EDITORIAL

Aspiration Pneumonia after Rapid Sequence Intubation: A Diagnostic Dilemma!

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Abstract

Rapid sequence intubation (RSI) is generally done in the patients requiring intubation in the emergency room. These patients are often full stomach and are at the risk of regurgitation and aspiration leading to aspiration pneumonia. The incidence of aspiration pneumonia during RSI is not known as the term "RSI" is poorly defined and the diagnosis of aspiration pneumonia is often clinical and circumstantial.

Keywords: Aspiration pneumonia, Pepsin, Rapid sequence intubation.

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Endotracheal intubation (ETI) is considered to be one of the most important techniques in which a physician from emergency medicine, anesthesiology, and critical care specialty must be skilled. It is performed daily in a variety of settings including prehospital, emergency departments (ED), operating room (OR), and intensive care units (ICU). Although similar, the airway management in the ED and ICU is not the same as done in the OR settings because, in the ED and ICU, the ETIs are invariably performed emergently. Therefore, the incidence of failed intubation (1 in 50–100)[1] and repeat attempt at intubation in ED is considerably higher than that reported in the controlled environment of OR (1 in 1–2000).[2] These patients are frequently not fasting and remain at the risk of regurgitation and aspiration of gastric contents leading to aspiration pneumonia.

Rapid sequence induction (RSI), originally described by Sellick in 1961, is a method of achieving rapid control of the airway whilst minimizing the risk of regurgitation and aspiration of gastric contents.[3] The necessary steps in the original technique were emptying of the stomach via an esophageal/gastric tube which is then removed, adequate preoxygenation, positioning the patient supine with a head-down tilt, sedation with a barbiturate or volatile anesthetic, muscle relaxation with suxamethonium, application of cricoid pressure and laryngoscopy, and intubation of the trachea with a cuffed tube immediately following fasciculations. In current clinical practice, several modifications to this classic approach have been made. The term "modified RSI" is sometimes used to describe such variations and include omitting the placement of an esophageal/gastric tube, supine or ramped positioning, use of midazolam or opioid, titrating the dose of induction agent to loss of consciousness, use of propofol, ketamine or etomidate to induce anesthesia, use of high-dose rocuronium as a neuromuscular blocking agent, allowing gentle mask ventilation, and omitting cricoid pressure. In North America, the alternative term "rapid sequence intubation" is used when the same process is used in the emergency department.

For emergency medicine physicians and intensivists, the medications used in the OR for intubation were made available as late as in the 1970s. Taryle et al. reported a very high complication rate (occurred in 24 of 43 patients) of emergency ETI in a university hospital ED. They suggested improved training in ETI and the use of OR approaches, such as sedation and muscle relaxation outside of the OR.[4] Their suggestion call for expansion of training in intubation and introduction of rapid sequence intubation in the ED. However, the neuromuscular blocking agents took more time to make their way to the ED and into the hands of emergency physicians. The reasons for this delay were the fear of losing control of the airway in the paralyzed patient and the potentially catastrophic consequences.[5]

Several studies have reported higher intubation success rate and lower complication rate with the use of RSI.[6] The observed higher success rate could be attributed to better intubating conditions (still and abducted vocal cords and ease of laryngoscopy without cough reflex).

In this issue, Roshan et al. have reported a prospective observational study to determine the prevalence and risk factors for the development of aspiration pneumonia after RSI in ED.[7] They observed desaturation, witnessed aspiration, hypotension, and esophageal intubation in 14.3, 9.7, 5.2, and 3.9% of patients, respectively. The prevalence of aspiration pneumonia was 13.4% (18 of 134). They also determined tracheal aspirate pepsin concentration which was positive (>12.3 ng/mL) in 29.2% of patients. However, only 44.44% of patients who developed aspiration pneumonia had positive pepsin levels. The male gender (AOR: 7.29, 95% CI: 1.52–35.03, $p = 0.013$) and diabetes mellitus (AOR: 3.76, 95% CI: 1.23–11.51, $p = 0.020$) were risk factors for the development of aspiration pneumonia. Although the authors could not recruit the required sample size of 174 patients it could not have affected the

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power of the study as the endpoint of 13% aspiration pneumonia was achieved with the recruited sample. The recently published OcEAN study also reported a 42.6% (55 of 129) incidence of complications during airway management in ED. Hypotension (20.2%), desaturation (9.3%), and esophageal intubation (5.4%) were major complications while aspiration accounted for a comparatively lower incidence (3.1% of total complications).[8]

Aspiration pneumonia results from aspiration of materials or chemicals foreign to the tracheobronchial tree from above (e.g., aspiration of colonized oropharyngeal materials) or from below (e.g., aspiration of gastroesophageal contents). Aspiration remains an ever-present risk during RSI; however, the fourth National Audit Project showed that aspiration of gastric contents was the most common cause of death in patients undergoing anesthesia in the OR, while outside the OR, deaths were principally due to failed intubation, tracheal tube misplacement, or tracheostomy displacement. In 36 serious reported events from intensive care units in the UK, none was due to aspiration.[9,10]

A prospective multicenter observational trial from Japanese emergency medicine network investigators compared the effectiveness of airway management between RSI and non-RSI (defined as intubation with sedative agents only or without medications) in the ED and found that intubation with RSI was independently associated with a higher success rate (OR: 2.3; 95% CI: 1.8–2.9; $p < 0.0001$) on the first attempt but not with the risk of complications (OR: 0.9, 95% CI: 0.6–1.2, $p = 0.31$). Regurgitation was found in 1 and 2% of patients in the RSI and non-RSI group, respectively.[11] The definition of RSI itself is confusing, particularly after the revised recommendations for using anesthetic agents and rocuronium in the ED for RSI and allowing gentle mask ventilation. So, what is non-RSI? Is it intubation just using sedation, as defined by the Japanese investigators[11] or the intubation in the controlled atmosphere in the OR. In an attempt to decrease the failure rate and trauma by allowing anesthetic agents and rocuronium during RSI, the difference between the RSI and intubation in the controlled atmosphere of the OR has blurred. Moreover, acid aspiration is also reported during elective intubations[9] and the difference in its incidence vis-a-vis RSI is not known.

Numerous investigations have examined the role of pepsin as a biomarker for aspiration (as is used by Roshan et al.[7] in the current issue) both in humans and in animal models.[12] The advantage of using pepsin is that it is easily obtainable from tracheal aspirates and specific for lung aspiration. However, it lacks standardization, and the window of detection is very short. Bronco-alveolar lavage amylase levels in aspiration pneumonia patients could be a potential biomarker. BAL fluid amylase level of 204 U/L or more had a sensitivity and specificity of 78.6 and 82.8%, respectively with an area under its receiver operating characteristic curve of 0.859 (95% CI: 0.803–0.915) for the diagnosis of aspiration pneumonia.[13] Similarly, CT has more accuracy than a bedside X-ray in diagnosing pneumonia. Moreover, the patients in the ED requiring intubation may have evolving community-acquired pneumonia, that manifested only after 48 hours and is labeled as aspiration pneumonia. Therefore, the diagnosis of aspiration pneumonia needs to be more accurate. The major issue in getting the specific biomarker for the diagnosis of aspiration pneumonia is the absence of a gold standard for its diagnosis impeding epidemiologic and therapeutic studies in this field. Therefore it may be difficult to attribute all such cases of pneumonia as "aspiration pneumonia due to RSI" till we have a better diagnostic tool and unless the incidence is compared with the incidence associated with intubation in the controlled OR environment.

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