Cricoid pressure with the Truview Evo2™ laryngoscope improves the glottic view

La pression cricoïdienne avec le laryngoscope Truview Evo2™ améliore la visualisation glottique

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Abstract

Objective The Truview Evo2™ laryngoscope blade is designed to improve glottic view. This study was designed to evaluate the effect of cricoid pressure (CP) on laryngeal view and the ease of orotracheal intubation with the Truview Evo2 laryngoscope.

Methods In this randomized controlled trial, 50 patients (American Society of Anesthesiologists physical status I–II, aged 18 to 60 yr) scheduled for elective surgery were enrolled. After induction of anesthesia and muscle paralysis, laryngoscopy was performed using the Truview Evo2™ laryngoscope with the patient's head in the neutral position. In Group 1, the percentage of glottic opening (POGO) score was evaluated first without CP, then with CP, and CP was applied for intubation. In Group 2, the POGO score was evaluated first with CP, then without CP, and no CP was applied for intubation. Time to intubation and number of attempts required for intubation were also recorded.

Results In 50 patients, the mean (standard deviation) POGO view obtained with the application of CP was 93% (10%) compared with 81% (19%) in patients without CP ($P < 0.01$). Times to intubation were similar in the two groups: 14.2 (6.6) sec vs 14.0 (9.3) sec in Groups 1 and 2, respectively ($P = 0.924$). Sixteen percent of patients in Group 1 required a second attempt at tracheal intubation,

while only 4% of patients in Group 2 required a second attempt ($P = 0.162$).

Conclusion When using the Truview Evo2™ laryngoscope with the patient's head in the neutral position, application of CP improves the glottic view. This approach is not associated with increased difficulty in intubation.

Résumé

Objectif La lame du laryngoscope Truview Evo2™ est conçue de façon à améliorer la visualisation glottique. Cette étude a été mise au point afin d'évaluer l'effet de la pression cricoïdienne (PC) sur la visualisation laryngée et la facilité d'intubation orotrachéale avec le laryngoscope Truview Evo2.

Méthode Dans cette étude randomisée contrôlée, 50 patients (statut physique de l'American Society of Anesthesiologists (ASA) I–II, âgés de 18 à 60 ans) devant subir une chirurgie non urgente ont été recrutés. Après l'induction de l'anesthésie et la curarisation, une laryngoscopie a été réalisée à l'aide du laryngoscope Truview Evo2™, la tête du patient en position neutre. Dans le groupe 1, le score de pourcentage d'ouverture glottique (POG) a d'abord été évalué sans PC, puis avec PC, et une PC a été appliquée lors de l'intubation. Dans le groupe 2, le score POG a d'abord été évalué avec PC, puis sans PC, et aucune PC n'a été appliquée pendant l'intubation. Le temps jusqu'à intubation et le nombre de tentatives nécessaires pour réaliser l'intubation ont également été notés.

Résultats Chez 50 patients, la visualisation moyenne (écart type) de la POG obtenue lors de l'application d'une PC était de 93 % (10 %) par rapport à 81 % (19 %) chez les patients sans PC ($P < 0,01$). Les temps jusqu'à intubation étaient comparables dans les deux groupes : 14,2 (6,6) s vs 14,0 (9,3) s dans les groupes 1 et 2,

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respectivement ($P = 0,924$). Seize pour cent des patients du groupe 1 ont nécessité une deuxième tentative pour l'intubation trachéale, alors que seulement 4 % des patients du groupe 2 ont nécessité une deuxième tentative ($P = 0,162$).

Conclusion Lors de l'utilisation du laryngoscope Truview Evo2™ avec la tête du patient en position neutre, l'application d'une PC améliore la visualisation glottique. Cette approche n'est pas associée à une augmentation de la difficulté d'intubation.

In 1774, Dr. Munro first reported the application of backward pressure on the neck to prevent gastric distension and regurgitation of gastric contents,¹ and 187 years later, Brian Sellick described the approach again.² This technique has become the cornerstone of rapid sequence induction of anesthesia. Although the efficacy and hence the necessity of this maneuver has been questioned,^{3,4} its use continues to be recommended by airway guideline developers. In a recent editorial, Dr. Lerman points out that “currently, there is insufficient evidence to advocate or abandon the use of cricoid pressure to prevent passive regurgitation in at-risk anesthetized patients.”⁵ One major reason in favour of abandoning use of cricoid pressure is the claim that the technique makes tracheal intubation and mask ventilation either difficult or impossible. There is also conflicting evidence regarding the effect of cricoid pressure (CP) on the laryngoscopic view with the conventional Macintosh laryngoscope.^{6–10}

The Truview Evo2™ blade (Truphatek Holdings Ltd, Netanya, Israel) enables an indirect view of the vocal cords and may improve glottic visualization compared with the conventional Macintosh laryngoscope.^{11,12} The Truview Evo2 blade, based on a combination of an optical system with a steel blade, provides a 42° angled view (refracted) through a 15-mm eyepiece. In addition, it has a port which connects to the auxiliary oxygen flow of the anesthesia machine. At a flow rate of 4–6 L·min⁻¹ it prevents misting, clears secretions from the lens, and provides continuous oxygen insufflation during laryngoscopy and intubation.¹¹ The improved laryngeal view might make the Truview Evo2™ laryngoscope suitable for rapid sequence induction provided that this important advantage is not lost with the application of CP. Thus, the present study was designed to study the effect of CP on the laryngoscopic view and to ascertain the ease of orotracheal intubation with the aid of the Truview Evo2™ laryngoscope.

Methods

After Institutional Review Board approval from Maulana Azad Medical College and Lok Nayak Hospital, New Delhi, this randomized controlled trial was conducted with

50 adult patients (American Society of Anesthesiologists (ASA) grade I–II, aged 18–60 yr) who were admitted to Lok Nayak Hospital from November 2009 to February 2010. All patients were scheduled for elective surgery requiring general anesthesia with endotracheal intubation. A written informed consent was obtained from all patients. Exclusion criteria included patients with mouth opening < three finger breadths, body mass index > 30 kg·m⁻² missing or loose teeth, ASA physical status > II, facial trauma, at risk of aspiration, and/or pregnancy. Randomization was performed in a single block in a 1:1 ratio according to a computer-generated list using SPSS Statistics 17.0 (IBM, NY, USA). The randomization sequence was concealed using sealed, opaque, sequentially numbered envelopes, provided to the operator in each case by an anesthesiology resident. Orotracheal intubation was performed in Group 1 with CP and in Group 2 without CP.

Preoperative airway evaluation was performed by anesthesiologists unaware of the patient's group allocation. All patients fasted as per the ASA guidelines (clear liquids - two hours and light meal - six hours) and received oral diazepam 10 mg the night before surgery. Electrocardiographic, noninvasive blood pressure, and pulse oximetry (SpO₂) monitors were attached; peripheral venous access was secured, and baseline pulse rate, systolic and diastolic blood pressures, and SpO₂ were recorded. Anesthesia was induced with fentanyl 2 µg·kg⁻¹ iv and propofol 2 mg·kg⁻¹ iv and was maintained with 66% nitrous oxide and 2% sevoflurane in oxygen. Neuromuscular blockade was provided with vecuronium bromide 0.1 mg·kg⁻¹ iv. The patient's lungs were ventilated with bag and mask using a closed circuit for three minutes followed by laryngoscopy and tracheal intubation with the patient's head in the neutral position (no extension at the atlanto-occipital joint).

Laryngoscopy and tracheal intubation were performed by an anesthesiologist who was unaware of the group allocation. In Group 1, the Truview Evo2 laryngoscope was inserted in the midline and the percentage of glottic opening (POGO) score^{13,14} was assessed without the application of CP, as viewed by an independent blinded observer on a video monitor away from the patient. The POGO score is considered to be 100% if the entire glottis is visualized from the anterior commissure to the posterior cartilages, and the POGO score is 0% if none of the glottic opening is seen. Partial visualization of the glottis is thus given a subjective score between 0 and 100%. Cricoid pressure of 40 N (approximately 4 kg) was then applied (using the single-hand technique with the thumb and first two fingers of the dominant hand) by an anesthesiology resident with his back towards the video monitor. The residents were trained in applying a 40 N force using an infant weighing scale. The POGO score was evaluated again and the pressure was maintained until the patient's

trachea was intubated. The endotracheal tube (ETT) had an internal diameter 7.0–7.5 mm for females and 8.0–8.5 mm for males, and correct placement of the tube was confirmed by the expired CO₂.

In Group 2, the Truview Evo2 laryngoscope was inserted in the midline, and the POGO score was assessed with the CP applied as above. Cricoid pressure was then released; the POGO score was noted again, and the patient's trachea was intubated without the application of CP. Thus, the POGO score was noted twice in each patient in both groups and each patient served as his/her own control. The time to intubate (picking up the ETT to removal of the laryngoscope from the mouth) and the number of attempts (withdrawing the ETT to the angle of the mouth and reinserting it) required to intubate were recorded in both groups by an independent observer. The stylet provided with the laryngoscope was used in all cases. In order to blind the laryngoscopist, a screen separated the laryngoscopist and the resident applying CP, and the hand position for the CP was maintained throughout the intubation procedure in both groups, even when CP was not applied or released. The independent observer signalled to the resident applying CP once the first POGO score had been recorded so that the CP could either be applied or released for the second reading and tracheal intubation. Any trauma or a decrease in SpO₂ to < 95% during laryngoscopy was recorded and managed with mask ventilation with 100% O₂.

The airway characteristics of the patients, as assessed preoperatively, were not revealed to the laryngoscopist. The observer who recorded the POGO score, time to intubation, and number of attempts required was also blinded to the application of CP.

Statistical analysis

The primary endpoint of the study was the POGO score with and without application of CP. We assumed that application of CP would produce a difference of at least 25% in the POGO score. The number of patients required in each group was determined using data obtained from a pilot study with a mean standard deviation (SD) POGO score of 78.5% (21.5) with CP and 88% (13.9) without CP. This indicated that 42 patients would be sufficient to achieve a power of 0.9 with $\alpha = 0.05$. To allow for drop-outs we thus recruited 50 patients in total (25 in each group). Data are presented as mean (SD) or median and range.

A commercial software package, SPSS Statistics 17.0, was used for the analysis. Paired Student's *t* tests was applied to compare POGO scores with and without the application of CP. The two-sample (unpaired) Student's *t* test was used to compare time taken to intubate.

The number of attempts required to intubate were compared using the Mann-Whitney U test. A *P* value of < 0.05 was considered to indicate statistical significance.

Results

Sixty-two patients were screened, 52 patients met eligibility criteria, two patients refused to participate in the study. Fifty patients entered the trial and the patient characteristics are summarized in Table 1. In 50 patients, the mean POGO view obtained with the application of CP was 93% (10%) compared with 81% (19%) without CP (*P* < 0.001). Mean time to intubation in Group 1 (with CP) [14.2 (6.6) sec] was comparable to that observed in Group 2 (without CP) [14.0 (9.3) sec] (*P* = 0.924). In Group 1, 16% of patients required a second attempt at tracheal intubation compared with only 4% in Group 2 (*P* = 0.162) (Table 2). We did not observe any trauma or a decrease in oxygen saturation to < 95% during laryngoscopy.

Discussion

This study shows that application of CP with the Truview Evo2TM laryngoscope improves the laryngeal view without increasing difficulty with intubation. With the advent of new technology, various aids are now available to improve the view of the larynx provided traditionally with the Macintosh laryngoscope. The indirect or videolaryngoscopes are the most notable of these aids. Recent reports evaluating these new devices present a somewhat mixed

Table 1 Patient characteristics

	Group	
	Group 1 Intubation with CP (<i>n</i> = 25)	Group 2 Intubation without CP (<i>n</i> = 25)
Age (yr)	30.1 (8.2)	28.7 (7.4)
Weight (kg)	56.8 (7.7)	57.2 (9.4)
Sex		
F	19 (76%)	19 (76%)
M	6 (24%)	6 (24%)
MMT		
1	17 (68%)	17 (68%)
2	8 (32%)	6 (24%)
3	0	2 (8%)
TMD > 6.0 cm	25 (100%)	25 (100%)

CP = cricoid pressure; MMT = modified Mallampati test; TMD = thyromental distance

Data are shown as means (standard deviation) or numbers (%)

Table 2 Laryngeal view and intubation data

		Group 1 Intubation with CP(<i>n</i> = 25)	Group 2 Intubation without CP(<i>n</i> = 25)	<i>P</i> value
Time to intubate(sec)	(<i>n</i> = 25)	14.2 (6.6)	14.0 (9.3)	0.924
Number of attempts(<i>n</i> = 25)	1	21 (84%)	24 (96%)	0.162
	2	4 (16%)	1 (4%)	

CP = cricoid pressure; POGO = percentage of glottic opening. Data are shown as means (standard deviation) or numbers (%)

picture. While CP deteriorates the view with the use of the Wu™ scope (head in neutral position),¹⁰ it has no effect on the view with the Airtraq® or Bullard™ laryngoscopes.^{15,16} These equivocal results prompted us to undertake this evaluation.

A recent crossover study by Turgeon *et al.* evaluated the incidence of failed intubation with a CP of 30 N. They found no difference whether it was applied or not, and they recommended that it should not be avoided for fear of increasing the difficulty of intubation when its use is indicated.¹⁷ The Truview Evo2 laryngoscope has a marginal edge over the other indirect laryngoscopes since it improves the glottic view with the application of CP.

Compared with the standard Macintosh blade, the Truview Evo2 laryngoscope has consistently been shown to provide a better view of the glottis, and it is used with the patient's head in the neutral position. Using magnetic resonance imaging, Adnet *et al.* showed that the angle between the laryngeal axis and the line of vision was 42° (12°) in the neutral position.¹⁸ The Truview Evo2 requires less force to provide the 42° angled deflection of the glottic view than the standard Macintosh blade would require to provide a better glottic view.¹⁹ This might account for the improvement in the view we obtained with the application of CP. The external force, CP in this case, is countered with little or no upward and outward opposite force exerted at the tip of the blade, resulting in downward movement of the glottis and improvement of the view. The continuous oxygen insufflation also helps to prevent oxygen desaturation during laryngoscopy and intubation, making it useful during rapid sequence intubation.

While a second attempt at intubation with CP was required in 16% of the patients, compared with 4% without CP, this difference was not statistically significant. This difference could be due either to improper application of CP or to laryngeal inlet distortion.

We did not use the Cormack and Lehane classification as it is an insensitive measure of laryngeal view; different views fall within the same grade and there is poor inter-user reliability. We used a more discriminating measure of laryngeal view, i.e., the POGO score.^{13,14} The POGO score is a useful research tool for quantifying laryngeal exposure. This research methodology can be used to assess exposure

with different blades, the effect of laryngeal manipulation, and other aspects of direct laryngoscopy.²⁰

The main limitation of our study was the inability to ensure blinding. The anesthesiologist could not be blinded to the application of CP as the movement of the glottis would have been visible on the monitor. We tried to overcome this issue by maintaining the position for CP even when pressure was not being applied and by having an independent observer record the observed variables. The data analyst was also blinded to the group allocation. Another limitation was lack of a strain gauge to measure the force required for laryngoscopy and CP.

In conclusion, the application of 40 N CP with the Truview Evo2 laryngoscope improves the laryngeal view, and it is not associated with increased difficulty in intubation.

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Conflicts of interest None declared.

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