



INTUBATION PERFORMED IN THE EMERGENCY DEPARTMENT IS ASSOCIATED WITH INCREASED PULMONARY COMPLICATIONS

Surgery

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ABSTRACT

Ventilator Associated Pneumonia (VAP) is among the most common hospital acquired infections. Trauma patients are known to have a unique predisposition to the development of pneumonia. At our urban level 1 trauma center, we noticed variability in the incidence of aspiration and pneumonia among intubated patients with similar levels of injury severity. In an attempt to discern why, we hypothesized that location of intubation was a risk factor for development of in-hospital complications.

We performed a retrospective cohort study over a 6 month period using adult patients admitted to our trauma service. Intubations performed were reported from four different locations: Emergency Department (ED), operating room (OR), intensive care unit (ICU) and the surgical floor. Data obtained included location of intubation, age, Acute Injury Score (AIS), days on a ventilator, incidence of pulmonary infection, incidence of aspiration, intubation difficulty, ICU length of stay (ICU-LOS), hospital length of stay (HLOS), and survival. One way analysis of variance (ANOVA) was then performed.

Our study included 96 enrolled patients consisting of 13 women and 83 men with a mean age of 49.5. Patients intubated in the ED, in comparison to patients intubated on the surgical floor, ICU or OR, were noted to have a statically significant increase in ventilator days (10.9 days), ICU length of stay (12.1 days), HLOS (18.8 days). Additionally, incidence of pulmonary infection (63.9%) and incidence of aspiration (37.7%) were noted to be increased with no statistically significant change in survival.

In conclusion, trauma patients requiring emergent intubation in the ED are uniquely predisposed towards development of pneumonia and in-hospital morbidity. These patients should be aggressively managed with strategies aimed at VAP prevention.

KEYWORDS

Ventilator Associated Pneumonia (VAP), Emergency Department (ED), Intensive Care Unit (ICU)

INTRODUCTION

Ventilator Associated Pneumonia (VAP) is among the most common hospital acquired infections. Defined by the onset of infection 48 hours after intubation, VAP causes significant in-hospital morbidity with a reported mortality of up to 50%.¹ Trauma patients are known to have a unique predisposition to the development of pneumonia.² At our urban level 1 trauma center, we noticed variability in the incidence of aspiration and pneumonia among intubated patients with similar levels of injury severity. In an attempt to discern why, we hypothesized that location of intubation was a risk factor for development of in-hospital complications.

MATERIALS AND METHODS

We performed a retrospective cohort study over a 6 month period using adult patients admitted to our trauma service. Intubations performed were reported from four different locations: Emergency Department (ED), operating room (OR), intensive care unit (ICU) and the surgical floor. As this was a retrospective data analysis using de-identified data, we sought and obtained exemption from our institutional review board for the study of human subjects. Data obtained included location of intubation, age, Acute Injury Score (AIS), days on a ventilator, incidence of pulmonary infection, incidence of aspiration, intubation difficulty, ICU length of stay (ICU-LOS), hospital length of stay (HLOS), and survival. One way analysis of variance (ANOVA) was then performed using JMP Statistical Software ©.

RESULTS

Our study included 96 enrolled patients consisting of 13 women and 83 men with a mean age of 49.5. Documented intubation locations included 61 patients in ED, 10 patients on the surgical floor, 13 patients in the ICU, and 12 patients in the OR. Patients intubated in the ED, in comparison to patients intubated on the surgical floor, ICU or OR, were noted to have a statically significant increase in ventilator days (10.9 days), ICU length of stay (12.1 days), HLOS (18.8 days) (Figure 1 and Table 1). Additionally, incidence of pulmonary infection (63.9%) and incidence of aspiration (37.7%) were noted to be increased with no statistically significant change in survival (Table 2). Although intubations performed in the ED were noted to have an increased proportion of patients with head injury (39.3%), even with exclusion of

this particular population, ICU LOS, HLOS ventilator days and incidence of aspiration were noted to be increased in patients intubated in the ED. There was no difference in incidence of COPD noted among the groups.

Table 1 - Clinical Outcomes in Intubated Patients

Intubation Location	Ventilator Days	ICU LOS (Days)	HLOS (Days)
ED	10.9	12.3	18.1
Surgical Floor	5	6.9	10.4
ICU	5.2	7.1	10.8
OR	1.8	4.9	7.8
P value	0.0003	0.0015	0.028

Figure 1: Clinical Outcomes in Intubated Patients vs. Location of Intubation

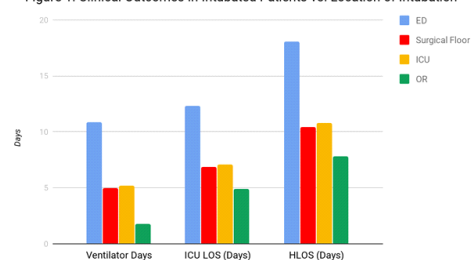


Table 2 - Morbidity Incidence Among Intubated Patients

Intubation Location	Survival (%)	Difficult Intubations (%)	Pulmonary Infection Incidence (%)	Aspiration Incidence (%)	Head Injury (AIS >3) Incidence
ED	78.7%	62.3%	63.9%	37.7%	39.3%
Surgical Floor	70%	60%	30%	0%	0%
ICU	76.9%	76.9%	46%	7.7%	23.1%
OR	91.6%	50%	8.3%	0%	8.3%
P value	0.648	0.587	0.0015	0.0016	0.017

DISCUSSION

Ventilator Associated Pneumonia (VAP) is among the most common hospital acquired infections that causes significant morbidity and mortality. The CDC definition of VAP is pneumonia that develops 48 hours after intubation. VAP is associated with prolonged period requiring mechanical ventilation, increased ICU length of stay, hospital length of stay in addition to augmenting the development of multidrug resistant pathogens.³ Classically, VAP is differentiated into early onset, which occurs 48-72 hours after intubation, and late onset, which occurs after 72 hours.⁴

The pathogenesis of VAP is two-fold: microaspiration of upper respiratory and gastrointestinal tract organisms, and biofilm development on organisms present on endotracheal tube (ETT).⁵ Risk factors for developing disease are categorized as either modifiable and non-modifiable. Non-modifiable risk factors include: Age over 60, history of chronic pulmonary disease, presence of tracheostomy or cranial trauma, recent neurologic injury, ARDS, multiorgan failure, coma, and prior antibiotic use. Modifiable risk factors include supine position, gastric overdistention, medication altering gastric pH and emptying, ventilator circuit colonization, low pressure in ETT cuff, and repeated patient transfers.^{6,7} Trauma is an independent risk factor for the development of VAP. In addition the trauma itself, these patients frequently experience prehospital intubation and emergent intubation - both of which are independent risk factors for development of VAP. With increasing attention brought to the clinical effects of ED overcrowding, one study reported a direct correlation between ED length of stay and incidence of VAP in emergently intubated blunt trauma patients.²

One note must be made here regarding the identification of a difficult airway. The notation of a difficult airway and the percentage of patients in each group that were noted to have a difficult airway were similar. The use of a mallampati score or other criteria were not well documented in these patients. That having been said, several simple clinical findings are useful for predicting a higher likelihood of difficult endotracheal intubation, no clinical finding reliably excludes a difficult intubation¹⁴

Modifiable risk factors play an important role in management strategy, as these risk factors become targets for planned preventative intervention. As VAP is defined by the presence after intubation, the primary strategy of prevention is aimed at reducing the amount of time patients remain on mechanical ventilation.⁵ Of multiple attempted strategies use the of non-invasive positive pressure ventilation (NPPV) has been shown to reduce incidence of patients requiring intubation and consequently reducing risk of developing VAP.⁸ In contrast, patients requiring reintubation are at higher risk of developing VAP.⁹ Other interventions found to play a role in active prevention strategy include head of bed elevation, ETT cuff drainage and hand hygiene.^{5,10,11} Although oropharyngeal decontamination strategies using antibiotics have demonstrated efficacy in reduction of VAP incidence, there was also noted to be a significant impact on development of antimicrobial resistance.^{12,13}

Trauma poses a unique burden in hospitalized patients, predisposing them to development of VAP. The aim of our study was to identify if admitted trauma patients intubated in different hospital settings had variability in risk for development of pneumonia. Our data found that despite equivalence of injury severity and incidence of COPD, patients intubated in the ED were uniquely predisposed to additional morbidity including increased incidence of aspiration and VAP. Consequently, these patients frequently had increase in time requiring mechanical ventilation, ICU length of stay, and hospital length of stay. These patients were more apt to develop in-hospital morbidity, but there was no significant change in mortality. Although novel in our findings on the clinical effect of location of intubation in trauma patients, this study has limitations. This was a retrospective cohort study utilizing a trauma registry. Although populations were matched based on injury severity and certain risk factors, not all comorbidities could be accounted for. Consequent bias can impact results obtained. While a single study on review of available literature demonstrated ED length of stay correlation to development of pneumonia in trauma patients, the role of specific risk factors in the ED for development of VAP in trauma patients remains unclear. Areas of future study should focus on modifiable risk factors in the ED contributing to this increased risk and attempt to provide a plausible intervention strategy. In conclusion, trauma patients requiring emergent intubation in the ED are uniquely

predisposed towards development of pneumonia and in-hospital morbidity. These patients should be aggressively managed with strategies aimed at VAP prevention.

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