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## Brief Reports

### TRAUMA PATIENTS CAN SAFELY BE EXTUBATED IN THE EMERGENCY DEPARTMENT

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□ **Abstract—Background:** Many trauma patients are intubated for conditions that fully resolve during their emergency department (ED) stay. Often, these patients remain intubated until after they leave the ED. **Objective:** The objective of this study was to examine the prognosis of patients extubated in the ED. **Methods:** Data from the records of adult trauma patients who were intubated and then extubated in the ED at a single trauma referral center were prospectively collected for a quality initiative. Two trained abstractors retrospectively recorded these data as well as additional information from the trauma registry and patient charts. The primary outcome was the need for unplanned reintubation during hospitalization. Additional outcomes were disposition and complications from the extubation. **Results:** There were 50 eligible patients identified and included in the study. Reasons for the intubation included combative behavior or decreased mental status before computed axial tomography (CT) scan in 24 patients (48%), sedation before the performance of a painful procedure in 18 patients (36%), and seizures before CT scan in 3 patients (6%). None of the patients (0%; 95% confidence interval 0–6%) required unplanned reintubation. Eight (16%) of the patients were able to be discharged from the ED before admission. **Conclusions:** Although our findings must be verified in larger, controlled studies, it may be safe to extubate patients in the ED, if the condition necessitating intubation has fully resolved. This practice may reduce admission rates and limit the need for intensive care unit beds for the patients who are admitted. © 2009 Elsevier Inc.

□ **Keywords—**emergency medicine; intubation; intratracheal; extubation; ventilator weaning

### INTRODUCTION

#### *Background*

Our specialty has a high level of expertise with most aspects of airway management. Emergency Physicians have become experts at inserting an endotracheal tube (ET) for definitive control of the airway. However, very little training is given for the removal of the ET tube. Although extubation is commonly performed during peri-operative management, a search of the Emergency Medicine literature revealed no studies on extubation in the emergency department (ED). At some centers, ED extubation is routine, though the safety of this procedure has not been definitively established.

#### *Importance*

Intubation in the ED requires admission to a high-acuity bed and intensive monitoring by nurses and physicians during the entirety of the patient's ED stay (1). If a subset of patients can have their endotracheal tube removed safely, it will allow admission to a lower-acuity bed or, in some cases, even discharge. This has the potential to save resources and decrease length of stay.

#### *Goals of this Investigation*

To our knowledge, the safety of extubation in an ED population has not been previously established. We

sought to follow a group of these patients to establish their prognosis.

## MATERIALS AND METHODS

### *Study Design*

We performed a retrospective observational study of adult trauma patients who were extubated in the ED. The medical center's institutional review board (IRB) approved the protocol without the need for informed consent.

### *Setting*

The study was conducted at the State's primary adult resource center for trauma. Patients were treated in the trauma resuscitation unit, an ED exclusively for trauma patients.

### *Selection of Participants*

As part of a separate quality initiative (QI) on patient memory of peri-intubation events, a questionnaire was

## ED Extubation Protocol

### ***Inclusion***

- Resolution of clinical issue requiring intubation
- Sat > 95% on FiO<sub>2</sub> ≤ 40%, PEEP ≤ 5 cm H<sub>2</sub>O
- RR < 30, SBP > 100, HR < 130
- Patient not known to be a difficult intubation

### ***Preparation***

- Turn off sedatives
- Leave opioids on at a low dose (e.g., fentanyl 50 µg/h)
- Allow patient to regain full mental status
- If patient shows signs of discomfort, consider administering more pain medication.
- Patient should be able to understand and respond to commands

### ***Testing for Readiness***

- Ask patient to raise arm and leave in air for 15 seconds
- Ask patient to raise their head off the bed
- Ask patient to cough, they should be able to generate a strong cough
- Place Patient on Pressure Support at a setting of 5 cm H<sub>2</sub>O. Sit patient up to at least 45°. Observe for 15-30 minutes. If Sat < 90%, HR > 140, SBP > 200, severe anxiety, or decreased LOC—discontinue extubation attempt.

### ***Procedure***

- Have a nebulizer filled with normal saline attached to a mask
- Sit pt up to at least 45°
- Suction ET tube with bronchial suction catheter
- Suction oropharynx with Yankeur suction
- Deflate the ET tube cuff
- Have the patient cough, pull the tube during the cough
- Suction the oropharynx again
- Encourage the patient to keep coughing up any secretions
- Place the nebulizer mask on the patient at 4–6 LPM

### ***After Extubation***

- Patient should receive close monitoring for at least 60 minutes
- If patient develops respiratory distress, NIV will often be sufficient to avoid reintubation.

**Figure 1. Protocol for ED extubation. When first starting to perform ED extubation, all patients should be admitted to the hospital for further observation. Sat = oxygen saturation; PEEP = positive end-expiratory pressure; RR = respiratory rate; SBP = systolic blood pressure; HR = heart rate; LOC = level of consciousness; ET = endotracheal; LPM = liters per minute; NIV = non-invasive ventilation.**

**Table 1. Characteristics of Study Patients**

Characteristics	All Patients (n = 50)
Age, median (years)	36
Range	18–68
Male (%)	78
Injury type	
Blunt trauma (%)	84
Motor vehicle collision (%)	36
Pedestrian struck (%)	8
Assault (%)	14
Fall (%)	20
Hanging (%)	6
Penetrating trauma (%)	16
Gun shot wound (%)	4
Stab wound (%)	12
Intubated before arrival (%)	32
Reason for intubation	
Combative behavior/AMS before CT scan (%)	48
Procedural sedation (%)	36
Seizures before CT scan (%)	6
Gastric lavage (%)	2
Unknown, prehospital (%)	8

AMS = altered mental status; CT = computed tomography.

prospectively filled out on patients who were extubated in the ED. The patients from this QI project formed the consecutive cohort of patients included in the present study. No patients were excluded from the study. Two trained abstractors retrospectively recorded the data from these questionnaires as well as further information from the patients' health records using a standardized abstraction form and the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) methodology (2). The staff who filled out the original extubation questionnaires were unaware that a study would be conducted on patient prognosis.

### Interventions

If the patient's clinical status allowed, sedation was discontinued and the patient was assessed by the ED nurse or trauma fellow (originally trained in either emergency medicine or general surgery) for possible extubation. Appropriate patients were extubated by the ED nurse or respiratory therapist. Figure 1 describes the institutional procedure for assessing patient eligibility and performing the extubation (3,4). Patients were observed for complications and then were either admitted to the hospital or discharged.

### Outcome Measures

The primary outcome of this study was the need for unplanned reintubation after ED extubation. A planned

reintubation was defined as a wholly elective intubation for the purpose of a surgical procedure in the operating room. The secondary outcome measure was discharge from the ED without the need for admission to the hospital. These outcomes were established before entering patients in the study.

### Primary Data Analysis

Data were entered and analyzed using SAS software (SAS Institute, Inc., Cary, NC) and 95% confidence intervals were calculated where appropriate.

## RESULTS

We analyzed 50 patients extubated in the ED from February 2004 to January 2005. Table 1 summarizes the characteristics of the study patients. The median patient age was 36 years; 78% were male. Thirty-two percent were intubated before arrival in the ED. Table 1 also shows the original reasons for intubation. Reasons for intubation included combative behavior or decreased mental status before computed tomography (CT) scan of the head in 24 patients (48%), seizures before CT scan of the head in 3 patients (6%), and deep sedation before the performance of a painful procedure in 18 patients (36%).

Table 2 shows the study outcomes. No patients (0%, 95% confidence interval 0–6%) required unplanned reintubation after their original intubation. Two patients (4%) were electively reintubated later in their hospital course. In both cases, the reason for reintubation was orthopedic surgery in the operating room. None of the patients had aspiration pneumonia or post-extubation stridor during their subsequent course. Eight (16%) of the patients were able to be discharged without admission to the hospital. All of these discharged patients were originally intubated for decreased mental status after blunt trauma; they all had negative initial head CT scans

**Table 2. Study Outcomes**

Outcome	All Patients (n = 50)
Minutes from arrival to extubation, mean (SD)	256 (202)
Unplanned reintubation (%)	0%
Planned reintubation	4%
Reason for reintubation—orthopedic procedure in the OR (%)	4%
Disposition	
Admitted (%)	84%
Discharged (%)	16%

OR = operating room.

and were extubated after a return to normal mental status. Seven of these 8 patients did not require reintubation between the time of their discharge and their first subsequent trauma clinic visit 4–8 days after discharge. One of the discharged patients was lost to follow-up.

## DISCUSSION

To our knowledge, this is the first study to evaluate the safety of extubating patients in the ED. Although many of the patients we intubate will be ventilated for days, a subset of patients will have their clinical issues resolve during their ED stay. Although this study examined trauma patients, patients who have completed procedures or have recovered from overdose of drugs, such as gamma-hydroxybutyrate, may also benefit from ED extubation (5,6).

The skills of extubation are easily learned and, in most hospitals, respiratory therapists are already extubating patients on the inpatient services (7). More critical than the actual procedure is assessing the appropriate patient group in whom ED extubation is safe.

### *Limitations*

All patients were evaluated at a single center and only trauma patients were studied. At the study center, there is an aggressive policy of early airway control, therefore, some patients may have been intubated who would not have been intubated at less aggressive centers. The nurse staffing ratio (1 nurse for 2–3 patients) and the extubation experience of the staff in this study is greater than in many EDs. The retrospective nature of this study may have led to missed cases, deviation from the extubation protocol, and review bias. There was no control group in this study; this was due to the belief on the part of the IRB that a prospective trial could not be performed without first

establishing the safety of the procedure, because there has not been any literature published previously.

## CONCLUSION

Although this is a retrospective prognostic study, it seems to indicate that ED extubation may be safe if the clinical condition necessitating airway control resolves during the ED stay. Prospective controlled trials will need to be performed to confirm these findings and establish whether ED extubation saves resources and limits length of stay. At many centers, an intubated patient requires an intensive care unit bed; ED extubation may allow admission to a lower acuity bed. At this stage, we do not recommend that centers inexperienced with ED extubation discharge these patients from the ED. An in-hospital admission allows the patient to be observed for any post-extubation airway complications. Emergency Physicians have become experts at the insertion of the endotracheal tube, and soon it may be time to become facile with its removal as well.

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**ARTICLE SUMMARY****1. Why is this topic important?**

Leaving patients intubated, even after the condition necessitating airway protection has resolved, leads to unneeded exposure to mechanical ventilation and may use unnecessary resources.

**2. What does this study attempt to show?**

This study attempts to demonstrate that extubation in the emergency department (ED), in a properly selected population, may be a safe practice.

**3. What are the key findings?**

In this study, there were no patients who required reintubation. This was a small, non-controlled trial in a single center.

**4. How is patient care impacted?**

This is the first trial to show that extubation in the ED may be a viable strategy for trauma patients.