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Original Contributions

THE ABILITY OF PARAMEDICS TO PREDICT ASPIRATION IN PATIENTS UNDERGOING PREHOSPITAL RAPID SEQUENCE INTUBATION

Tyler F. Vadeboncoeur, MD,* Daniel P. Davis, MD* Mel Ochs, MD† Jennifer C. Poste,‡ David B. Hoyt, MD§ and Gary M. Vilke, MD*†

*Department of Emergency Medicine, University of California San Diego (UCSD) Medical Center, San Diego, California; †San Diego County EMS, San Diego, California; ‡UCSD Muir College, San Diego, California; and §UCSD Department of Surgery, Division of Trauma, San Diego, California

Reprint Address: Daniel Davis, MD, Department of Emergency Medicine, UCSD Medical Center, 200 West Arbor Drive, #8676, San Diego, CA 92103-8676

□ **Abstract—One of the purported benefits to invasive prehospital airway management is the prevention of aspiration; however, aspiration events may occur before the arrival of prehospital personnel. We explore the timing of aspiration in patients with severe traumatic brain injury (TBI) undergoing paramedic rapid sequence intubation (RSI). Severely head-injured (Glasgow Coma Scale [GCS] score 3–8) adults were prospectively enrolled into the San Diego Paramedic RSI Trial. As part of the prehospital data collection tool, paramedics prospectively assessed for clinical evidence of aspiration before RSI (pre-intubation), aspiration events occurring during RSI (peri-RSI), and regurgitation of vomitus or blood after intubation (post-intubation). Data were abstracted from worksheets used during the RSI procedure, a telephone debriefing by one of the principal investigators immediately after delivery of the patient, and San Diego County prehospital and trauma databases. The incidence of pre-intubation aspiration, peri-RSI aspiration, and post-intubation regurgitation of vomitus or blood were determined. Patients with and without pre-intubation aspiration were compared with regard to pre- and post-intubation hypoxia and the rate of aspiration pneumonia. Logistic regression was used to explore the association between pre-intubation aspiration and various demographic and clinical factors. The results showed that pre-intubation aspiration was noted by paramedics in 72/269 patients in whom complete data were available. Peri-RSI aspiration was reported in one patient; there were no reported cases of post-intubation regurgitation of vomitus or blood. Patients in the pre-intubation aspiration group required more intubation attempts, had a higher incidence of desaturations and lower pre- and post-intubation SaO_2 values, and were more frequently diagnosed with aspiration pneumonia. Pre-intubation aspiration was associated with severe TBI, GCS score of 3, younger age, and the absence of alcohol intoxication despite controlling for age, gender, GCS, Head AIS (Abbreviated Injury Score), and serum ethanol. It is concluded that paramedics seem to be able to accurately assess for aspiration in patients undergoing prehospital RSI. The vast majority of aspiration events seem to occur before the arrival of prehospital personnel. Alteration in consciousness from TBI may carry a higher risk of aspiration than with other causes, such as alcohol intoxication. © 2006 Elsevier Inc.**

□ **Keywords—aspiration; prehospital; EMS; paramedics; rapid sequence intubation; airway management; traumatic brain injury; head trauma**

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INTRODUCTION

Secondary injury plays a substantial role in the outcome of patients with severe head trauma (1–5). As a result, the early intubation of patients with traumatic coma has become standard practice to reverse hypoxia and prevent aspiration due to the loss of airway reflexes (6–8). In hospitals and in many prehospital systems, medication-assisted intubation is performed, including the use of neuromuscular blockade to facilitate laryngoscopy as part of a rapid sequence intubation (RSI) protocol (9–14). Concerns over paramedic use of these agents include the consequences of failed intubation attempts as well as the unnecessary exposure of patients to a potentially dangerous procedure (15,16).

Although it is clear that severe traumatic brain injury (TBI) increases susceptibility to aspiration, it is less clear that prehospital intubation is an effective means to ameliorate this risk (17–21). The aspiration event may occur immediately after the traumatic event and before the arrival of prehospital personnel (22,23). In addition, the requirement for neuromuscular blockade suggests the presence of protective airway reflexes that may prevent aspiration, and removal of these reflexes may lead to aspiration during the intubation itself.

The San Diego Paramedic RSI trial revealed an increase in mortality associated with paramedic RSI (24,25). As part of the trial protocol, paramedics made assessments as to the presence of clinical evidence of aspiration. Here we use these assessments as well as clinical and outcome data to explore the timing of aspiration in patients with TBI.

METHODS

The San Diego Paramedic RSI Trial was a prospective, descriptive trial performed over 3 1/2 years from November 1998 to April 2002 (24). The purpose of this trial was to investigate the impact of paramedic RSI on outcome in patients with severe TBI. Data collected during the San Diego Paramedic RSI trial were used for the current analysis. Approval for this project was obtained from the State EMS Commission, our institutional Investigational Review Board, and each of the participating medical centers. The San Diego Paramedic RSI Trial enrolled adult major trauma victims with clinical suspicion of severe TBI (Glasgow Coma Scale [GCS] score 8 or less), transport time to trauma center of 10 min or greater, and inability to intubate without RSI. All enrolled subjects were pre-oxygenated with a nonrebreather facemask for 1 min; bag-valve-mask ventilation was performed if oxygen saturation (SaO_2) values were less than 95%. Patients were administered midazolam and succinylcholine before laryngoscopy. Paramedics were allowed a maximum of three attempts at endotracheal intubation, with the Combitube used as a salvage device. Tube placement was confirmed using physical examination findings, capnometry, pulse oximetry, and syringe aspiration. Rocuronium was administered for paralysis during transport.

Worksheets were used during the RSI procedure as a procedure guide and to record clinical data. In addition, San Diego County prehospital and trauma databases were used. All hospital and outcomes variables, including the presence of aspiration and non-aspiration pneumonia, are routinely abstracted from the hospital medical record by trained nurses at each trauma facility. The determination of aspiration and non-aspiration pneumonia is based on physician progress notes and radiologist interpretation of chest radiographs. Finally, data regarding the procedure were collected during a telephone debriefing with one of the principal investigators immediately after delivery of the patient. This included an assessment regarding clinical evidence of aspiration before intubation (pre-intubation aspiration), witnessed aspiration during the RSI procedure (peri-RSI aspiration event), and post-intubation regurgitation of vomitus or blood. Pre-intubation aspiration was defined as the visualization of blood or vomitus distal to the vocal cords during laryngoscopy or the presence of rhonchi on pulmonary examination in a patient with oropharyngeal blood or vomitus. A peri-RSI aspiration event was defined as witnessed large-volume aspiration after administration of RSI medications and before intubation.

The primary purpose of this analysis was to explore the timing of aspiration events and the potential role of prehospital RSI to prevent aspiration in the management of patients with severe TBI. Descriptive statistics were used to report the incidence of pre-, peri-, and post-intubation aspiration events. The predictive value of paramedic assessment of aspiration was determined by comparing patients with and without determinations of pre-intubation aspiration with regard to the incidence of pre- and post-intubation hypoxia, the incidence of aspiration and non-aspiration pneumonia as recorded in the San Diego County Trauma Registry, and multiple demographic and clinical variables. The incidence of non-aspiration pneumonia was included for reference and to exclude the possibility of reporting bias. In addition, logistic regression was used to explore the relationship between pre-intubation aspiration and age, gender, GCS score, Head/Neck Abbreviated Injury Score (AIS), and serum ethanol. Each of these was input as either continuous or as dichotomous (age 55 years or greater, GCS 4–8, Head AIS 3 or greater, serum ethanol 0.08 mg/dL or greater), with odds ratios used to quantify the association with paramedic assessment of aspiration.