Published in final edited form as:

J Emerg Med. 2017 January ; 52(1): 59–65. doi:10.1016/j.jemermed.2016.07.114.

Endotracheal Intubation after Acute Drug Overdoses: Incidence, Complications, and Risk Factors

Angela Hua¹, Stephen Haight², Robert S. Hoffman³, and Alex F. Manini^{4,*}

¹ Emergency Medicine Residency, Icahn School of Medicine at Mount Sinai, NY, NY, USA

² University at Buffalo School of Medicine and Biomedical Sciences, Buffalo, NY, USA

³ Division of Medical Toxicology, Ronald O. Perelman Department of Emergency Medicine, NYU School of Medicine, NY, NY, USA

⁴ Division of Medical Toxicology, Icahn School of Medicine at Mount Sinai, Elmhurst Hospital Center, NY, NY, USA.

Abstract

Background—Drug overdose is the leading cause of injury related fatality in the United States, and respiratory failure remains a major source of morbidity and mortality.

Objectives—We aimed to identify the incidence and risk factors for endotracheal intubation following acute drug overdose.

Methods—This secondary data analysis was performed on a 5-year prospective cohort at two urban tertiary-care hospitals. The present study analyzed adult patients with suspected acute drug overdose to derive independent clinical predictors of endotracheal intubation.

Results—We analyzed 2,497 patients with acute drug overdose, of whom 87 (3.5%) underwent endotracheal intubation. Independent clinical risk factors for endotracheal intubation were: younger age (OR 0.97, CI 0.96-0.98), and history of obstructive lung disease (OR 6.6, CI 3.5-12.3); however, heart failure had no association. Patients with obstructive lung disease had significantly more hypercapnea (mean difference 6.8mmHg, CI 2.3-11.3) and a higher degree of acidemia (mean pH difference 0.04, CI 0.01-0.07) than patients without obstructive lung disease. Lack of rapid sequence sedative/paralytic was associated with in-hospital fatality. Early complications of endotracheal intubation itself included desaturation (3.4%) and bradycardia (1%).

Conclusions—Endotracheal intubation was infrequently performed on patients with acute drug overdose, and complications were rare when performed. Risk factors associated with endotracheal intubation included younger age and prior obstructive lung disease.

*Corresponding Author: Dr. Manini can be reached at One Gustave Levy Place, Box 1620, New York, NY 10029. Telephone: 212-824-8076; alex.manini@mssm.edu; Facsimile: 866-255-822.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conflicts of Interest: The authors declare no commercial conflicts of interest.

Keywords

Overdose; Intubation; Risk Factors

Introduction

Drug poisoning accounts for a considerable morbidity, mortality, and health care expenditures worldwide. With nearly 100 deaths per day since 2007, the United States is currently experiencing its worst drug overdose epidemic of all time (1). According to the CDC, there were approximately 2.5 million drug-related emergency department (ED) visits in 2011 (2). Even more concerning is that drug overdose is now the leading cause of injury related fatality in the United States, surpassing even motor vehicle collisions (3).

Respiratory failure from various mechanisms may lead to the requirement of mechanical ventilation, which has historically been a major cause of morbidity and mortality in poisoned patients (4). Drugs can affect the respiratory system in a number of ways: direct suppression or stimulation of the respiratory center; alteration in the response of chemoreceptors to changes in PCO₂; impaired mechanics of respiration from muscular weakness; increase in metabolic demands (e.g. agitation, fever) leading to increased total body oxygen consumption; and creation of acid-base disorders (5).

Despite the clinical significance, neither the incidence nor risk factors for endotracheal intubation (ETI) in ED patients with suspected overdose are well described. The purpose of this study was to identify the incidence as well as potential risk factors for ETI in this patient population. Additionally, we analyzed variables surrounding ETI that may impact adverse outcomes.

Methods

Study Design and Setting

This study was a secondary analysis of data collected from a prospective cohort of adult ED patients with acute drug overdose at two urban tertiary-care hospitals over a 5-year period (2009-13) (6). These EDs have a combined annual visit volumes in excess of 150,000 and are staffed 24 hours per day with board certified emergency physicians and intensivists. The study protocol was approved by the Institutional Review Board for all participating institutions with a waiver of informed consent.

Study Population

Patients with suspected acute drug overdose in general were initially screened for inclusion by trained research assistants using one of two mechanisms: (A) normal business hours (9a-5p) by rounding in person with ED staff several times daily; or (B) patients were enrolled after hours and on weekends by telephone referral of the case to the regional Poison Control Center (PCC) that is staffed 24 hours/day and 7 days/week by Certified Specialists in Poisoning Information. Reporting of suspected acute poisoning to the Poison Control Center in New York City is mandated by public health law (7).

The screening, inclusion, and exclusion criteria have recently been described elsewhere (6). Briefly, patients were included who met both of the following criteria: (A) acute presentation (within 24 hours of exposure); and (B) suspected overdose (i.e., illicit drug dose sufficient to cause symptoms or any prescription drug exposure greater than its therapeutic dose). Exclusion criteria were the following: alternative diagnosis (e.g., trauma or infection), chronic presentation (i.e., not meeting acute criteria above), non-drug overdose (e.g., plant), exposures limited to dermal or inhalational means only (i.e., trivial exposures), prisoners, age <18 years, anaphylaxis, patients with incomplete data (i.e., left against medical advice, transferred to an outside institution, or otherwise eloped from the hospital), and patients with do-not-resuscitate orders.

Measurements

Data collection from the medical chart occurred in accordance with accepted guidelines for valid medical chart abstraction, including training of abstractors (blinded to study objectives) and 95% agreement of a random sampling of ten test charts prior to mass data abstraction (8). While PCC data was used to enhance initial screening/inclusion of subjects, actual medical record data was relied upon for all other data measurements, including study outcomes. ED clinical data included demographics, congestive heart failure (CHF), obstructive lung disease (OLD defined as any one or more of asthma, chronic bronchitis, or emphysema), drug information/screens, and blood gas analysis. Non-respiratory comorbidities (e.g., psychiatric) were not collected as part of the present study.

Outcomes

The study outcome for the current study was endotracheal intubation (ETI) during the hospital or pre-hospital course, defined as placement of an endotracheal tube for the purpose of mechanical ventilation. The original (primary) data analysis for this cohort was adverse cardiovascular events, which has previously been reported (6). ETI was counted regardless of rapid sequence induction, and excluded non-invasive ventilation. Chart information was recorded regarding indications for ETI, and details of ETI (location, drugs, and procedural complications). In-hospital mortality was also recorded as exploratory secondary outcome.

Study Protocol

Subjects were prospectively followed to hospital discharge with data that included electronic medical records, paper medical records, consult records, and Poison Control Center records (for initial screening/inclusion only, not for data acquisition or outcome data). Hospital medical record follow-up for all patients was performed by research assistants trained in medical abstraction and recorded using standardized data collection forms. Results (from electronic physician notes, laboratory records, radiology results, and discharge summaries) were prospectively available to the study investigators. Patients discharged from the hospital had no further follow-up.

Data Analysis

Sample size was calculated a priori. Assuming a 4% incidence of ETI (based on preliminary data), we calculated the need to analyze 2500 patients to show 150% increased risk from

common predictors with an 80% power. We calculated 95% confidence intervals using the estimated standard error method. Normality testing of demographic data (e.g., age) was confirmed using the Shapiro-Wilk test. Chi-squared (with two-tailed Fisher's exact test when appropriate) and t-test were calculated for categorical and continuous variables, respectively, with 5% alpha (2-tailed).

Multivariable logistic regression was built using associations between clinical factors (e.g., past medical history) and the primary outcome, which were first calculated using univariate analysis ($p < 0.05$). Clinically significant covariates with biologically plausible confounding effects, as determined by the study team, were then added to the multivariable regression (SPSS version 21.0, IBM, Chicago, IL), with the exception of individual drug classes/types in an effort to avoid over-fitting the regression model. Regression model fit was assessed by the Nagelkerke method with R^2 statistics. Missing data was handled by listwise deletion. Multicollinearity was assessed using the Variance Inflation Factor (VIF). No interaction terms were introduced.

Results

Main Results

Patient screening and final inclusion of 2,497 patients analyzed for this study is summarized in **Figure 1**. Basic demographics of the study population are listed in **Table 1**. Of these, there were 87 who underwent ETI, thus the incidence of ETI was 3.5%. Univariate (unadjusted) risk factors for ETI included age (mean difference -3.6 years, CI -7.4 to -0.2) and history of OLD; neither gender nor CHF were associated with ETI. Drug exposures significantly associated with ETI included opioids followed by benzodiazepines and sedative-hypnotics. **Table 2** lists the indications for ETI, the most common of which was perceived worsening of clinical course.

Multivariable Regression Model

We derived independent risk factors for ETI using multivariable logistic regression, summarized in **Table 3**. After controlling for confounders (gender, site), younger age (adjusted OR 0.97, CI 0.96-0.98, or 3% decreased odds for each year over 18) and OLD (adjusted OR 6.6, CI 3.5-12.3) were found to be independent predictors of ETI risk.

Blood Gas Analysis

In the entire cohort, mortality was associated with lower mean pH (7.15 vs 7.36) and higher mean PCO_2 (68 vs. 48 mmHg) as outlined in **Table 4**. In subsequent analysis of just the OLD subgroup, we found that these patients had a significantly higher PCO_2 (54.6 vs. 47.9 mmHg, $p < 0.01$) and lower pH (7.31 vs. 7.36, $p < 0.01$) than non-OLD patients (**Table 4**). Using a PCO_2 cutoff of 60 mmHg had a negative and positive predictive value for mortality of 99.4% (98.8-99.8) and 6.0% (CI 2.8-11.2), respectively.

Rapid Sequence Intubation (RSI)

ETI performance sites were pre-hospital (N=16), the ED (N=58), and the ICU (N=13). The most commonly used induction agents for ETI were etomidate, followed by propofol and

ketamine (**Table 5**). Rocuronium was the paralytic of choice for 34% of ETI, 29% used succinylcholine, while 22% documented no use of a paralytic. Pre-hospital ETI was associated with increased risk of mortality (OR 2.0) compared with ED and inpatient ETI, however this finding did not achieve significance. Early complications of ETI included uncommon desaturation (3.4%) and rare bradycardia (1%). There was a significant association between in-hospital fatality and lack of use of either a sedative (OR 8.6, CI 2.1-34.9) or paralytic (OR 7.5, CI 1.9-3.1) for RSI.

Discussion

The main findings of this study were that younger age and a prior history of obstructive lung disease are associated with ETI in acute overdose patients, implying that they are more at risk for respiratory failure following overdose. Furthermore, drug exposures also had several associations with ETI risk. As expected, the patients with OLD had a higher PCO₂ and a lower pH than those without OLD. We also found that failure to use of a sedative and/or paralytic for RSI was associated with significantly increased odds of in-hospital mortality.

Currently, there is no established consensus or guideline for when an overdose patient requires ETI. It has been suggested that the Glasgow Coma Scale (GCS) may be useful in guiding the requirement for endotracheal intubation, as a patient with decreased consciousness and loss of protective airway reflexes may be predisposed to respiratory failure and aspiration injury (9-10). However, the correlation between the GCS score and the risk of aspiration is poor (11-12). Additionally, previous studies have shown that patients with a decreased GCS score may be safely observed and does not mandate endotracheal intubation (9,13). Therefore, this study aimed to explore other risk factors that may be associated with respiratory failure and ETI.

We found an interesting association between ETI risk and age. Initially with univariate analysis, there was suggestion of increased risk with increased age; however, in the more conclusive multivariable model, older age was *protective* with a 3% decreased odds of ETI for every year over age 18 (i.e., the youngest age meeting study inclusion criteria). From a statistical standpoint, this change is explained by the effect of confounding variables on the association between age and ETI. Confounding was controlled in the model (i.e., gender, hospital site, and OLD), and the true effect of decreased risk with increasing age was uncovered. From a clinical standpoint, there are several possible explanations. Younger patients may display higher risk-taking behaviors (14), and be more prone to severe drug overdose by virtue of lack of experience, or may be associated with psychiatric comorbidities prevalent at younger ages, such as attention deficit hyperactivity disorder (15). Alternatively, drugs with prominent respiratory depression such as opioids and sedative-hypnotics may be more prevalent in select younger age groups (16). The full clinical implications of this association are unclear from the current study and require further investigation.

In our secondary analysis of blood gas data, we found a lower pH and higher PCO₂ in OLD patients. While this may seem intuitive, it may actually be useful information to obtain in this population, especially early in the care of a patient who may be obtunded or provide a

limited history (e.g., due to suicidality). This finding is consistent with a study conducted by Donald et al. regarding associations with ETI, which found a higher pre-intubation PCO_2 in overdose patients (17). Approximately 2-4% of patients who are hospitalized for an acute exacerbation of asthma will require mechanical ventilatory support (18); however, the majority of hypercapnic asthma patients do not require intubation (19). Our findings add to this data, and further indicate that PCO_2 monitoring may be an early predictor of the need for intubation in the overdose population.

Our study found that the early complication rate for ETI was very low overall. However, pre-hospital endotracheal intubation was loosely associated with increased mortality compared with ED and inpatient ETI. This may be explained by confounding of pre-hospital cardiac arrest. Interestingly, the results demonstrated highly increased odds of mortality for the ETI cases that had no sedative and/or no paralytic compared to those who were intubated with medications. A previous study, by Adnet et al., demonstrated that in poisoned patients, intubations with etomidate but without neuromuscular blockade were more technically difficult (20). Their results suggested that RSI should result in better conditions for ETI in poisoned patients. A separate study, also by Adnet et al., showed that patients with a GCS score between 7-9 had the highest rate of difficulties during intubation (21). Our finding of higher mortality in patients without any sedative/paralytic may be a reflection of the fact that RSI enhances the care of the patient, or possibly may be a marker for higher quality of care. Alternatively, it may be that these patients were more seriously poisoned and required a “crash” intubation which may explain the higher mortality.

Clinically, the results of this study may be applicable to the initial ED approach to the poisoned patient. Screening for high-risk co-morbidities and demographics (i.e., age and OLD) may be useful for early risk stratification of airway management. The results also suggest a potential role for end tidal CO_2 monitoring in overdose patients, since capnography would allow for an estimation of the PaCO_2 based on the waveform displayed on an end tidal monitor (22). As the current protocol did not include routine capnography, future studies should evaluate systematic use of end-tidal CO_2 monitoring to allow for potentially earlier identification of overdose patients at risk for respiratory failure.

Limitations

The design of this study as a secondary data analysis may have limited the interpretation of the reason for respiratory failure; therefore, we used simply ETI as our study outcome, rather than “respiratory failure”. Exposure confirmation through analytical testing was lacking in a subset of patients, however suspicion of overdose based on history, clinical findings, or ancillary testing was documented by healthcare providers in all cases. Timing of blood gas measurement could not be standardized as this was an observational study; thus our blood gas data are hypothesis-generating only, and require further validation. There were no set criteria for ETI of poisoned patients and each case was subject to the individual physician's clinical judgment; unfortunately clustering by provider was not possible. Additionally, both study centers in this study were urban teaching hospitals, and the results may or may not be generalizable to rural or community settings. Finally, future studies

should include a larger sample size, given the low rate of ETI for acutely poisoned patients and the even lower rate of early complications from ETI.

Conclusions

ETI was infrequently performed for ED patients with acute drug overdose; when it was performed, complications were rare. Age and prior obstructive lung disease were derived as independent clinical risk factors for ETI in this study population. Clinicians should be aware of these high risk features during the initial ED approach to the poisoned patient.

Acknowledgements

Acknowledgements: None

Financial Support: This study was made possible by a career development award DAXXXXXX (PI blinded) from NIH/NIDA.

References

- Centers for Disease Control and Prevention. Wide-ranging Online Data for Epidemiologic Research (WONDER Database). US Department of Health and Human Services, CDC; Atlanta, GA: 2010. Available at wonder.cdc.gov. [January 15, 2015]
- Drug Overdose in the United States: Fact Sheet. Centers for Disease Control and Prevention Web site; <http://www.cdc.gov/homeandrecreationalsafety/overdose/facts.html>. Updated: February 10, 2014 [January 15, 2015]
- Warner, M.; Chen, LH.; Makuc, DM., et al. Drug poisoning deaths in the USA, 1980–2008. NCHS data brief, no 81. National Center for Health Statistics; Hyattsville, MD: 2011.
- Jay SJ, Johanson WG, Pierce AK. Respiratory complications of overdose with sedative drugs. *Am Rev Resp Dis*. 1975; 112:591–8. [PubMed: 1190613]
- Stolbach, A.; Hoffman, RS. Respiratory Principles.. In: Hoffman, RS.; Howland, MA.; Lewin, NA., et al., editors. Goldfrank's Toxicologic Emergencies. Tenth Edition.. McGraw Hill; New York: 2015. p. 367-376.
- Manini AF, Hoffman RS, Stimmel B, Vlahov D. Clinical risk factors for in-hospital adverse cardiovascular events after acute drug overdose. *Acad Emerg Med*. 2015; 22(5):499–507. [PubMed: 25903997]
- [January 19, 2015] N.Y. Public Health Law § 2500-d, section 11.03. Available at: <http://public.leginfo.state.ny.us>.
- Gilbert EH, Lowenstein SR, Koziol J, et al. Chart reviews in emergency medicine research: where are the methods? *Ann Emerg Med*. 1996; 27:305–308. [PubMed: 8599488]
- Chan B, Gaudry P, Grattan-Smith TM, et al. The use of Glasgow Coma Scale in poisoning. *J Emerg Med*. 1993; 11:579–82. [PubMed: 8308236]
- Cosgrove JF, Gascoigne AD. Inadequate assessment of the airway and ventilation in acute poisoning, a need for improved education? *Resuscitation*. 1999; 40:161–4. [PubMed: 10395398]
- Moulton C, Pennycook A, Makower R. Relation between Glasgow Coma Scale and the gag reflex. *BMJ*. 1991; 303:1240–1. [PubMed: 1747645]
- Moulton C, Pennycook A. Relation between Glasgow Coma Scale and cough reflex. *Lancet*. 1994; 343:1261–2. [PubMed: 7910279]
- Duncan R, Thakore S. Decreased Glasgow Coma Scale score does not mandate endotracheal intubation in the emergency department. *J Emerg Med*. 2009; 37:451–455. [PubMed: 19272743]
- Petersen IT, Bates JE, Dodge KA, et al. Describing and predicting developmental profiles of externalizing problems from childhood to adulthood. *Dev Psychopathol*. 2014; 28:1–28.

15. Kaye S, Gilseman J, Young JT, et al. Risk behaviours among substance use disorder treatment seekers with and without adult ADHD symptoms. *Drug Alcohol Depend.* 2014; 144:70–7. [PubMed: 25193717]
16. Schrager SM, Kecojec A, Silva K, et al. Correlates and Consequences of Opioid Misuse among High-Risk Young Adults. *J Addict.* 2014 (Epub ahead of print).
17. Donald C, Duncan R, Thakore S. Predictors of the need for rapid sequence intubation in the poisoned patient with reduced Glasgow coma score. *Emerg Med J.* 2009; 26:510–512. [PubMed: 19546273]
18. Pendergraft TB, Stanford RH, Beasley R, Stempel DA, Roberts C, McLaughlin T. Rates and characteristics of intensive care unit admissions and intubations among asthma-related hospitalizations. *Ann Allergy Asthma Immunol.* 2004; 93(1):29–35. [PubMed: 15281469]
19. Mountain RD, Sahn SA. Clinical features and outcome in patients with acute asthma presenting with hypercapnia. *Am Rev Respir Dis.* 1988; 138(3):535–539. [PubMed: 3202409]
20. Adnet F, Minadeo JP, Finot MA, et al. A survey of sedation protocols used for emergency endotracheal intubation in poisoned patients in the French prehospital medical system. *Eur J Emerg Med.* 1998; 5:415–419. [PubMed: 9919445]
21. Adnet F, Borron SW, Finot M, et al. Intubation difficulty in poisoned patients: association with initial Glasgow Coma Scale score. *Acad Emerg Med.* 1998; 5(2):123–127. [PubMed: 9492132]
22. Danzl, DF.; Vissers, RJ. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 6th ed.. Vol. 3. McGraw-Hill; New York: 2011. Tracheal Intubation and Mechanical Ventilation.; p. 108-118.
23. Nee PA, Bengert J, Walls RM. Airway management. *Emerg Med J.* 2008; 25:98–102. [PubMed: 18212147]

Article Summary

Why is this topic important?

Respiratory failure from various mechanisms may lead to the requirement of mechanical ventilation, which has historically been a major reason for morbidity and mortality in poisoned patients.

What does this study attempt to show?

The purpose of this study was to identify the incidence as well as potential risk factors for endotracheal intubation in this patient population.

What are the key findings?

The study demonstrates that younger age and history of obstructive lung disease are risk factors for endotracheal intubation in this patient population.

How is patient care impacted?

Screening for high-risk co-morbidities and demographics may be useful for early risk stratification of airway management for ED patients with drug overdose. There may also be a role for end tidal CO₂ monitoring in overdose patients.

Figure 1. Study Enrollment Diagram

Figure 1 Legend: n/a

Figure 1 Abbreviations: n/a

Table 1

Clinical Characteristics of All Patients (N=2,497)

Characteristic:	ETI	No ETI
	N or Mean (% or SD)	
<i>Demographics</i>		
Age *	45 (17)	41 (18)
Males	42 (48)	1310 (54)
<i>Past Medical History</i>		
OLD **	16 (18.4)	69 (2.9)
CHF	3 (3.5)	51 (2.1)
<i>Drug Exposures</i> [†]		
Opioids **	59 (67.8)	361 (14.9)
Benzodiazepines **	38 (43.7)	308 (12.8)
Sedative-Hypnotics **	34 (39.1)	347 (14.4)
Stimulants **	32 (36.8)	363 (15.1)
Antidepressants **	29 (33.3)	151 (6.3)
TOTAL	87	2410

Abbreviations: CHF = congestive heart failure; OLD = obstructive lung disease; ETI = endotracheal intubation; N = number; SD = standard deviation

* Indicates univariate $p < 0.05$

** indicates $p < 0.001$.

[†] Most common five self-reported exposures significantly associated with ETI listed in descending order. (Due to multi-drug overdoses, these numbers do not add up to 87.)

Table 2

Indications for Endotracheal Intubation (N=87)

Perceived worsening clinical course *	44	(50.6%)
Coma or depressed mental status	24	(27.6%)
Failure to oxygenate	21	(24.1%)
Protect airway/vomiting	17	(19.5%)
Failure to ventilate	13	(14.9%)
Cardiac arrest	12	(13.8%)
Seizing	5	(5.7%)
Unspecified Respiratory Arrest	4	(4.6%)
Other/Unknown	2	(2.3%)

Indications for ETI were adapted from the heuristics developed by Walls and colleagues [23], and based on the documented procedure note or progress note. Many patients met more than one indication for intubation.

* Determined by agreement of two study investigators.

Table 3

Independent Risk Factors for Endotracheal Intubation

Risk Factor	OR (95% CI)	Adjusted OR * (95% CI)
Age [†]	1.1 (1.0-1.2)	0.97 (0.96-0.98)
OLD	7.6 (4.2-13.8)	6.6 (3.5-12.3)
Male Gender	0.8 (0.5-1.2)	0.4 (0.3-0.6)

Abbreviations: CI = confidence interval; OLD = obstructive lung disease; OR = odds ratio.

* Adjusted OR derived from multivariable model which included: gender, hospital site, age, and OLD.

[†] Age OR interpretation is the following: odds change per additional year over 18.

Table 4

Secondary Data Analysis: Blood Gas Associations with Obstructive Lung Disease and Survival

Blood Gas Parameter	Death (N=16)	Survivor (N=2481)
	Mean $\pm$ SD	
pH ^{**}	7.15 $\pm$ 0.05	7.36 $\pm$ 0.01
PCO ₂ (mmHg)	68 $\pm$ 9.6	48 $\pm$ 0.5
PO ₂ (mmHg)	67 $\pm$ 17	47 $\pm$ 0.9
HCO ₃ ^{-*} (mEq/L)	20.4 $\pm$ 1.4	26.4 $\pm$ 0.3
	O.L.D. (N=85)	No O.L.D. (N=2412)
pH ^{**}	7.31 $\pm$ 0.05	7.36 $\pm$ 0.01
PCO ₂ ^{**} (mmHg)	54.6 $\pm$ 17	47.9 $\pm$ 0.9

Abbreviations: O.L.D. = obstructive lung disease; HCO₃ = serum bicarbonate; mEq/L = milliequivalents per liter; mmHg = millimeters Mercury; PCO₂ = partial pressure of carbon dioxide; PO₂ = partial pressure of oxygen.

* Indicates univariate p<0.05

** indicates p<0.01.

Table 5**Medications Used for Rapid Sequence Intubation**

Choice of Sedative	N (%)
Etomidate	23 (28%)
Propofol	18 (22%)
Ketamine	12 (15%)
Midazolam	5 (6%)
Diazepam	2 (2%)
Lorazepam	1 (1%)
Fentanyl	1 (1%)
None Used	17 (21%)
Not Documented	12 (15%)
Choice of Paralytic	
Rocuronium	28 (34%)
Succinylcholine	24 (29%)
None Used	18 (22%)
Not Documented	12 (15%)