Analysis of the Application of Cricoid Pressure: Implications for the Clinician

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The application of cricoid pressure may reduce the incidence of pulmonary aspiration of gastric contents in at-risk patients. Cricoid pressure may be applied during intubation in a variety of settings including the operating room, postanesthesia care unit, intensive care unit, and emergency department. Significant deficits in cognitive knowledge and practical application skills have been demonstrated among medical personnel responsible for the application of cricoid pressure. It has been suggested that a formalized training program should improve cognitive knowledge and practical application skills of cricoid pressure. The purpose of this nonexperimental, correlational, descriptive study was to evaluate registered nurses' cognitive knowledge and ability to correctly identify and apply cricoid cartilage pressure. No statistically significant correlation was found between gender, hand dominance, frequency of application, or previous training and the ability to identify the correct anatomy, state the correct pressure, or apply the correct pressure. Participants who were unable to correctly identify the cricoid cartilage were less likely to demonstrate cognitive knowledge concerning the correct amount of cricoid pressure (P = .045). However, there was no significance between cognitive knowledge and practical application of the correct pressure (P = .187). The descriptive aspect of the study revealed significant deficiencies in knowledge and application skills. Despite 57.7% of the study participants acknowledging having formalized training within the previous 8 months, the results demonstrated that they were no more likely to identify, correctly state, or apply the proper cricoid pressure when compared with participants who did not attend formalized training. Future studies should focus on determining effective approaches to formalized training programs and the optimal timing of competency-based testing/review for retention of knowledge and skills related to the application of cricoid pressure.

Keywords: *research, cricoid pressure, nursing knowledge.*

CRICOID cartilage pressure was first described in the 1770s for the prevention of gastric distention during the resuscitation of drowning victims. In the 1960s, Dr B.A. Sellick formally described the application of cricoid pressure to reduce pulmonary aspiration of gastric contents. This technique became known as the Sellick maneuver.[1]

The use of cricoid pressure for the prevention of pulmonary aspiration in at-risk surgical patients is considered standard practice among the majority of anesthesia providers. Application of cricoid pressure may occur outside of the operating room (OR) during intubation of patients at risk for aspiration. Locations include the emergency department, postanesthesia care unit, and intensive care. The role of the perianesthesia nurse is crucial, ensuring the vital function of ventilation and oxygenation in the patient recovering from potent anesthetics. The incidence

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1089-9472/09/2402-0006$36.00/0

doi:10.1016/j.jopan.2009.01.006

of critical events such as hypoxemia, hypercarbia, and hypoventilation requiring intubation are not common in the postanesthesia care unit.[2] However, patients may require reintubation because of the inability to maintain adequate pharyngeal reflexes, hypoventilation not amenable to simple maneuvers such as a chin lift/jaw thrust, hypercarbia, pulmonary edema, severe airway obstruction, and respiratory and/or cardiac arrest. The perianesthesia nurse is an expert in the recognition of inadequate ventilation and oxygenation and should be familiar with not only the techniques of intubation,[3] but also the identification of patients at risk for aspiration and in need of subsequent application of cricoid pressure.

Patients at Risk/Contraindications/ Complications

Conditions that place patients at risk for aspiration include obesity, diabetes, pregnancy, trauma, the elderly, nonfasting state, gastrointestinal obstruction or dysfunction, uncontrolled gastroesophageal reflux disease, uncoordinated swallow and respiration pattern, decreased level of consciousness unrelated to head trauma, esophageal pathology, or presence of hiatal hernia.[4-7] Contraindications to cricoid cartilage pressure include unstable cervical spine fracture, active vomiting, cricotracheal injury, foreign body in upper airway, and/or a history of difficult airway management that may require an awake fiber optic intubation. Other situations that may necessitate a reduction in pressure or actual release of cricoid pressure include inability to intubate, inability to advance the endotracheal tube (ETT), inability to ventilate, or active vomiting.[4,8-12] Complications of cricoid cartilage pressure include airway obstruction, esophageal rupture, regurgitation, pulmonary aspiration, recall of the application of cricoid pressure possibly resulting in posttraumatic stress disorder, and a diminished glottic view during direct laryngoscopy.[8-9,13-18]

Management of the "At-Risk" Patient

The management of patients at risk for aspiration begins in the preoperative period. Preoperative anesthetic management focuses on prevention via gastric emptying, decreasing gastric secretions, and increasing pH of the gastric secretions. Gastric emptying can be accomplished through use of prokinetic medications such as metoclopramide. Decreasing gastric secretions and acidity is accomplished with antacids, histamine-2 antagonists, and/or proton pump inhibitors.[6,19,20] Routine use of these medications in patients that are considered not at risk for aspiration is not recommended by the American Society of Anesthesiologists.[21]

Cricoid Pressure Anatomy and Force

The next step in caring for the at-risk patient involves the administration of medications that rapidly renders the patient unconscious, application of cricoid pressure, and successful endotracheal intubation. The suggested effectiveness of cricoid pressure can be explained by understanding anatomy and force. The cricoid cartilage is the only complete tracheal ring. The administration of hypnotics, sedatives, anesthetic induction agents, and/or muscle relaxants will result in the loss of lower esophageal tone, upper esophageal tone, and protective laryngeal reflexes. Application of pressure to the cricoid cartilage allows for the occlusion of the upper esophagus, between the cricoid and the sixth cervical vertebra, replacing the loss of upper esophageal tone (Fig 1).[4,22] Identification of surface landmarks is performed by moving slightly caudad to the thyroid cartilage and cricoid notch, or just inferior to the thyroid prominence or "Adam's apple" (Fig 2).[23,24]

The standard descriptive unit for cricoid pressure is the kilogram (kg) or the Newton (N), the former a measurement of weight and the latter force. Many authors accept the value of 1 kg being equivalent to 9.81 N. A simple approximation is 1 kg = 10 N. Furthermore, a consensus has been made that application of cricoid cartilage pressure to the conscious patient should be 1 kg to 2 kg or 10 N to 20 N. Once the patient becomes unconscious, pressure should increase to 3 kg to 4 kg or 30 N to 40 N. Forty-four N should reasonably protect patients from aspiration.[4,9,23-29]

Controversial Aspects of Cricoid Pressure

The effectiveness of cricoid pressure has been questioned because of the continued occurrence of pulmonary aspiration despite its application. There are no controlled clinical trials to assess actual effectiveness of cricoid pressure.[27] The strongest arguments questioning effectiveness of cricoid pressure center on the lack of knowledge by those who are applying cricoid pressure. Several studies have formally and informally discussed the fact that less

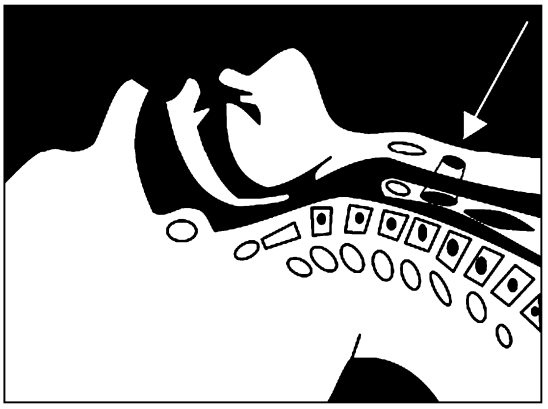

Figure 1. Reprinted from Daniel D. Moos' Basic Guide to Anesthesia for Developing Countries, Volume 1. Available at http://worldanaesthesia.org.