

The "BURP" maneuver worsens the glottic view when applied in combination with cricoid pressure

[La manœuvre PAHD, combinée à la compression cricoïdienne, dégrade la visualisation de la glotte]

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Purpose: The purpose of this study was to determine if the application of a BURP maneuver to the cricoid cartilage would combine the benefits of both the BURP and the Sellick maneuvers, resulting in an improved glottic view and offer the potential of protection against passive gastric regurgitation.

Methods: This was a double-blind, prospective, randomized, crossover trial. Forty-three patients scheduled for elective surgery participated in this study. General anesthesia was induced using fentanyl, propofol and rocuronium. In a random sequence for each case and blinded to the laryngoscopist, one of three maneuvers was carried out. Direct vertical pressure, using 30 newtons, a BURP maneuver with cricoid pressure, or no pressure was applied to the cricoid and the laryngoscopic view was ascertained. A separate laryngoscopy was conducted for each maneuver and the views were graded as good (part of the glottis seen), poor (only the arytenoids were seen) or no view (only the epiglottis was seen). Endotracheal intubation was then performed in each case.

Results: The results showed that the combination of the BURP maneuver and cricoid pressure worsened the view obtained at laryngoscopy in 30% of cases ($P = 0.007$). Cricoid pressure alone worsened the view in 12.5% of cases ($P = 0.279$). No difference was seen in 65% of cases. All patients but one were intubated easily.

Conclusion: There is no benefit to routinely applying a modified "BURP" maneuver to the cricoid cartilage during rapid sequence induction of anesthesia.

Objectif : Déterminer si l'application de la manœuvre PAHD (pression vers l'arrière, vers le haut et vers la droite) du cartilage cricoïde va combiner ses effets à ceux de la manœuvre de Sellick, améliorant la visibilité de la glotte et offrant la possibilité d'une protection contre les régurgitations gastriques passives.

Méthode : Notre étude à double insu était prospective, randomisée et croisée. Quarante-trois patients de chirurgie réglée y ont participé. L'anesthésie générale a été induite avec du fentanyl, du propofol et du rocuronium. Une des trois manœuvres utilisées selon une séquence aléatoire pour chaque cas a été réalisée à l'insu de la personne qui faisait la laryngoscopie. Une pression verticale directe a été appliquée, utilisant 30 newtons, ou une manœuvre PAHD avec compression cricoïdienne ou aucune pression sur le cricoïde, et la vue laryngoscopique a été vérifiée. Une laryngoscopie séparée a été faite pour chaque manœuvre et les vues classées comme bonne (une partie de la glotte est visible), pauvre (seuls les aryténoïdes sont visibles) ou nulle (seulement l'épiglotte est visible). L'intubation endotrachéale a été réalisée ensuite dans chaque cas.

Résultats : La combinaison de la manœuvre PAHD et de la compression cricoïdienne dégradait la vue à la laryngoscopie dans 30 % des cas ($P = 0,007$). La compression cricoïdienne seule détériorait la vue dans 12,5 % des cas ($P = 0,279$). Aucune différence n'a été notée dans 65 % des cas. Tous les patients, sauf un, ont été facilement intubés.

Conclusion : Il n'y a pas d'avantage à appliquer régulièrement une manœuvre PAHD modifiée sur le cartilage cricoïde pendant l'induction de l'anesthésie à séquence rapide.

SELICK'S maneuver¹ was first described in 1961 and shortly thereafter became a standard of care during rapid sequence induction (RSI) of anesthesia. Sellick originally suggested that the cervical spine should be extended instead of flexed and that cricoid pressure should be applied at the level of C5, the idea being to stretch and prevent lateral dis-

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placement of the esophagus. It soon became evident that the application of cricoid pressure in the presence of neck extension frequently impeded the laryngoscopist's view of the larynx during attempts at intubation. Soon thereafter the "sniffing position"² was adopted as the standard during cricoid pressure. Despite this change, the primary concern with Sellick's maneuver was that it sometimes distorted the glottic view during attempts at endotracheal intubation and delayed the process at a time that patients were most vulnerable to the risks of aspiration and hypoxia.³

The 'BURP' maneuver⁴ (consisting of backward, upward and right-sided pressure on the thyroid and cricoid cartilages) was introduced by Knill in 1993, to improve the glottic view during endotracheal intubation. The efficacy of the 'BURP' maneuver was validated by Takahata⁵ who demonstrated significant improvement of the glottic view during attempts at endotracheal intubation in 630 cases.

We hypothesized that the application of a 'BURP' maneuver to the lower portion of the thyroid and cricoid cartilage, in combination with Sellick's maneuver, would enhance the glottic view in cases requiring RSI of anesthesia.

Methods

Following Ethics approval and written informed consent, 43 patients scheduled for procedures requiring endotracheal intubation, in a community hospital setting, were recruited for this prospective, randomized, double-blind, crossover trial. Patients aged 18 yr and older with an ASA physical status I-III were considered eligible for the study. The following patients were excluded from the study: those in whom endotracheal intubation was considered to be potentially difficult, those who were considered to be at risk for gastric regurgitation and those in whom propofol, fentanyl and rocuronium were contraindicated.

One experienced anesthesiologist (D.S.) performed all laryngoscopies and one trained assistant (D.C.) performed all airway maneuvers during the study. The cricoid cartilage was identified and verified by both the assistant and anesthesiologist and marked with a marking pencil. A small weighing scale was used before each case to estimate 30 newtons of force (3.2 kg). The assistant then randomly determined the sequence of the maneuvers to be performed, using a shuffled set of marked cards. Three maneuvers were performed: cricoid pressure, a modified 'BURP' maneuver or a sham maneuver (no maneuver). Following is a brief description of the 'modified BURP maneuver': the patient lies supine with the neck flexed on a pillow, with the head extended at the atlanto-occipital joint (sniffing

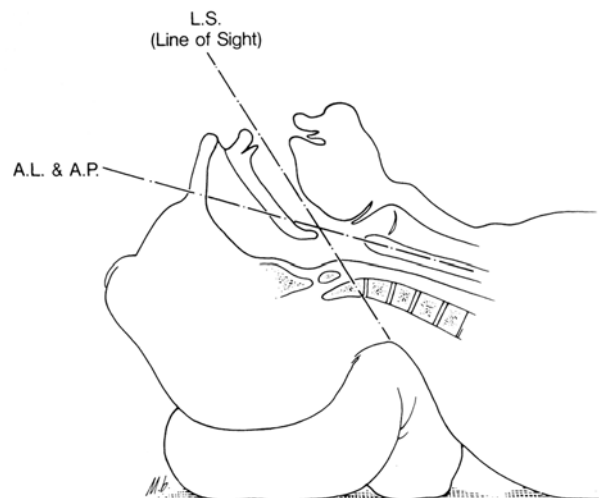


FIGURE 1 The "sniffing position" is achieved by flexing the neck and extending the atlanto-occipital joint.



FIGURE 2 The modified BURP maneuver is performed by placing the thumb and middle finger on the cricoid cartilage and the index finger is placed on the left hand side of the lower portion of the cricoid cartilage (patient's). Then pressure is applied to both of these structures downwards, superiorly and to the right hand side (patient's).

position, Figure 1). The thumb and middle finger are applied to the cricoid cartilage and the index finger is applied to the left hand side of the thyroid cartilage (patient's). Then pressure is applied to both of these structures, downwards, superiorly and to the right hand

TABLE I The quality of glottic views with each manipulation

	Good view (1)	Poor view (2)	No view (3)
Control	32 (80%) M 9/15 F 22/25	4 (10%) M 3/15 F 1/25	4 (10%) M 3/15 F 1/25
Cricoid	28 (70%)	8 (20%)	4 (10%)
Pressure	M 8/15 F 20/25	M 4/15 F 4/25	M 3/15 F 1/25
Modified 'BURP'	21 (52.5%) M 7/15 F 14/25	14 (35%) M 4/15 F 10/25	5 (12.5%) M 4/15 F 1/25

Comparison of the quality of glottic views obtained in 40 patients with each maneuver using numbers and percentages. M = males; F = females. Differences were not statistically significant.

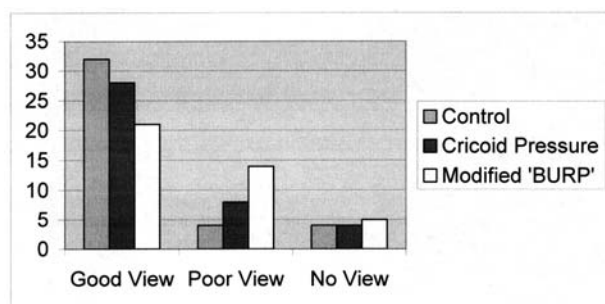


FIGURE 3 Laryngoscopic view with each manipulation. A comparison of the numerical value of the views obtained with each maneuver. Differences were not statistically significant.

side (Figure 2). This maneuver was intended to be a combination of both Sellick's and the BURP maneuvers. Each patient had all three maneuvers performed in random order, determined by the card selection.

Following preoperative assessment, *iv* access was established and the appropriate monitors attached. Patients were pre-oxygenated and anesthesia was induced using fentanyl 2 to 3 $\mu\text{g}\cdot\text{kg}^{-1}$, propofol 1 to 3 $\text{mg}\cdot\text{kg}^{-1}$, and rocuronium 0.4 to 0.6 $\text{mg}\cdot\text{kg}^{-1}$ and were ventilated using 100% oxygen and sevoflurane, in increasing concentrations. Neuromuscular function was monitored using the train-of-four method. The patient was optimally positioned for endotracheal intubation (sniffing position). Mask ventilation was performed for approximately three minutes. When the patient was deemed to be adequately anesthetized and paralyzed (train of four) the three maneuvers were performed in the appropriate sequence, and following the final maneuver endotracheal intubation was performed using a #3 or 4 Macintosh blade. The laryngoscopist's view of the neck region was hidden by a drape to prevent him from seeing which maneuver was

being applied by the assistant. The laryngoscopist viewed the glottis during each maneuver and assigned a score on a scale from 1 to 3. A score of 1 was assigned if any part of the glottic opening was seen. A score of 2 was assigned if only the arytenoids were seen and a score of 3 was assigned if only the epiglottis was seen. The laryngoscopist partially withdrew the laryngoscope after each airway maneuver whilst the assistant was preparing to perform the next maneuver. The laryngoscopic views were recorded and blinding was maintained until the study was completed.

Results

Forty-three patients were recruited into the study. The first three patients were excluded from analysis because they were utilized in the study to iron out practical difficulties in the execution of the study and to test the logistics of doing the study in the manner in which it was designed. Data were analyzed for the remaining 40 patients.

There were no episodes of significant desaturation (< 93%), regurgitation or dental damage during the laryngoscopies and manipulations. Intubation was successful in all cases regardless of the maneuver applied. The esophagus was intubated in one case. This was immediately recognized and corrected without sequelae. In this patient, the glottis was not seen with any of the three maneuvers and was not seen when the 'BURP' maneuver was applied to the thyroid cartilage. There were no cases of regurgitation, aspiration or bronchospasm.

There was a predominance of females in the study (25:15). Ages ranged from 22 to 87 yr with a mean age of 47.6 yr. Complete details of the comparison of the views obtained with each maneuver are listed in Table I and Figure 3.

When one compares the changes in glottic view with manipulation (Table II and Figure 4), the modified 'BURP' worsened the view in 30% of patients in comparison with control ($P = 0.007$). Cricoid pressure worsened the view in 12.5% of patients ($P = \text{ns}$ vs control).

The majority (75%) of the worsened views caused by the modified 'BURP' maneuver occurred in females.

Statistical analysis

A power analysis was performed to determine the number of patients needed for the study. Data from Takahata's paper⁵ were used in which laryngeal views were scored. A score of 1 = full view of the larynx, 2 = posterior commissure only, 3 = arytenoids only, 4 = epiglottis only and 5 = no view. With a standard deviation of 0.78 and a mean of 1.6 from these data we

TABLE II Changes in glottic view with manipulation

	No change	Improved view	Worsened view
Cricoid	34 (85%)	1 (2.5%)	5 (12.5%)
Pressure	M 12/15 F 22/25	M 1/15 F 0/25	M 2/15 F 3/25
Modified	26 (65%)	2 (5%)	12 (30%)*
Pressure	M 10/15 F 16/25	M 2/15 F 0/25	M 3/15 F 9/25

Changes in glottic view with manipulation in comparison to control group. * $P = 0.007$; M = male; F = female; total number of patients = 40.

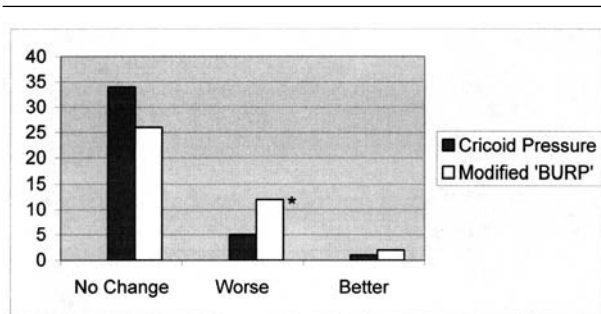


FIGURE 4 Changes in glottic view with airway manipulation. A side-by-side comparison of the changes in glottic view vs control with each maneuver. $P = 0.007$.

determined that we needed to study 38 patients. When the study was complete the laryngoscopic grades were collapsed into three groups. Seeing that it was clear that the hypothesis would be rejected we were comfortable that this would not weaken our results and would make data analysis easier.

Any maneuver that made the glottic view better or worse would be considered clinically significant. A P value of 0.05 or less would confirm that differences were statistically significant and did not occur by chance alone. The Friedman test was used to test whether the results from the three different maneuvers came from the same population. The mean ranks for the control, cricoid and modified groups were 1.83, 1.95 and 2.22 respectively. A P value of 0.002 indicated that a statistical difference occurred somewhere among the three groups.

The actual difference was tested for using the Wilcoxon signed rank test. This test looks at one pair of variables at a time and assesses whether or not those two variables have the same distribution. The test takes into account information about the magnitude

of differences between pairs and gives more weight to pairs that show large differences than those that show small differences. Comparing the modified "BURP" maneuver to the control group showed a P value of 0.007, at making the view worse. When comparing the cricoid to the control group the P value was 0.279. Finally, upon comparing the modified "BURP" group with the cricoid groups, a P value of 0.11 was obtained.

Discussion

The motivation for performing this study came from concerns about distortion of the glottic view during RSI of anesthesia using cricoid pressure. The "BURP" maneuver, popularized by Knill⁴ in 1993, has been shown to improve the glottic view in a significant number of cases. Salem *et al.*⁶ demonstrated that cephalad displacement of the larynx greatly improved the view at laryngoscopy when the initial view was poor and suggested that cephalad displacement should be used routinely in combination with cricoid pressure during RSI of anesthesia. We hypothesized that by combining the BURP maneuver with cricoid pressure we would prevent regurgitation and improve the view of the larynx during RSI of anesthesia.

The modified "BURP" maneuver not only failed to enhance the glottic view during RSI but actually worsened it in 30% of cases and this may represent what sometimes occurs when cricoid pressure is improperly applied. The majority of worsened views occurred in females. This observation may be explained on the basis that females had better views in the first place. Using patients as their own control we also demonstrated that cricoid pressure worsened the view in 12.5% of cases. Although not statistically different from control, any distortion of the glottic view during RSI has clinical significance. We reported an unusually high percentage of "poor views" and "no views" in the control group in this study, yet all patients were intubated relatively easily. The most likely explanation for this aberration is that the laryngoscopist was subconsciously less vigorous in his approach to laryngoscopy, knowing that he would be performing this maneuver three times on each patient.

The scientific basis for Sellick's maneuver is weak at best and is based on studies of saline regurgitation in cadavers and a small study in obstetric patients undergoing general anesthesia using a face mask.¹ This maneuver was introduced in 1961 when there was great concern about the number of maternal deaths from anesthesia related aspiration.⁷ The onus was upon the profession to do something about this problem and Sellick's approach seemed very reasonable

and practical at the time. Even though the maneuver does not stand up to scientific scrutiny today, it is very unlikely that we will ever abandon its use because it makes intuitive sense.

In most of Canada the circulating nurse assists the anesthesiologist during RSI of anesthesia. Few nurses or anesthesiologists' assistants (as in Quebec) have had formal training in this skill and even when they do, there is evidence to show that they quickly lose this skill.⁸ A recent study from the United States showed that only 5% of nurses applied the correct amount of force among 102 perioperative nurses⁹ when performing this skill. We should take the time to demonstrate the landmarks to our nurses/assistants and allow them to simulate the degree of force that should be applied (using a weighing scales). We should also explain that we may ask them to relieve the pressure when the glottic view is distorted. Far more patients suffer from hypoxic episodes during difficult or failed intubation than from aspiration.¹⁰

The "BURP" maneuver may distort the laryngeal view in some cases also. Benumof¹¹ has suggested that during laryngoscopy the operator should manipulate the larynx (hyoid and thyroid cartilages) with the free hand in an effort to improve the laryngoscopic view. He referred to this maneuver as "optimal external laryngeal manipulation" (OELM). In a study of 181 patients acting as their own controls he demonstrated a significant improvement in the laryngoscopic view when OELM was applied.

In conclusion the combination of a "BURP" maneuver and cricoid pressure worsens the glottic view during laryngoscopy. Cricoid pressure, even when properly performed, may distort the glottic view during laryngoscopy in some cases.

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