	75	100%		75	100%	

Table 2. Laryngeal view grading in relation to time.

appropriate equipment and position for laryngoscopy in order to obtain good view of the glottis and perform safe and successful intubation.¹⁴ Glottis visualization can be optimized by laryngeal manipulation which can be performed using three different maneuvers: External Laryngeal Manipulation (ELM), the Backward, Upward, Rightward Pressure (BURP) and cricoid pressure (Sellick) maneuver.

Cricoid pressure and BURP are commonly used for airway management but several studies have showed that cricoid pressure or BURP might worsen laryngeal visualization,¹⁹⁻²¹ ELM is designed to improve laryngeal view with the cooperation between the anesthesiologist and the assistant during direct laryngoscopy.²²⁻²⁵ External laryngeal manipulation can be carried out in two ways either conventional bimanual laryngoscopy or modified bimanual laryngoscopy. In the conventional method, the anesthesiologist manipulates the larynx under direct vision, and an assistant holds the best position until the tracheal tube is passed, while in modified bimanual laryngoscopy, the anesthesiologist guides the assistant's hand to achieve the best laryngeal view and ask to keep the same force and direction.

Levitan et al²⁶ showed that bimanual laryngoscopy improves laryngeal view compared with cricoid pressure or BURP. Jinyoung Hwang et al²⁶ found that the modified bimanual laryngoscopy is more effective in obtaining the optimal laryngeal view on the first attempt compared with the conventional bimanual laryngoscopy. Some studies on the ELM in adults have described varying degrees of effectiveness in improving laryngeal view, they observe that the best laryngeal view is obtained when the manipulation is undertaken by the anaesthesiologist but when the assistant completed the maneuver the view often deteriorates, this will prolong the process of intubation placing the patient at risk of hypoxia and repeated attempts of manipulation resulting in laryngeal trauma as it would be difficult to achieve the same position, direction, or force as those of the anesthesiologist's manipulation. Prabhakar H. et al²⁹ studied the role reversal during external laryngeal manipulation for tracheal intubation, an alternate approach whereby the anesthesiologist maintains the external laryngeal manipulation at the same time as

performing the laryngoscopy and the assistant passes the endotracheal tube under direction. This technique carries risk of tube malposition, it is impractical, can be used for training purposes and it is not reliable in small children.

In this study, a hypothesis utilized that external laryngeal manipulation using the anesthesiologist left hand little finger can improve glottis view and facilitate intubation in children with minimum time as the larynx in a child is fairly mobile and can be moved with external laryngeal manipulation to improve the laryngoscopic view. In addition, a shorter thyromental space provides a sufficient space to use the little finger at the same time with laryngoscopy. This greatly improved the grade of Cormack and Lehane view. These improvements facilitates greater exposure of the larynx, results in a successful intubation conditions, and causes no trauma. No study has been done so far utilizing this maneuver in pediatric patients.

The best glottis view (Grade I) was obtained in 48 patients (64%) with mean time to good exposure 11±4 seconds in group A. While in group B the best view was obtained in 72 patients (96%) over mean time of 6±1 seconds. These differences in exposure and mean time were statistically significant. The great difference in view and time was explained by the fact that the best laryngeal view is obtained when the manipulation is undertaken by the anaesthesiologist.¹⁷⁻²¹ While an assistant required more time to achieve best view due to misorientation of the assistant to the laryngeal field even when the maneuver was initiated by the anesthesiologist the view often deteriorates resulting in prolonged time for obtaining best view and required repeated attempts of manipulation as it would be difficult to achieve the same position, direction, or force as those of the anesthesiologist's manipulation. The maneuver used in this study was considered easy, safe, time saving and practicable, this technique have been taught to anesthesiologist residents to be familiar with its application.

CONCLUSIONS

In this study, the glottis was manipulated to obtain

an optimal view using the left little finger for patients in whom the epiglottis could not be visualized with standard laryngoscopy to improve the laryngoscopic view. Furthermore, the use of this technique routinely in every patient regardless of grade makes the technique more easy and familiar.

RECOMMENDATIONS

Every anesthesiologist have to utilize the little finger to manipulate the larynx regardless of the initial view as this will help proper alignment of the larynx and results in successful intubation in children.

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