

The Cricoid Pressure Pendulum

When Dr. Sellick first introduced the idea of “cricoid pressure” in 1961, he stated that "the maneuver consists of temporary occlusion of the upper end of the esophagus by backward pressure of cricoid cartilage against bodies of cervical vertebrae."^[1] His published research, however, had some noted limitations. They were small, non-randomized, uncontrolled case series that were performed on patients undergoing induction with anesthesia. The patients were positioned "head down slightly with head turned" and there was no mention of the sequence of administration or dosing of the induction agent and paralytics that were used in the anesthesia.^{[1][2]} Sellick also did not discuss the actual technique of cricoid pressure, including how much pressure to apply, and admitted that it was performed by untrained personnel. Despite these major limitations, this technique was rapidly and rather uncritically adopted by anesthetists all over the world.^[2]

Over the past two decades, many providers have questioned the utility of cricoid pressure and many studies have been published which further support or refute its efficacy. Specifically, the following is the evidence regarding the question of whether cricoid pressure does what it is suppose to do or not, whether it can make our management of the airway more difficult, and whether or not we should be using it.

Does Cricoid Pressure Occlude the Esophagus and Prevent Regurgitation?

According to one author, crucial to the **theorized effectiveness of cricoid pressure is the idea that the cricoid cartilage, esophagus, and vertebral bodies are all perfectly aligned** in the axial plane.^{[2][3]} In a retrospective review of 51 cervical CT scans and a prospective analysis of 22 cervical MRI scans, there was some degree of lateral displacement of the esophagus relative to the midline in 49% and 53%, respectively, even without cricoid pressure. When cricoid pressure was applied in the MRI scans, the incidence of lateral displacement of the esophagus increased from 53% to 91%.^{[2][3][4]}

So, does lateral displacement of the cricoid cartilage imply that it is not useful to the provider as a tool to occlude the esophagus? Rice *et al.* studied the MRI of 24 adult volunteers with and without cricoid pressure and determined that it was not the esophagus, but actually the **hypopharynx that was compressed posterior to the cricoid cartilage**. They found that the cricoid cartilage moved laterally with respect to the vertebral body in 17-33% of the applications of cricoid pressure, but the hypopharynx moved as well and the result was compression of the hypopharynx between the cricoid ring and the longus colli muscle group.^[5] Ultimately, they determined that cricoid pressure indeed occluded the conduit between the stomach and pharynx as Sellick originally intended.

However, does this necessarily translate to prevention of aspiration? The limited evidence which supports the prevention of aspiration by use of cricoid pressure is through cadaver studies or case reports of regurgitation seen after release of cricoid pressure after tracheal intubation.^{[2][12]} There is also compelling evidence that cricoid pressure prevents

gastric inflation in anesthetized children and adults and therefore it is assumed that the same maneuver would prevent esophageal contents from reaching the pharynx.^{[2][13]} Ultimately, there have **not been any published randomized controlled trials comparing the incidence of regurgitation on induction with and without cricoid pressure in patients at high risk of regurgitation.**^[2]

Does Cricoid Pressure Obstruct the Airway?

The question of whether cricoid pressure worsens the laryngeal view due to its obstructive effects has been an area of vastly growing research over the past 10 years. The **results have been contradictory.** For example, one randomized study by Noguchi *et al.*^[6] determined that cricoid pressure **significantly worsened the laryngeal view** whereas a study by McCaul *et al.*^[7] determined that cricoid pressure actually **improved the laryngeal view in both lateral and supine positions.** Alternatively, Turgeon *et al.*^[8] concluded in their large, randomized, double-blinded, controlled trial that there was **no effect on laryngeal view.** However, it was noted in their study that they used 30N of force, which is generally considered less than optimal for proper technique given that Wraight *et al.*^[9] recommended a force of at least 44N to prevent regurgitation. It has been reported that forces >40N of cricoid pressure may compromise airway patency and cause difficulty with tracheal intubation.^[2]

Additional evidence in the literature has shown that cricoid pressure on 40 patients resulted in 8 of them having a **marked worsening of laryngeal view** as determined by endoscopic photography down the laryngoscopic blade^[10] and that cricoid pressure interferes with laryngeal mask airway (LMA) placement, can make ventilation with a facemask or LMA difficult, and can alter laryngeal visualization by flexible bronchoscope.^[11]

Should Providers Utilize Cricoid Pressure?

Due to the lack of great evidence supporting the efficacy of cricoid pressure over the past decade, cricoid pressure has **fallen out of favor with most providers.** However, some providers continue to use it on a case-by-case basis as the risks and benefits of using it may change from patient to patient and even on a single patient during a prolonged or problematic intubation.^[2] So then, what are the risks of using cricoid pressure? In addition to the possible obstruction of the airway, one perceived risk is the fact that regurgitation and aspiration occurs despite the use of cricoid pressure. It has been suggested that pulmonary aspiration despite cricoid pressure may reflect concomitant reflex relaxation of the lower esophageal sphincter and therefore the application of cricoid pressure is the very reason why gastro-esophageal reflux occurs in the first place. Additionally, the fact that aspiration occurs despite cricoid pressure may reflect that cricoid pressure is not applied properly,^[14] is released prematurely, or aspiration occurs at some time other than induction, such as prior to induction or at extubation.^[15]

In conclusion, there is insufficient evidence to support or abandon the use of cricoid pressure to prevent passive regurgitation. If used properly, it is likely to prevent aspiration. However, the provider should be properly trained in its application to both

prevent aspiration and obstruction of the airway, as well as be prepared to release cricoid pressure if there is any difficulty in either intubating or ventilating the patient.^[2]

References/Further Reading

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