Reintubation Rate and Mortality After Emergent Airway Management Outside the Operating Room

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Abstract

Background Little is known about reintubations that are performed outside of the operating room (outside-OR). Reintubation in general does not occur without risk and is associated with prolonged mechanical ventilation, higher incidence of nosocomial pneumonia, increased morbidity, mortality, and care of cost. The objective of this study was to evaluate the reintubation rate and mortality after emergent airway management outside-OR, including ICU and non-ICU settings.

Methods A retrospectives cohort study design was used to review all emergent airway management outside-OR. The primary outcome measures were reintubation rate and mortality. Secondary outcome measures were demographics, location of intubation, indication for intubation, time until reintubation, total intubated days, ICU-stay, hospital stay, 30-day in-hospital mortality, and overall in-hospital mortality.

Results A total of 336 outside-OR intubations were performed in 275 patients. Of those 275 patients, 51 (18.5%) were reintubated during the same hospital admission. Of the 336 performed intubations, 61 (18.1%) were reintubations. There was no statistical difference in admission demographics and comorbidities among reintubated and non-reintubated patients. Reintubations occurred after up to 30-days after extubation, including within 24-hours (8.2%, n=5), 24-72 hours (27.9%, n=17), 3-7 days, (23%, n=14), and 7-30 days after extubation (32.8%, n=20). Most of the reintubated patients were reintubated just once (56.9%; n=29), but some were reintubated two times (29.4%; n=15) or three times or more (13.7%; n=7). Reintubated patients had significant longer total ICU-stay (24±3 days vs. 12±1 day, $p < 0.001$), hospital stay (37±3 vs.18±1, $p<0.001$), and total intubation days (8±1 vs. 7±0.6, $p<0.02$) than non-reintubated patients. The 30-day in-hospital mortality in reintubated patients was 13.7% (n=7) compared to non-reintubated patients 35.9% (n=80; p=0.002).

Conclusion The reintubation rate was high, reaching 18%, in intubations performed outside-OR and is associated with a significant increase in hospital and ICU-stay. Almost half of the reintubation occurred in a non-ICU setting and more than 72-hours after extubation. The higher mortality rate among non-reintubated patients may indicate survival bias, in that severely sick patients did not survive long enough to attempt extubation. Further research is needed to identify the causes for increased reintubation outside-OR and the difference in mortality between the two groups.

Background

Little is known about reintubations that are performed outside of the operating room (outside-OR). Reintubation in general does not occur without risk and is associated with prolonged mechanical ventilation, higher incidence of nosocomial pneumonia, increased morbidity, mortality, and care of cost.

In the operating room (OR), most reintubations are done under a controlled environment, with adequate equipment and backup and under the supervision of attending anesthesiologists. Additionally, the cause of extubation failure and previous intubation history is usually well communicated between teams. In contrast, reintubations that occur outside of the OR are typically performed by a trained, designated

airway response team but may occur under less-ideal conditions with limited patient information and information regarding previous intubation.

Presumably most outside-OR intubations are performed in an ICU setting. Intensive care unit (ICU) reintubations are not as controlled as reintubations in the OR, but the ICU usually has sufficient personnel with critical care knowledge and a respiratory therapist available so that the procedure can be performed safely. Additionally, since patients' vital signs and clinical status is monitored continuously, reintubations in patients can be predicted and the primary team is prepared to notify the intubation team. However outside-OR non-ICU reintubations may occur in more difficult and challenging circumstances, with conditions that may include an unfamiliar environment, lack of equipment, and limited backup personnel. Patients also may have unexpectedly sudden acute respiratory failure or complication making the situation challenging. Additionally, patient history, communication between care teams, and information transfer may be limited during an emergent situation.

Compared to first time intubations, reintubations are generally more challenging for the intubating medical provider. The ICU literature reports a reintubation rate between 5%-47% within 24 to 72 h of planned extubation.[,] There is no clear consensus on an acceptable rate of reintubation in the ICU, but 5%-10% is reported to be optimal to prevent prolonged intubation or extubation failure. However, considering that 42% of primary intubations occur outside-OR in non-ICU settings, the reintubation rate in outside-OR, non-ICU setting will be as high accordingly. Since the setting and indications for reintubations in outside-OR non-ICU are different compared to an ICU setting, the ICU reintubation data can't be used for comparison. The objective of this study was to evaluate the reintubation rate and mortality rate after emergent airway management outside of the operating room, including both ICU and non-ICU settings. The null-hypothesis was that the reintubation and mortality rate is higher in ICU setting compared to non-ICU setting. The second null-hypothesis was that most reintubations would occur in an ICU setting within 24-hours of extubation.

Methods

The study design was a retrospectives cohort study. It was approved by the institutional review board and consent was waived. Data for all airway intubations at our institution were collected retrospectively over a 6-month period before Covid-19 pandemic. The location includes the acute care floors (587 beds), medical-ICU (23 beds), surgical-ICU (17 beds), cardiac-ICU (17 beds), neurosurgery-ICU (14 beds), and remote locations (CT, MRI, cardiac-catheterization-laboratory, interventional-radiology, endoscopy).

Inclusion criteria were all intubated patients outside of the operating room during the time period of the study. Exclusion criteria were patients that were unable to identify due to inappropriate documentation. The primary outcome measure of the study was reintubation rate (number of reintubations, number of reintubated patients) and mortality. Secondary outcome measures were location of intubation, indication for intubation, time until reintubation, total intubated days, ICU stay, hospital stay, 30-day in-hospital mortality, and overall in-hospital mortality. Demographics including age, sex, BMI, ASA status, and

comorbidity were collected on initial admission. No recalculation was performed for patients who had reintubation events. “Reintubation” was defined as endotracheal intubation during the same hospital admission after an endotracheal extubation. “Reintubated patients” was defined as the patient who were reintubated during the same hospital admission after an endotracheal extubation. This was important to distinguish because some patients experienced multiple reintubations during the same hospital admission.

Statistical analysis was performed to compare outcomes in reintubated patients vs. non-reintubated patients. Arithmetic mean, standard deviations, and 95% confidence intervals were used to report the patient’s demographics. Data were also reported as medians with interquartile range (IQR) when indicated. Statistical analyses were performed using Chi-Square, Fisher, and independent 2-tailed t-tests. Systat (Systat Software Inc., San Jose, CA) version 13 software was used.

Results

A total of 336 outside-OR intubations were performed in 275 patients during the six-month period. Out of those 275 patients 51 (18.5%) patients were reintubated during the same hospital admission (Fig. 1). Out of the 336 performed intubations 61 (18.1%) intubations were reintubations (Fig. 2). Out of the reintubated patients 59% (n = 30) were reintubated in the ICU setting and 41% (n = 21) in non-ICU setting.

Additionally, to the 61 reintubations, 2 postoperative reintubations in the PACU were reported. Both of these patients were reintubated within 10 min on arrival to PACU immediately after surgery. One patient was a 32-year-old male who was reintubated for negative pressure pulmonary edema after anterior and posterior ankle open reduction and internal fixation. The other patient was a 55-year-old male status post cadaveric kidney transplant and was intubated for acute respiratory failure due to intraoperative volume overload and pulmonary edema. Median admission ASA status of the reintubated patients was 3.5 ± 0.6, age 62.5 ± 15.5, and BMI of 29.7 ± 6.5 kg/m^2. There was no statistical difference in admission demographics and comorbidities among reintubated and non-reintubated patients (Table 1). The time between airway notification to completion of the airway note was 18.8 ± 11.4 minutes. Reintubation rate was the highest between 7–30 days of extubation (32.8%, n = 20) followed by 24–72 h (27.9%, n = 17), 3–7 days, (23%, n = 14), over 30 days (8.2%, n = 5) and within 24hours (8.2%, n = 5) (Fig. 3).

Table 1
Demographics of reintubated and not reintubated patients.

Demographics	Reintubated patients n = 51	Not reintubated patients N = 224	P value
Age	62.5 ± 15.5	59.0 ± 14.9	p = 0.787
ASA	3.5 ± 0.6	3.6 ± 0.5	p = 0.435
BMI	29.7 ± 6.5	30 ± 11.1	p = 0.439
Male	52.9% (27)	58.9% (132)	-
Female	47% (24)	41% (92)	p = 0.435
Comorbidity			
Hypertension	58.8% (30)	59.4% (133)	p = 0.935
Coronary artery disease	19.6% (10)	23.2% (52)	p = 0.578
Myocardial infarction	5.9% (3)	14.7% (33)	P = 0.091
Congested heart failure	9.8% (5)	18.8% (42)	P = 0.123
Atrial fibrillation	15.7% (8)	18.8% (42)	P = 0.600
Hyperlipidemia	27.5% (14)	32.6% (73)	P = 0.453
Diabetes	27.5% (14)	28.6% (64)	P = 0.921
Asthma	3.9% (2)	4% (9)	P = 0.975
COPD	15.7% (8)	10.7% (24)	P = 0.318
Pulmonary embolism (history)	9.8% (5)	11.6% (26)	P = 0.738
Cardiovascular accident	17.6% (9)	17% (13)	P = 0.907

Demographics	Reintubated patients n = 51	Not reintubated patients N = 224	P value
Gastroesophageal reflux disease	7.8% (4)	11.6% (38)	P = 0.436
Obstructive sleep apnea	2% (1)	7.7% (16)	P = 0.165
Chronic kidney disease	21.6% (11)	28.1% (63)	P = 0.332
Hemodialysis	7.8% (4)	15.2% (34)	P = 0.171
Sepsis	37.3% (19)	35.7% (80)	p = 0.836
Seizure	13.7% (7)	12.1% (27)	P = 0.752
Pulmonary hypertension	15.7% (8)	10.3% (23)	P = 0.257
Acute hepatic failure	17.6% (9)	14.7% (33)	P = 0.601
Hepatic encephalopathy	19.6 (10)	10.7% (24)	P = 0.082
Place of intubation			
Overall ICU reintubation rate	30/275 (10.9%)		P = 0.918
Overall non-ICU reintubation rate	21/275 (7.6%)		
ICU reintubation rate	30 (59%)		P = 0.918
Non-ICU reintubation rate	21 (41%)		
Called for Airway			
Code blue	9.8% (5)	8.4% (19)	P = 0.784
RRT	29.4% (15)	19.2% (43)	P = 0.107
STAT	27.4% (14)	31.7% (71)	P = 0.554
Other	33.3% (17)	41.1% (92)	P = 0.308
Indication for intubation			

Demographics	Reintubated patients n = 51	Not reintubated patients N = 224	P value
ARF	76.5% (39)	75% (168)	P = 0.826
Self extubation	5.9% (3)	4.5% (10)	P = 0.714
ETT change	0	1.3% (3)	P = 1.000
Airway protection	7.8% (4)	7.6% (17)	P = 1.000
Surgical patient	56.9% (29)	25.9% (58)	**P < 0.001**
Admitted medical service			
Medicine	23.5% (12)	30.4% (68)	P = 0.333
Pulmonology	19.6% (10)	11.6% (26)	P = 0.126
Surgery	15.7% (8)	14.7% (33)	P = 0.863
Orthopedic surgery	11.8% (6)	0.9% (2)	**P = 0.001**
Gastrointestinal	7.8% (4)	5.4% (12)	P = 0.508
Neurology	7.8% (4)	6.7% (15)	P = 0.761
Trauma	3.9% (2)	2.2% (5)	P = 0.617
Cardiology	2% (1)	7.6% (17)	P = 0.211
Emergency Medicine	2% (1)	4.9% (11)	P = 0.702
Neuro surgery	2% (1)	2.7% (6)	P = 1.000
Oncology	0	6.7% (15)	P = 0.082
Nephrology	0	1.3% (3)	P = 1.000

Demographics	Reintubated patients n = 51	Not reintubated patients N = 224	P value
Urology	0	1.3% (3)	P = 1.000
Family medicine	0	0.9% (2)	P = 1.000
Obstetric	0	0.9% (2)	P = 1.000
Other	3.9% (2)	1.8% (4)	P = 1.000
Hospital stay			
Total ICU stay days	23.6 ± 2.5 days	11.7 ± 0.9 days	**p < 0.001**
Hospital length of stay	36.9 ± 3.3 days	18 ± 1.1 days	**p < 0.001**
Total intubation days	8.0 ± 1.3 days	6.9 ± 0.6 days	**p < 0.02**
30 day in hospital mortality	13.7% (7/51)	35.9% (80/224)	**p = 0.002**
Expired/Overall in hospital mortality	23.5% (90/224)	40.4% 12(51)	**p = 0.029**

Of the reintubated patients, 56.9% (n = 29) were reintubated once, 29.4% (n = 15) twice and 13.7% (n = 7) three time or more (Fig. 4, Table 2). Intubated days after each reintubation is reported in Table 3. Reintubated patients had significantly longer total ICU stays (23.6 ± 2.5 days vs. 11.7 ± 0.9 day, $p < 0.001$), hospital stays (36.9 ± 3.3 vs. 18 ± 1.1, $p < 0.001$) and total intubation days (8 ± 1.3 vs. 6.9 ± 0.6, $p < 0.02$) than non-reintubated patients. The 30-day in-hospital mortality in reintubated patients was 13.7% (n = 7) compared to non-reintubated patients 35.9% (n = 80, $p = 0.002$). The overall in hospital mortality was 23.5% vs. 40.4% ($p = 0.029$) in reintubated vs. non-reintubated patients respectively.

Table 2
Reintubation time and location.

	reintubation (n = 61)	reintubated in ICU	reintubated in non-ICU	P Value
Reintubation < 24 h	5 (8.2%)	4 (6.1%)	1 (2.2%)	0.327
Reintubation < 24–72 h	17 (27.9%)	11 (16.7%)	6 (13%)	0.599
Reintubation 3–7 days	14 (23%)	9 (13.6%)	5 (10.9%)	0.663
Reintubation 7–30 days	20 (32.8%)	14 (21.2%)	6 (13%)	0.267
Reintubation > 30 days	5 (8.2%)	1 (1.5%)	4 (8.7%)	0.070
Total	61			

Table 3
Intubated days after each reintubation.

Duration of intubated days	
Intubated days after first intubation	7.9 ± 7.7 days
Intubated days after second intubation	7.1 ± 5.5 days
Intubated days after third intubation	7.6 ± 12.1 days
Intubated days after fourth intubation	5 ± 4.2 days

Conclusion

The reintubation rate was high, reaching 18%, in intubations performed outside-OR and is associated with a significant increase in hospital and ICU-stay. Almost half of the reintubation occurred in a non-ICU setting and more than 72-hours after extubation. The higher mortality rate among non-reintubated patients may indicate survival bias, in that severely sick patients did not survive long enough to attempt extubation. Further research is needed to identify the causes for increased reintubation outside-OR and the difference in mortality between the two groups.

Discussion

Reintubation rate and location

Our study found that 18% of patients were reintubated during the same hospital admission after they underwent an emergent airway management outside of the OR. Sub-analysis showed that out the 18% of reintubated patients, 43.1% of patients were reintubated more than twice during the same hospital admission. This is an important finding indicating that almost half of the reintubated patients required

reintubation again during the same hospital admission. The overall reintubation rate of 18% in our study is compareable to the ICU literature, which reports ranges from 5–40%. [5,6,7] Our study showed that the ICU reintubation rate was 10.9% and the non-ICU intubation rate was 7.6%. Considering the optimal reintubation rate in the ICU is reported to be 5–10%, it is within optimal range.[8] However a 7.6% reintubation rate in the non-ICU setting is an important finding, indicating that almost the same number of reintubations occur in a non-ICU setting as in an ICU setting. Airway providers might not be aware of this fact, which should be included in outside the operating room airway management training. There is limited literature to compare our study findings. Elmer et al. showed a reintubated patient rate of 14% in critically ill patients, however, 84% of these intubations occurred in the ICU setting. In our study, almost half (41%) of the reintubations that we reported occurred in a non-ICU setting. This information is important to an airway providers who needs to be prepared to reintubate in a less safe environment with limited resources that may lead to a higher risk of intubation related complications. Rothaar et al reported that in repeatedly intubated patients, procedural complications are more frequent during the last intubation compared with first intubation.[10]

Time of reintubation

Overall, 91% of reintubation occurred after 24 hours of extubation. Sub-analysis showed that out of the 91% reintubations 64% of reintubation occurred after 72 hours of extubation. Our study indicates that almost two third of reintubations occurred outside of a 24–72 h timeframe where patient may be monitored less frequently or downgraded care after initial extubation. Extubation failure is defined as inability to sustain spontaneous ventilation after removal of the artificial airway and need for reintubation within a specified time period. Most ICU literature defines extubation failure, as the need for reinstitution of ventilatory support within 24 to 72 hours of planned endotracheal tube removal. , However, in non-ICU settings, the timeframe from extubation to reintubation may vary from hours to days or weeks. Reintubation does not occur without risk and is associated with higher incidence of morbidity and mortality, prolonged mechanical ventilation, nosocomial pneumonia care of cost., Therefore, it is important to identify patients with risk for reintubation even after 72 hours. Possible markers leading to extubation failure includes severity of illness, premature extubation, upper airway edema, inability to clear secretions, weak cough, frequent suctioning, decreased level of consciousness, advanced age, poor nutrition and deconditioned muscles. Additional features that may predict reintubation include a rapid shallow breathing index over 58 breaths per minute per liter, a positive fluid balance during the 24 hours preceding extubation, and pneumonia as the reason for the initial intubation. Patients of age 65 and older with severe chronic cardiac or respiratory disease appear to be at particularly high risk for extubation failure.

We identified that orthopedic surgery patients had a significant higher risk of reintubation. Our studies reintubation rate is purely a descriptive analysis and indicates the rate of reintubation without evaluating the association or correlation with the initial extubation process.

Hospitals stay.

Our study found that reintubation resulted in a significant increase in total ICU stay, and hospital length of stay. This is not surprising since most intubated patient will be transferred to an ICU level care and the number of intubation events will correlate with an increase ICU and hospital stay. In our study, in the reintubated patient population the mean hospital stay was 36.9 ± 3.3 days, and the mean ICU-stay was 23.6 ± 2.5 days with a total intubation days of 8.0 ± 1.3 days. By comparison, Rosenberg et al. reported a mean ICU-stay of 4.6 days and hospital stay of 11.8 days. Finkielman reported the median ICU-stay of 6.5 days and Knaus et al. 3.3 to 7.3 days in a multicentre analysis including 42 ICUs. Our study finding indicates that patients requiring emergent intubation or reintubation have a 3–5 times longer ICU and hospital stay compared to the general ICU population. The aggregation of several diseases and complications, could have accounted for the prolonged ICU-stay, in addition to prolonged mechanical ventilation. Factors that have been reported to influence ICU-stay include specific medical conditions, like sepsis or acute respiratory distress syndrome. ICU accounts for approximately 7% of total U.S. hospital beds and 20–30% of the hospital costs. Therefore, identifying risk factors to optimize intubated patients and prevent reintubation may decrease ICU-stay and subsequent healthcare cost. Rapoport et al. reported that although differences in the intensity of treatment may lead to discrepancies, ICU-stay may be used as a surrogate measure of cost and hospital quality marker.

Mortality

The 30-day in-hospital and overall in-hospital mortality in the reintubation group was lower compared to the non-reintubated group, and we failed to reject the null-hypothesis. This was an unexpected finding and further analysis with regression model is needed to identify the cause of this significant finding. Survival bias may be the cause, in that the patients in the non-reintubated group did not survive long enough for extubation. A second hypothesis is that patients in the non-reintubated group underwent more frequent change to an DNR/DNI status after intubation. Overall, the 30-day in-hospital mortality and overall in hospital mortality rate was high compared to the literature. Lindenauer et al. reported a 30-day in hospital mortality of 11.1% in patients admitted with pneumonia. The ICU mortality reported in the literature is 7%-19%. ,, We believe that the mortality seen in our study is higher than the ICU mortality because the patients who required emergent intubation were overall more decompensated and had multiple comorbidities on admission. Epstein et al. reported that reintubation causes a higher risk of ICU mortality. Further analysis comparing the comorbidity of the general admitted population to the comorbidity of the in-hospital intubated population might be helpful to identify the severity of disease and enable comparison of both groups.

Clinical significance

Intubation, an invasive procedure, may itself increase morbidity and long-term mortality compared to the general patient population. This may be due to the life-threatening events during intubation, such as cardiac arrest, esophageal intubation, endobronchial intubation, aspiration of gastric contents and cardiac arrhythmias. The increased mortality after extubation failure may also reflect a sicker cohort of patients, and therefore act as an additional marker of severity of illness. It is important to know that extubation itself is a high-risk procedure causing adverse cardiovascular response and respiratory

complications. Tracheal extubation is associated with a 10–30% increase in arterial pressure and heart rate lasting 5–15 min.[14] Patients with coronary artery disease experience a 40–50% decrease in ejection fraction. Early postoperative hypoxaemia may be caused by inadequate minute ventilation, airway obstruction, increased ventilation perfusion mismatch, diffusion hypoxia, post-hyperventilation hypoventilation, shivering, inhibition of hypoxic pulmonary vasoconstriction, mucociliary dysfunction, and a decrease in cardiac output. A differential diagnosis of post-extubation upper airway obstruction (UAO) includes laryngospasm, laryngeal oedema, haemorrhage, trauma, and vocal cord paralysis/dysfunction. In general, patients > 65 years of age with underlying chronic cardiac or respiratory disease are at high risk for extubation failure and subsequent pneumonia and death. Contrasting with successful extubation, failed planned or unplanned extubation was followed by marked clinical deterioration, suggesting a direct and specific effect of extubation failure and reintubation on patient outcomes.[7]

Airway providers intubate and extubate patients outside of the operating room on a daily basis. This is a critical task in a critical environment and should not be underestimated. First it is important to understand the risk and patient demographic and outcome of the outside-OR intubations. Our study showed that a significant number of patients who had an emergent airway management outside the OR, were intubated before, during the same hospital admission. This means the patient should have medical records and documentation of the previous airway management available. In the absence of new or significantly worsening pathology, it is of value to have information regarding the ease of mask ventilation, ease of direct and/or indirect laryngoscopy, and with what airway devices they had success or failure. A previous intubation record is the single most predictable factor for a successful intubation and of great importance and should always be checked if possible. Second, it is a critical aspect of the hospital management to optimize the hospital course for any critically ill patient. Therefore, intubation and reintubation may serve as an additional independent marker of severity of illness or hospital quality measure. Identifying those patients with high risk and instituting quality improvement measures (e.g., closer monitoring, optimizing respiratory care) may reduce and duration of ICU and hospital stay and morbidity and mortality.

Limitations

It is difficult to generalize the findings of our study since the approach of the airway response team or airway management outside the OR is highly dependent on the hospital or institutional settings. Depending on the institution, an attending anesthesiologist, a resident, or a CRNA (certified registered nurse anesthetist) could be responsible for responding to an airway management outside-OR. Data collection from the intubation notes was a limiting factor. Only information that was pre-created as a check-off box was collected and analyzed. Additionally, demographics like BMI, ASA status, and comorbidity was recorded only on initial admission and might have changed over the hospital course. Whether the demographic change is associated with worsening outcome should be evaluated in future studies. Due to the retrospective nature of this study, the relationships of association or causality of

independent variables and risk factors cannot be clearly identified. For example, the mortality analysis in this study was purely descriptive without analysis of causality or association to the intubation. In general, mortality is a poor measurement for causality because of the complexity of diseases in addition to many unidentifiable confounders. [illegible] Finally, the literature to compare our outcome is limited since there are no studies looking at outcomes after emergent airway management outside of the operation room.

Conclusion:

We found that the reintubation rate was high, reaching 18%, in intubations performed outside of the operating room and these reintubations were associated with a significant increase in hospital and ICU stay. Almost half of the reintubations occurred in a non-ICU setting, and more than 72 hours after extubation and the null hypothesis was failed to reject. The mortality rate in non-reintubated patients was higher than the reintubated population, possibly due to survival bias. Severely sick patients probably did not survive long enough to attempt extubation. Further research is needed to identify the cause for reintubation and the difference in mortality between the two groups.

Abbreviations

ASA American Society of Anesthesiologist

BMI Body Mass Index

CRNA Certified Registered Nurse Anesthetist

ETT Endotracheal Tube

NPO Nil Per Os

OR Operating Room

PACU Post anesthesia care unit

Declarations

Ethics approval and consent to participate: The study was approved by the institutional review board and consent was waived. (Thomas Jefferson University Hospital IRB: #16D.030)

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and/or analysed during the current study are not publicly available due to institutaional HIPPA (Health Insurance Portability and Accountability Act) policy but are available from the corresponding author on reasonable request.

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Authors' contributions

UY designed the study, collected data, interpretation of results and wrote the manuscript

JM collected data and wrote the manuscript

MW collected data and wrote the manuscript

MT statistical analysis and review of the manuscript

EW Principal investigator and review of the manuscript

All authors read and approved the final manuscript.

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Figures

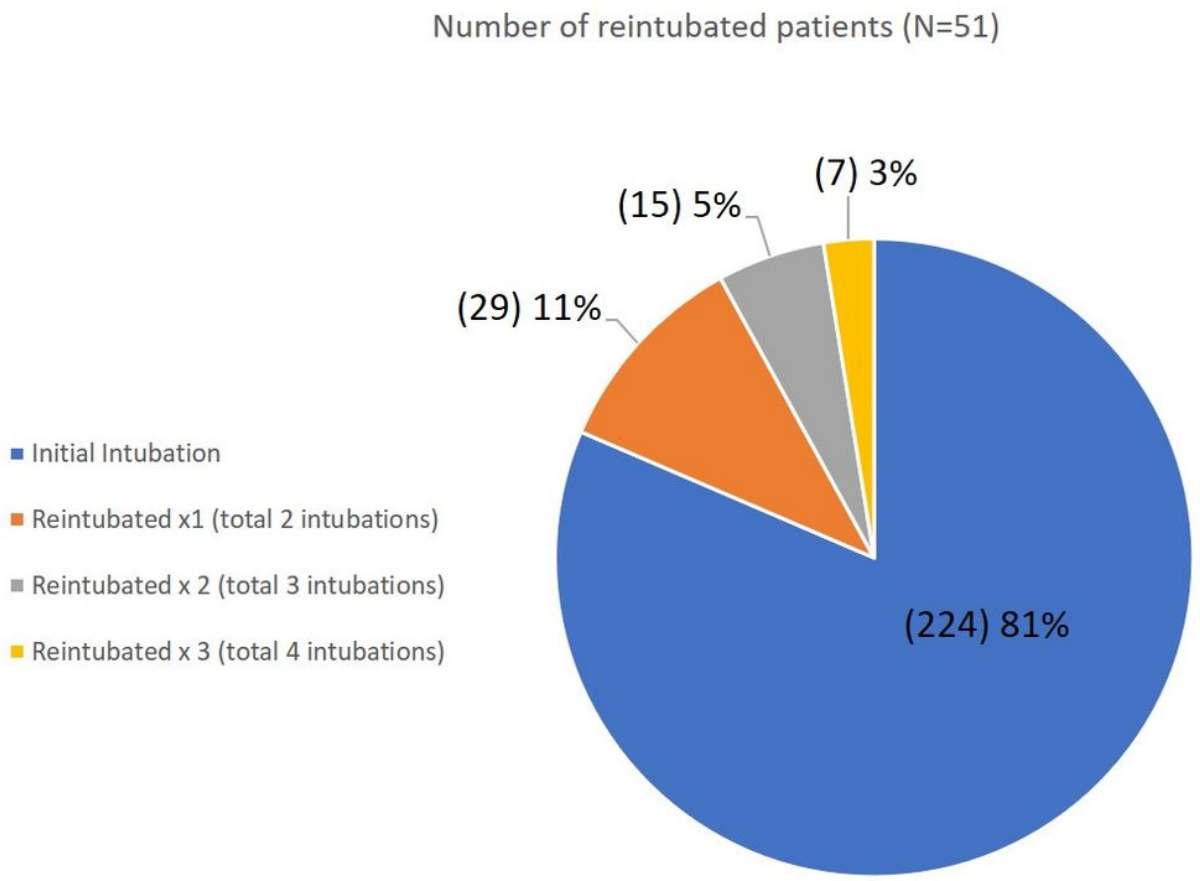

Figure 1

Number of reintubations in 51 patients.

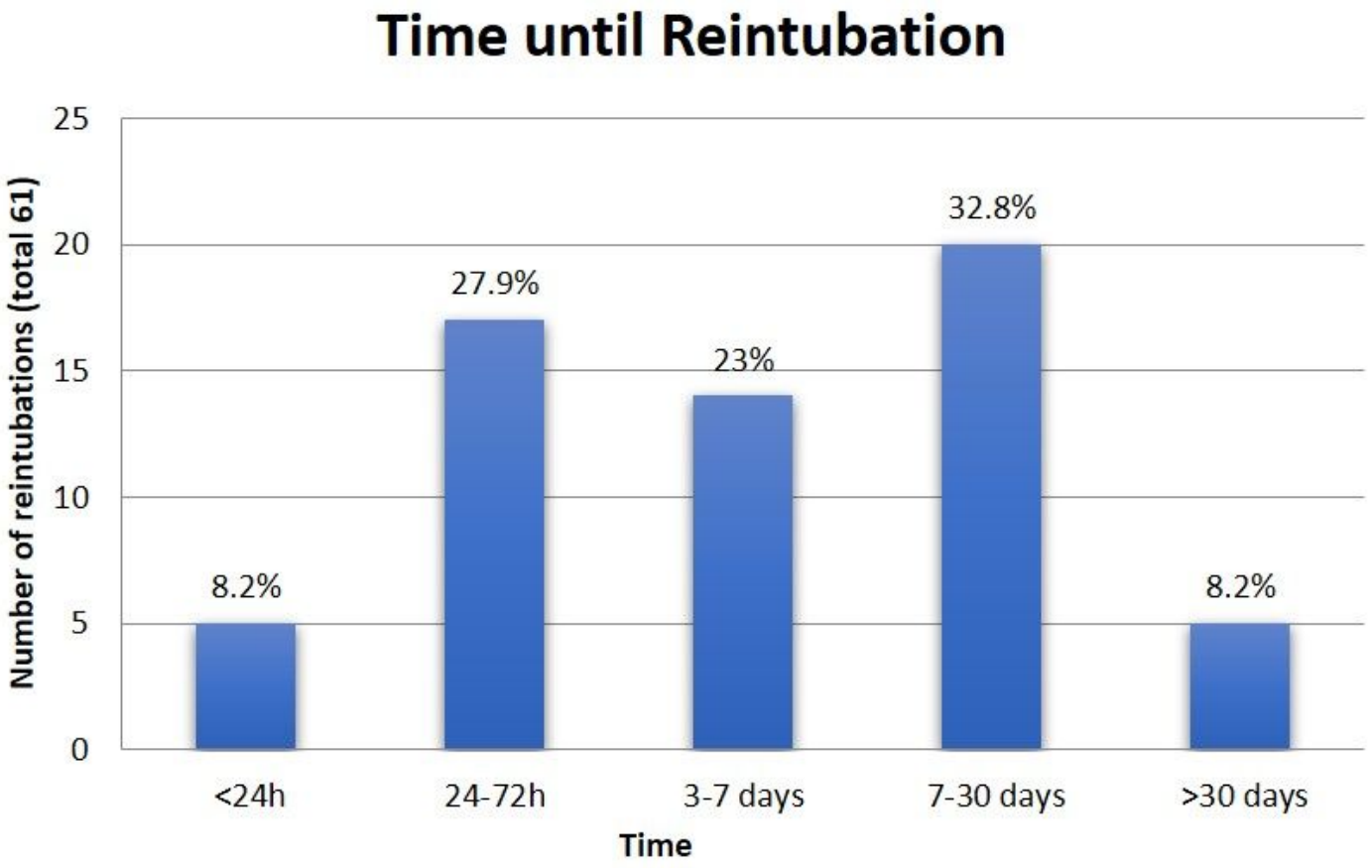

Figure 2

Time until reintubation after extubation.

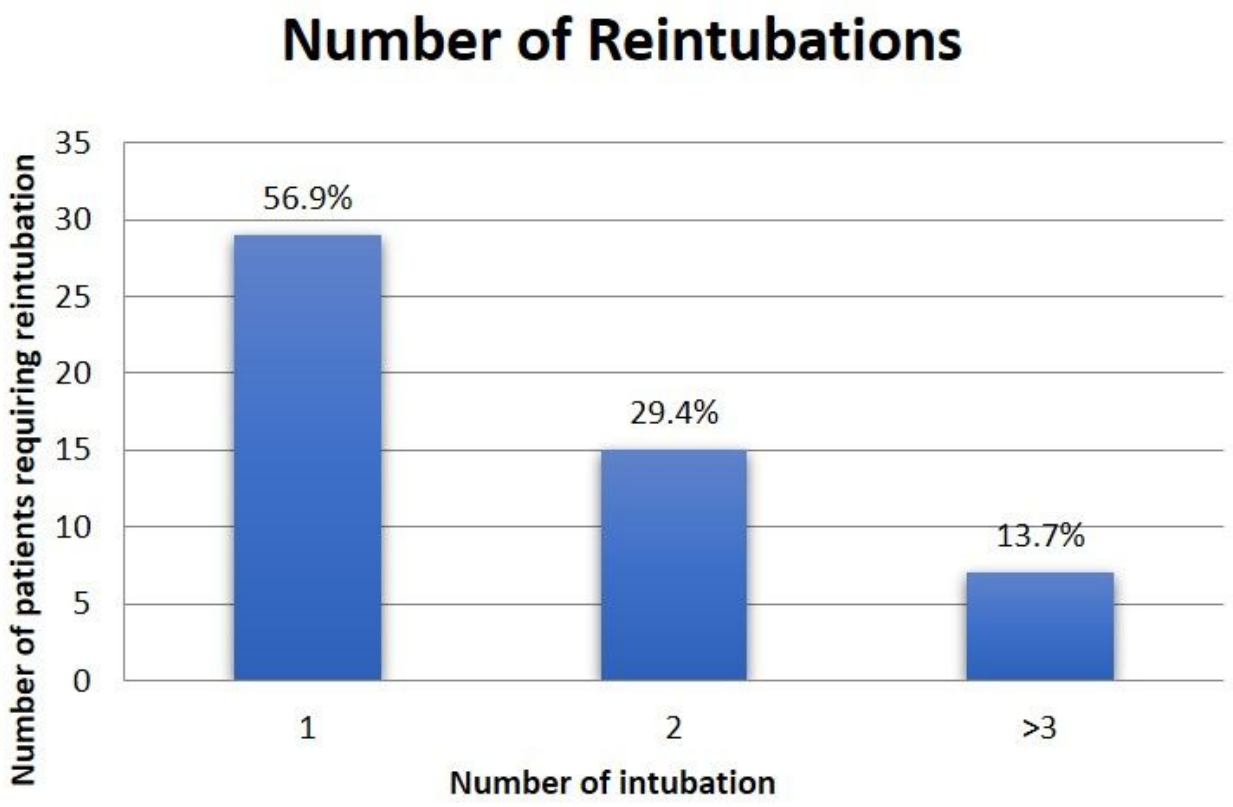

Figure 3

Number of reintubations.