Sellick's Maneuver: To Do or Not Do

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The introduction of cricoid pressure (CP) by Sellick[1] in 1961 "to control regurgitation until intubation with a cuffed endotracheal tube was completed" was met with an enthusiastic reception worldwide and rapidly became an integral component of the rapid sequence induction/intubation technique (RSII). The maneuver consisted of "occlusion of the upper esophagus by backward pressure on the cricoid ring against the bodies of cervical vertebrae to prevent gastric contents from reaching the pharynx."[1] Sellick[1] provided evidence that extension of the neck and application of CP obliterated the esophageal lumen at the level of the 5th cervical vertebra, as seen in a previously placed soft latex tube distended with contrast media to a pressure of 100 cm H_2O. He also confirmed the value of CP in preventing saline (run into the esophagus from a height of 100 cm H_2O) from reaching the pharynx in a patient undergoing gastroesophagectomy.[2] Sellick[1,2] emphasized that the lungs can be ventilated by intermittent positive pressure and that CP can prevent inflation of the stomach during positive pressure ventilation. References to CP were found in the literature more than 230 yr ago.[3] In a letter from Dr. W. Cullen to Lord Cathcart dated August 8, 1774, concerning the recovery of persons "drowned and seemingly dead," the use of CP by Dr. Monro was referred to as a means of preventing gastric distension during inflation of the lungs.[3]

Before Sellick described CP, several techniques were used in patients at risk of aspiration of gastric contents: awake intubation, induced hyperventilation with carbon dioxide during inhaled induction,[4] and RSII performed with the patient in a 40° head-up tilt.[5] The rationale behind the head-up tilt was that gastric contents could not reach the laryngeal level even if contents were moved up into the esophagus.[5] The RSII with CP was extended not only to emergency surgical and obstetrical procedures and the critical care setting, but also to elective procedures in patients at risk of aspiration of gastric contents. The plethora of manuscripts, correspondence, and reviews on CP is a testimony to its relevance to anesthetic practice and continuing interest to clinicians.[6]

In the last 2 decades, clinicians have questioned the efficacy of CP and therefore the necessity of the maneuver.[7,8] Some suggested abandoning it on the following grounds: (a) Its effectiveness has been demonstrated only in cadavers,[9–11] and therefore its efficacy lacks scientific validation. (b) It induces relaxation of the lower esophageal sphincter.[8,12] (c) There have been reports of regurgitation of gastric contents and aspiration despite CP.[13] (d) The esophagus is not exactly posterior to the cricoid, and thus the maneuver is unreliable in producing midline esophageal compression.[14] (e) It is associated with nausea/vomiting and also with esophageal rupture.[15] (f) It makes tracheal intubation and mask ventilation difficult or impossible.[15–18]

Because of ethical considerations, a controlled study of the efficacy of CP is not feasible. Even if such a study were conducted, it would probably yield little information, given the low incidence of pulmonary aspiration. The compelling evidence supporting the effectiveness of CP comes from studies that unequivocally demonstrate its efficacy in preventing gastric inflation in anesthetized children and adults.[19–21] It is inconceivable that a maneuver effective in preventing gastric inflation during manual ventilation would not be effective in preventing esophageal contents from reaching the pharynx.

The study by Rice et al.[22] in the current issue sheds new light on the efficacy of CP. In 24 awake volunteers, magnetic resonance imaging was

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Accepted for publication June 18, 2009.

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DOI: 10.1213/ANE.0b013e3181b763c0

performed with and without CP in sniffing, neutral, and extended head positions. Without CP, the diameter of the postcricoid hypopharynx was 7.3 ± 1.9 mm. The anteroposterior thickness of the anterolateral wall (2.6 ± 1.0 mm) and posterior wall (3.5 ± 1.2 mm) added up to 6.1 mm. Because the anteroposterior diameter of the postcricoid hypopharynx with CP measured only 4.7 ± 1.4 mm, the authors inferred that the lumen of the alimentary tract posterior to the cricoid cartilage was indeed compressed.[22] This finding clearly demonstrates the efficacy of CP. Furthermore, magnetic resonance imaging showed compression of the postcricoid hypopharynx during CP regardless of the position of the cricoid cartilage (midline or lateral displacement) relative to the vertebral body.[22]

Unlike "the cervical esophagus," Rice et al.[22] observed that the postcricoid hypopharynx moved with the cricoid ring as an anatomic unit, an anatomical relationship that has been described previously.[23] Although they distinguished between the postcricoid hypopharynx, the part of the alimentary tract compressed by CP, and the esophagus, they referred to the postcricoid hypopharynx as the "cricopharyngeus." The question remains: Is the postcricoid hypopharynx a part of the esophagus or a separate entity? Clinicians have regarded the cricopharyngeus as a major component of the upper esophageal sphincter. Its muscle tone creates a sphincteric pressure (mean 38 mm Hg, in awake subjects) that prevents esophageal contents from reaching the pharynx (second line of defense).[24] Sphincter pressure increases slightly during inspiration preventing air entry into the esophagus but markedly decreases with neuromuscular blockade.[25] Although distinct from the remainder of the cervical esophagus, one can argue that the postcricoid hypopharynx (the cricopharyngeus) is the upper esophagus.

It has been suggested that pulmonary aspiration despite CP may reflect concomitant reflex relaxation of the lower esophageal sphincter,[8] which is not attenuated by prior administration of metoclopramide.[12] This suggestion is unlikely for several reasons: (a) The purpose of CP is to prevent gastric contents from reaching the pharynx, not to prevent gastroesophageal reflux. (b) In a study of healthy volunteers, gastroesophageal reflux did not occur during CP.[26] (c) The incidence of pulmonary aspiration, with the use of a laryngeal mask airway (LMA), which is also known to decrease lower esophageal sphincter tone,[27] is not higher than that associated with tracheal intubation.[28]

Sellick recommended that CP should be applied "lightly" first, then with "firm" pressure exerted when consciousness is lost. Based on studies of cricoid force to prevent material from reaching the pharynx, 40 N (10 N = 1.0 kg) was recommended.[29] Studies showed that 34 and 30 N occluded a manometry catheter behind the cricoid cartilage in all patients at a pressure greater than 30 and 25 mm Hg, respectively.[24,29] In a cadaver study, 20 N prevented the regurgitation of esophageal fluid at a pressure of 25 mm Hg, and 30 N prevented regurgitation at a pressure of 40 mm Hg.[30] Accordingly, the current recommendation is to apply 10 N when a patient is awake, and increase the force to 30 N once the patient loses consciousness.[15] Evidence is mounting regarding improper application of CP by anesthesia personnel.[30] In one survey, 48% of participants did not apply CP properly. Conversely, anesthesia personnel can be trained to perform the correct maneuver by practicing on weighing scales.[31] With proper training, the correct force applied is reproducible within a range of 2 N.[31]

Cricoid force greater than 40 N can compromise airway patency and cause difficulty with tracheal intubation.[6,15,16] CP may displace the esophagus,[14] make ventilation with a facemask or with an LMA more difficult,[6,17] interfere with LMA placement and advancement of a tracheal tube,[6,16,18] and alter laryngeal visualization by a flexible bronchoscope.[16] Other investigators have found that CP does not increase the rate of failed intubation.[32,33] Releasing CP is certainly justified if the glottic view remains distorted or mask ventilation and tracheal intubation become difficult.

Contrary to Sellick's recommendations, the current teaching is to avoid manual ventilation of the lungs before intubation during RSII to prevent gastric distension, a potential cause for regurgitation. The effectiveness of CP in preventing gastric insufflation was first recognized in 1974.[15] Subsequent studies confirmed that CP prevents gastric distension even when inflation pressures as high as 60 cm H_2O are used, provided the airway remains clear.[15–17] Thus, manual inflation of the lungs need not be withheld before intubation during RSII. In patients with insufficient oxygen reserve, or when consumption is high or when a nondepolarizing muscle relaxant with a slow onset is used, manual ventilation during CP application is necessary.

SUMMARY

CP substitutes for the loss of tone in the cricopharyngeus, nature's normal defense mechanism. The findings of Rice et al. lend strong support to the efficacy of Sellick's maneuver in occluding the alimentary tract posterior to the cricoid cartilage. There is strong evidence that gastric insufflation can be prevented by CP, and that mask ventilation can be applied safely during RSII. On the other hand, there are circumstances in which CP or RSII is undesirable or contraindicated. These situations should be respected and other alternative management strategies sought. In the clinical setting, the decision to use CP should be a balance between the potential benefits that have been demonstrated repeatedly, and rare potential complications that are likely a result of improper application of the technique[34] but that can easily be taught.[31] It is our duty as clinicians to make Sellick's great contribution a safe practice.

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