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IMPACT OF CLINICAL PHARMACISTS ON INITIATION OF POSTINTUBATION ANALGESIA IN THE EMERGENCY DEPARTMENT

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☐ **Abstract—Background: Pain and anxiety are common in mechanically ventilated patients, and frequently undertreated in the emergency department (ED) setting. Objective: We sought to compare the rate of initiation of postintubation analgesia in the ED before and after intervention by pharmacists specialized in emergency medicine. Methods: This was a retrospective cohort study of patients who underwent rapid sequence intubation (RSI) in the ED. The primary endpoint was overall frequency of analgesia initiation, with subset analysis of RSI during the ED pharmacist (EDP) duty hours. Secondary endpoints included frequency of sedative or anxiolytic use without analgesia, time to initiation of postintubation analgesia, and adverse drug events (ADEs) resulting in analgesia discontinuation. Results: Forty-one patients were included in each group. The overall rate of postintubation analgesia increased after pharmacist intervention, from 20% to 49% (p = 0.005). Analgesia initiation during EDP hours was 50% and 85% in the pre- and postintervention groups, respectively. In the preintervention group, more patients received sedation without analgesia (73% vs. 51%; p = 0.04), and a small percentage (7%) received neither sedation nor analgesia. Time to initiation of postintubation analgesia decreased from 98 min to 45 min. ADEs were rare: there were no discontinuations of analgesic therapy in the preintervention group and one temporary discontinuation because of hypotension in the postintervention group. Conclusion: Analgesic use after RSI in the ED significantly increased after the implementation of ED pharmacy services. The large proportion of patients receiving analgesia during the EDP duty hours suggest the increase may be related to direct pharmacist involvement in postintubation management.** © 2016 Elsevier Inc.

☐ **Keywords—emergency service, hospital; hypnotics and sedatives; intubation, intratracheal; pain management; pharmacy service, hospital**

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INTRODUCTION

Mechanically ventilated patients frequently experience pain and anxiety caused by the physical and emotional discomfort of the endotracheal tube being in place, various modes and settings of ventilation, persistent effects of paralytic agents, and ongoing resuscitative procedures (1–5). Intubated patients are often unable to communicate these concerns, and physiologic signs of pain, including tachycardia and hypertension, may be unreliable because of medication use and underlying pathologies (3). Untreated pain may induce adverse effects related to catecholamine release (2–7). Agitation may be a direct manifestation of inadequate pain control, leading to an increased use of sedative and anxiolytic agents (3,4). Conversely, patients who receive adequate analgesia are able to reach comfort goals with less supplemental anxiolytic medication and may be weaned from mechanical ventilation sooner (6–10).

Guidelines have increasingly supported the use of analgesics in critically ill and mechanically ventilated patients (3–6). However, postintubation analgesia in the

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emergency department (ED) is often absent or inadequate. A retrospective evaluation of trauma patients intubated in the ED found that only 51% of patients received pain medication, usually a single bolus dose opiate (11). Only 47% were given analgesia in another study assessing analgesic and anxiolytic use in ED-intubated patients regardless of trauma status (5). Of these, 25% received an adequate dose. A recent study found similar results: 46% of ED-intubated patients received any form of sedation, and only one-quarter of these received an opioid during their ED stay (12).

Clinical pharmacists in the ED are important adjuncts to the resuscitation team who optimize and facilitate the provision of medication therapy (13,14). Upon establishing pharmacy services in our ED, we noted that most intubated patients were not receiving analgesia. In the course of recommending analgesic therapy, we identified several common barriers to its use: physician belief that pain control was not needed for intubated patients; the incorrect assumption that propofol provides both sedation and analgesia; fear among nurses and physicians that opiates would cause more hemodynamic instability than sedative agents alone; and concern for the amount of time required to initiate an infusion because none were readily available in the ED. We provided targeted education in addition to clinical and operational interventions to address these barriers.

This study was conducted in order to quantify the initiation of ED postintubation analgesia before and after education and intervention by clinical pharmacists specialized in emergency medicine. We hypothesize that clinical pharmacists improve the frequency of analgesia initiation in ED patients undergoing rapid sequence intubation (RSI).

METHODS

Study Design and Setting

This was a retrospective cohort study conducted at a community teaching hospital licensed for 480 beds. The mixed adult/pediatric ED sees approximately 60,000 patient visits per year, with 25 acute care beds and a fast track area. Beginning in October 2010, 2 ED pharmacist specialists (EDPs) provided clinical services (e.g., therapeutic recommendations, antimicrobial stewardship, medication counseling, drug information consults, medication procurement and unit stock optimization, and bedside assistance for cardiac arrests, myocardial infarctions, strokes, procedural sedations, RSIs, etc.) from 10 AM to 8:30 PM, seven days per week. This study was approved by the hospital's institutional review board before patient selection or data collection.

Interventions

In order to overcome the supply inconvenience, the EDPs arranged to have premixed fentanyl infusions stocked in the ED's automated dispensing cabinet (ADC). The EDPs notified nurses and physicians of the addition and began educating ED staff about the importance of providing postintubation analgesia. Pharmacology of sedatives and analgesics was reviewed, including therapeutic and adverse effects of these agents. Printed drug information was posted by the ADC and the pharmacy communication board in the ED conference room, but most opportunities for physician and nurse education occurred in the course of patient management. The EDPs initiated therapeutic dialogues with attending and resident physicians by directly recommending analgesic therapy as part of the postintubation regimen. They also provided opportunities to expedite therapy by being able to enter and verify the analgesic orders and obtain the medications from the ADC. In addition, EDP involvement at the bedside facilitated the provision of patient-specific drug information, such as compatibility with other intravenous medications and dosing and titration guidance. Being physically present in the ED, the pharmacists were also available to answer general questions and participate in discussions that did not arise from specific cases.

Selection of Participants

Eligible providers were those involved in caring for patients undergoing RSI while in the ED. Emphasis was placed on attending emergency physicians, resident physicians, and registered nurses.

Patients were identified by searching the ADC historical database for sedative and paralytic medications commonly used in RSI (i.e., succinylcholine, rocuronium, vecuronium, etomidate, midazolam, fentanyl, propofol, and ketamine). Two time periods were searched: preintervention (January 1, 2010–June 30, 2010) and postintervention (January 1, 2011–June 30, 2011). Data were collected on patients ≥18 years of age who had undergone RSI (receiving both a sedative and a paralytic agent) in the ED with an ED duration of stay of ≥30 min postintubation. Patients were excluded if they were <18 years of age. Patients who did not undergo RSI in the ED, required RSI because of opiate or benzodiazepine overdose or cardiac arrest, had documented allergies to opiates, had documented avoidance of analgesia because of hypotension, received direction of postintubation care by non-ED providers (e.g., intensive care unit or outside hospital), had an ED duration of stay of <30 min, or died while in the ED were excluded because of the inability to assess analgesia timing and

appropriateness. Because of the retrospective design, no identifying information was collected and patient consent was not obtained.

A convenience sample of up to 50 patients for each group (pre- and postintervention) was anticipated. Because the pharmacists were not available all hours of the day, and because resident staff rotates on a monthly basis, patient selection using a random number generator was planned to ensure that all times of day and varying degrees of experience were represented. If fewer than 50 patients met the study criteria in one group, the final sample size for both groups would decrease to that quantity.

Measurements and Data Analysis

The electronic medical records of eligible patients were reviewed for inclusion and exclusion criteria. Data collected included demographic information; indication for RSI; time in ED; sedative, anxiolytic, and analgesic medications used pre- and postintubation; time to analgesia after intubation; and any adverse drug events (ADEs). The EDPs collected all data, and each pharmacist independently reviewed one cohort. Both investigators contributed to the design of the data collection form. Definitions for RSI, indications for RSI, ADEs, and time of intubation and medication administration were established before data collection. The results of each study group were hidden from the other reviewer until collection was complete. Documentation occurred on a secure electronic database (Microsoft Excel spreadsheet; Microsoft, Redmond, WA) within a password-protected network.

Statistical comparisons were performed using the Pearson chi-squared test. All data were analyzed with SPSS software (version 18; SPSS Inc, Chicago, IL).

Outcomes

The primary outcome was the initiation of postintubation analgesia for patients in the ED. A subset analysis was performed for patients who underwent RSI during EDP duty hours. Secondary outcomes included frequency of sedative or anxiolytic use without analgesia, time to initiation of postintubation analgesia, and documented ADEs resulting in the discontinuation of analgesia in the ED.

RESULTS

Characteristics of Study Subjects

A total of 180 and 171 patients were identified via ADC records and screened for study inclusion in the 2010 and 2011 cohorts, respectively. Forty-one patients were included in the final analysis of each group after applying exclusion criteria (Figure 1). Demographic characteristics of each group are presented in Table 1. More than 50% of subjects in each group were men (majority was African American). More patients were intubated for unresponsiveness or loss of gag reflex in the postintervention group (46% vs. 24%), and the ED duration of stay was longer in the preintervention group (8.2 hours [range, 2.2–60.2 hours] vs. 6.2 hours [range, 2.2–20.3 hours]).

Main Results

Initiation of postintubation analgesia significantly increased after clinical pharmacist intervention, from 20% to 49% ($p = 0.005$). Between 10 AM and 8:30 PM, the EDP duty hours, 19 patients (46%) underwent RSI in the preintervention group vs. 24 (59%) in the postintervention group. This 10.5-hour timeframe accounted for 50% of analgesic use in the preintervention group and 85% in the postintervention group.

More patients in the preintervention group received sole sedative or anxiolytic therapy after intubation (73% vs. 51%; $p = 0.04$). One patient (7%) in the preintervention group received neither sedation nor analgesia in the ED after intubation. The average time to initiation of postintubation analgesia decreased from 98 min before pharmacist intervention to 45 min after, a decrease of 54%.

There were no discontinuations of analgesic therapy in the preintervention group and one temporary discontinuation because of hypotension in a patient receiving propofol and fentanyl in the postintervention group.

DISCUSSION

The awareness and importance of physical and psychological comfort provided to critically ill patients has increased in recent years (3,4). Previous studies identified deficiencies in analgesic use but have not made recommendations for improvement (5,11,12). In this study, analgesic use after RSI increased after initiation of EDP services. While one preintervention subject received neither sedation nor analgesia after intubation, all postintervention subjects received some form of sedation with or without analgesia. Because evidence-based practice change can take years to implement, it is possible the use of postintubation analgesia would have increased in 2011 regardless of the new pharmacy service. However, several points suggest the activities of the clinical pharmacists had a significant impact.

Time to analgesia initiation in the postintervention group decreased by 54%. While emphasizing postintubation pain control, the pharmacists coordinated the

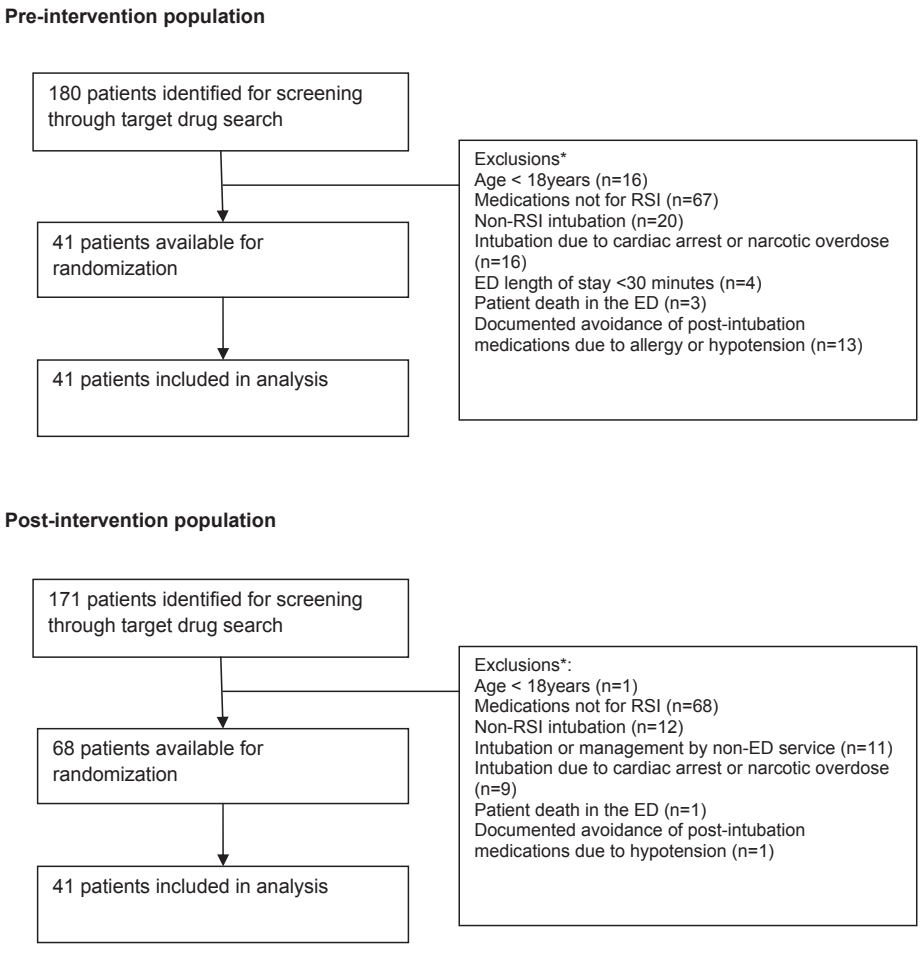

Figure 1. Study population. ED = Emergency department; RSI = rapid sequence intubation.

addition of premixed fentanyl infusions to the ED ADC. This relieved the nurse from leaving the ED to pick up the medication from pharmacy.

Misinformation about sedative and analgesic pharmacology may have contributed to a lack of analgesic prescribing. During bedside patient discussions, the EDPs found that physicians ordered propofol alone after intubation with the misconception that propofol provides both sedation and analgesia. As part of the pharmacist intervention, physicians were verbally educated about the minimal amount of analgesia provided by propofol, and supporting documentation was posted. Though not an outcome of this study, it was noted that orders for analgesia in the postintervention group were more evenly distributed between those receiving propofol and other sedatives, such as midazolam.

Reviews of opioid pharmacology were provided as necessary to physicians and nurses in order to discourage the avoidance of opioids when hypotension would be unlikely or clinically insignificant. Study data supported the safety of analgesic use: only one subject, receiving both propofol and fentanyl, developed hypotension resulting in discontinuation of therapy. In this case, both drugs were discontinued; later, fentanyl alone was restarted. Patients with documented avoidance of opioids because of hypotension were excluded from this study, but this only accounted for one excluded patient in each of the treatment groups (Figure 1).

Finally, the finding most closely associated with initiation of clinical pharmacy services in the ED is the increase in patients receiving analgesia for RSI taking place during EDP hours. While the number of intubations occurring between 10 AM and 8:30 PM was consistent across groups, only 50% of analgesia initiation occurred during this time in the preintervention group vs. 85% in the postintervention group. This suggests a quantifiable

Table 1. Patient Characteristics

Patient Characteristic	Preintervention	Postintervention
Age in years, mean (range)	66 (32–93)	59 (25–85)
Male, n (%)	23 (56)	27 (66)
Ethnicity, n (%)		
African American	29 (71)	28 (68)
Asian	3 (7)	7 (17)
White	6 (15)	4 (10)
Hispanic	3 (7)	2 (5)
Indication for RSI, n (%)		
Respiratory distress	21 (51)	18 (44)
Severe sepsis	3 (7)	1 (2)
Unresponsive	10 (24)	19 (46)
Trauma	2 (5)	1 (2)
Other/unspecified	5 (12)	2 (5)
Time in ED, hours (range)	8.2 (2.2–60.2)	6.2 (2.2–20.3)

ED = Emergency department; RSI = rapid sequence intubation.

impact of direct pharmacist involvement in postintubation care.

While this study noted both an improvement in the overall rate of postintubation analgesia and time to analgesia after dedicated pharmacist involvement in the ED, considerable room for improvement exists. The intervention group's analgesia rate of 49% is the same as the baseline rate reported in previous literature. Forty-five minutes to analgesia, while an improvement, is still a long time—especially considering the use of short-acting sedative agents for induction and intermediate to long-acting paralytics.

Limitations

This study had several limitations. First, it is retrospective and dependent upon provider documentation. It is possible that administration times were incorrect or that some medications given were not documented. Additional potential missing documentation includes clinical indication for appropriate avoidance of analgesia and adverse drug reactions warranting therapy discontinuation.

Another limitation is the study's restriction to RSI, by definition using both sedative and paralytic agents. Non-RSI intubations were more common before the EDPs, suggesting that intubation practices may have already been changing by the time the new pharmacy service began.

A third limitation is the variability of baseline analgesia use reported in previous studies compared to this investigation. One study categorized medications like ketamine and dexmedetomidine, which provide both sedation and analgesia, with propofol and barbiturates, so the actual analgesia rate could not be assessed (12). Other studies looked only at trauma patients, who have different analgesic needs from a general medical population (11,14). However, the consistently low rate suggests that the underuse of postintubation analgesia is a widespread concern.

Finally, the design of this study does not take into consideration specific indications for analgesia in intubated patients. However, as current guidelines suggest, an analgosedative approach may be beneficial for the majority of intubated patients (6). Given that nearly all patients in both groups received some form of sedation, there may have been an opportunity for analgesic use in all study patients.

CONCLUSION

In summary, analgesic use after RSI in the ED significantly increased after the implementation of ED pharmacy services. This study provides one quantifiable example of how clinical pharmacists may improve quality of care and adherence to evidence-based guidelines within EDs. Future investigation should include quality of sedation and analgesia for the intubated ED population; outcomes such as time to extubation and intensive care or hospital duration of stay; and patient satisfaction scores when early analgesic-based postintubation regimens are implemented.

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ARTICLE SUMMARY

1. Why is this topic important?

Mechanically ventilated patients frequently experience pain and anxiety, which is often undertreated in the emergency department. Clinical pharmacists in the emergency department perform a wide variety of interventions that may be difficult to quantify.

2. What does this study attempt to show?

This study attempts to show an improvement in the provision of analgesia to intubated patients after the implementation of emergency department pharmacy services.

3. What are the key findings?

Analgesia increased after interventions, especially when pharmacists were present. The average time to analgesia decreased from 98 min to 45 min.

4. How is patient care impacted?

The implementation of clinical pharmacy services in the emergency department may improve the quality of patient care and compliance with evidence-based guidelines.