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Original Article

Study of Reintubation in Intensive Care – A Retrospective Study

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Abstract

Introduction: In the intensive care unit (ICU), approximately 30% of all patients require mechanical ventilation. Reintubation is a high-risk procedure in critically ill patients. Anticipating a difficult airway and identifying high-risk patients can be life-saving. 10–20% of critically ill patients who are extubated will be reintubated within 72 h which leads to long-term ventilation-related complications such as ventilator-associated pneumonia and ventilator-associated lung injury, which greatly affect the length of stay and mortality in the ICU.

Aim: The aim is to study the causes, risk factors, and outcomes associated with reintubation.

Materials and Methods: In this retrospective study, clinical data of patients who were reintubated were collected and the factors associated with reintubation were analyzed.

Results: A total of 532 patients were intubated in the ICU, of which 25 cases (9.2%) required reintubation, 19 patients had diabetes, 17 of them had hypertension, and 14 had coronary artery disease. Majority of the patients improved after intubation and the mean ventilator stay after reintubation is 3.4 days. Among patients who were reintubated 9 patients were discharged after recovery, 4 patients were discharged against medical advice, 5 were discharged on request, and 7 patient died.

Conclusion: Reintubation is associated with more procedural complications such as hypoxia and hypotension and prolonged ICU stay, and the ICU team must be prepared for such complications. Laryngeal edema was also an observed complication in a few patients.

Key words: Intensive care unit, Reintubation, Risk factors

INTRODUCTION

Extubation failure and the need for reintubation within 72 h are common mishaps in the intensive care unit (ICU) setting which can lead to increased morbidity, longer length of hospital stay, and high treatment costs.[1] Reintubation is a common high-risk procedure, especially in critically ill patients. The ICU staff and the medical team should always anticipate a difficult airway and identify the high-risk category which will allow sufficient time for the preparation of life-saving measures. Unfortunately, there are very little studies that analyzed the difficulty and complications associated with reintubation in this critically ill population.[2] The high-risk category for extubation failure includes aged patients, high severity of illness at admission, pre-existing respiratory or cardiovascular diseases, and poor airway patency. Unresolved illness, development of nosocomial infections, or organ failure with progression from the extubation to the reintubation period or the reintubation itself are the possible reasons for morbidity and mortality.[3] The parameters to be considered to predict extubation failure are the respiratory mechanics, protection of airway patency, and preservation of the cardiovascular reserve. Before successful extubation, it is essential to analyze the secretions and adequacy of cough strength. The interventionist must be prepared for emergencies, must also identify the patients at high risk for extubation failure, and must institute early ventilation to avoid reintubation.[4] Once the illness resolves and the patient is liberated from the mechanical ventilator, the process is called weaning. Both

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weaning and extubation are distinctly separate processes which pose different problems. Extubation failure is the inability to sustain spontaneous breathing after detaining the artificial airway, endotracheal tube or tracheostomy tube, and the need for reintubation within 24–72 h or up to 7 days.[5]

About 10–12% of the ICU patients will be reintubated within 72 h of extubation[6,7] and literature suggests that about 40–90% of these patients present with laryngeal edema during laryngoscopy.[8,9] It is, therefore, assumed that reintubation is a more difficult procedure associated with more complications than the initial intubation. The interventional staff must adequately anticipate the occurrence of extubation failures and the potential need for reintubation which will allow sufficient time for selection of medications, equipment, and patient optimization, and this can appropriately reduce the high-risk reintubation and clinical management of patients.[10]

Numerous studies have attempted to determine the optimal rates of extubation failure and the need for reintubation, but there are no proven ideal predictive tests or models till date. The likely reason for this is the inability of the test parameters to adequately describe the overall physiological state of the patient and the need for continued airway maintenance and support. There are also challenges associated with the heterogeneity of the critically ill patients and profound differences in patient profile, extubation criteria, and practices in different centers which affect the predictive strategies.

Aim

The present study was aimed to analyze the causes, outcomes, and risk factors associated with reintubation.

MATERIALS AND METHODS

This retrospective study was conducted in a tertiary care hospital during the study period of 1 year, October 2017–

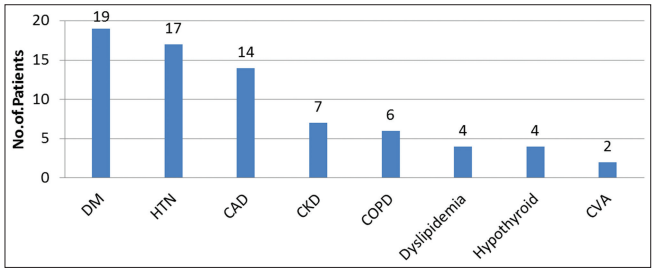

Figure 1: Comorbidities

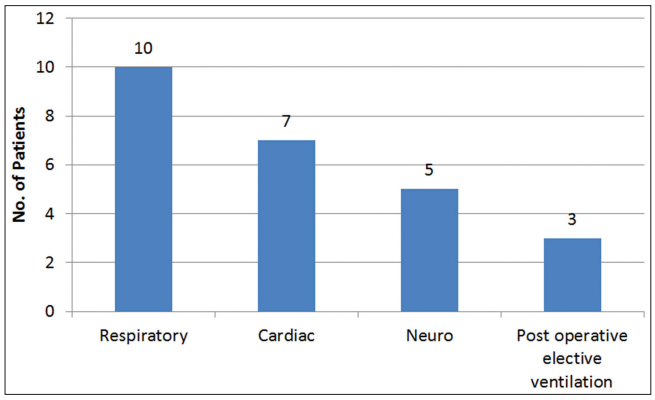

Figure 2: Intubation

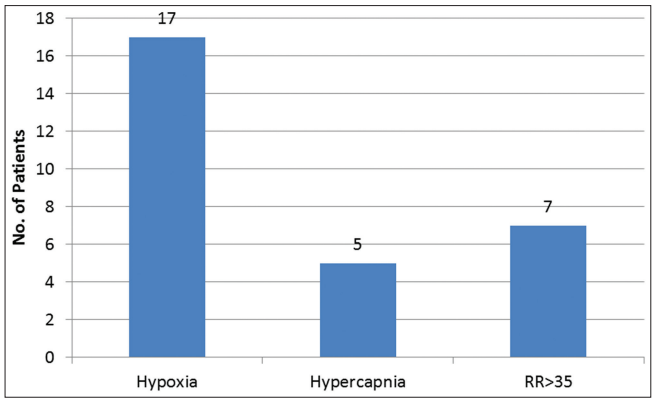

Figure 3: Respiratory indications

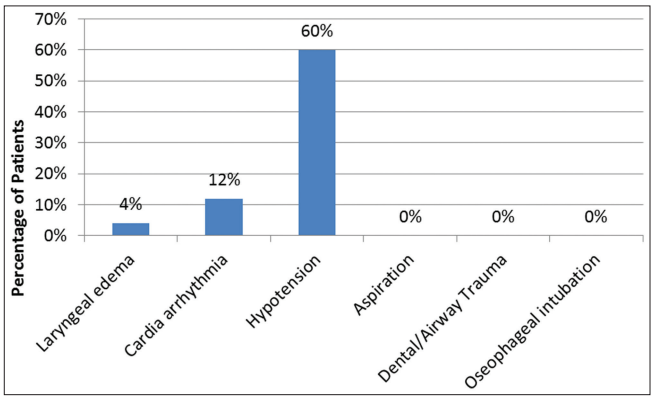

Figure 4: Complication

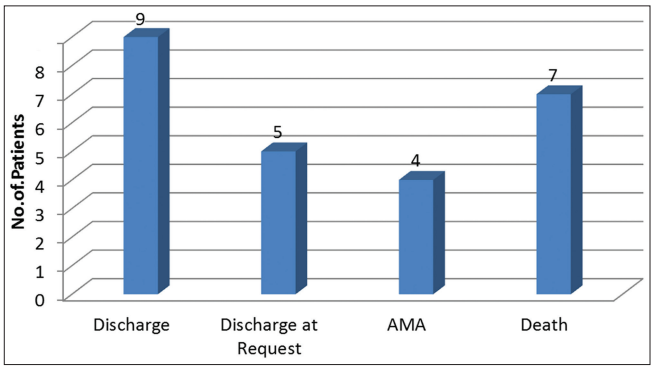

Figure 5: Outcome

October 2018. In this ICU, both medical and surgical patients are admitted.

Inclusion Criteria

All patients reintubated within 72 h of extubation were included in the study.

Exclusion Criteria

Pediatric patient, tracheostomized patient, and accidentally extubated patients were excluded from the study.

Reintubation Criteria

When the attending physician decided that reintubation is necessary, reintubation was carried out. Deterioration of mental state such as agitation, hemodynamic instability (tachycardia, arrhythmia, and hypotension), increased respiratory rate (RR), use of respiratory support muscle, decrease in partial pressure of arterial oxygen, and an increase in partial pressure of arterial carbon dioxide were considered to be indicators for the requirement of reintubation. Subjects in whom reintubation was required within 72 h after extubation were defined as reintubation cases.

Respiratory muscle fatigue, excessive airway secretion, weak cough, hypoxemia, and hypercapnia were defined as respiratory causes, whereas upper airway factors (laryngeal edema, mucosal ulcers, granulation, and vocal cord paralysis), hemodynamic instability, and lower level of consciousness were defined as non-respiratory causes. The baseline characteristics of the subjects are shown as mean and standard deviations (SD) for continuous variables and numbers and proportions for categorical variables.

RESULTS

A total of 532 patients were intubated in the ICU, of which 25 cases (9.2%) required reintubation. The median age of the patients was 68 with male predominance. The mean length of hospital stay of these patients was 16.52 days with an SD of 10.80 and the mean stay in ICU was 11.72 ± 6.85 days, in comparison with the average length of stay of the hospitalized patient of 5 days. Of the 25 patients who were reintubated, about 19 patients had diabetes, 17 of them had hypertension, 14 had coronary artery disease, and a few had other comorbid conditions such as chronic kidney disease, chronic obstructive pulmonary disease, and cerebrovascular accident and other associated conditions such as anemia, myopathy, and pleural effusion [Figure 1]. Most of the patients were intubated in-house, 10 were intubated for respiratory causes, 7 for cardiac reasons, and 5 for neurological reasons, and 3 were ventilated electively in the post-operative period [Figure 2].

The spontaneous breathing trial was initiated on day 2 for 9 patients. After sufficient assessment of respiratory parameters, hemodynamic stability, and CNS assessment, weaning was done with pressure support ventilation and synchronized intermittent mandatory ventilation. During which 17 patients could breathe spontaneously within the first 10 h and 7 patients in the next 11–24 h. After weaning, three patients were extubated on day 2 and seven patients on day 3, and within 7 days, 14 more patients were extubated to face mask, non-invasive ventilation, BiPAP, and non rebreathing mask and only one patient was extubated to room air. 13 patients required reintubation in the first 24 h (52%), 7 patients in the next 24–48 h (28%), and 5 patients after 48 h (20%). 13 patients were reintubated for neurological cause and 8 for cardiac instability. Hypoxia was noticed significantly, and increased work of breathing (RR >35) was observed in 7 patients and 5 patients had hypercarbia [Figure 3]. The heart rate was >90 in 18 patients and no significant changes in systolic blood pressure were noted. The complication associated was hypotension in about 60% of patients, laryngeal edema in about 40% of patients, and cardiac arrhythmia in about 12% of patients [Figure 4]. No aspiration was recorded. Majority of the patients improved after intubation, and the mean ventilator stay after reintubation is 3.4 days. Among these patients who were reintubated nine patients were discharged after recovery, 4 patients were discharged against medical advice, 5 were discharged on request, and 7 patients died [Figure 5].

DISCUSSION

The use of mechanical ventilation in the ICU is a double-edged sword. While being essential and life-saving, prolonged and unnecessary intubation may lead to a variety of complications associated with morbidity and mortality. A relative degree of extubation failure in the ICU setting is acceptable due to the optimal risk balance between the morbidities of extubation failure and prolonged ventilation. In this group of reintubated patients, procedural complications were noticed frequently than with the first intubation despite any differences in technical difficulties. The increase in complications without a corresponding change in technical difficulties leads to the suggestion that the patient's physiological conditions and the severity of the illness may be the reasons for such extubation failures rather than the anatomic factors.

In regard to this hypothesis, the risk of complications was more from the extubation to the intubation period. Peri-intubation hypoxia and hypotension were observed which are clinically significant and associated with increased mortality rates.[11,12] Contrarily, findings by Menon *et al*.

compared the complication rates and technical difficulties and found that there are no differences between the initial and subsequent intubations.[13] The complication rate in this study is within the observed range of 5–24% and is consistent with literature.[14,15]

The risk factors for extubation failure may include pre-existing left ventricular dysfunction, anemia, renal dysfunction, or large transfusion requirements.[16] Prolonged duration of ventilation before extubation and continuous sedation are also reported reasons for extubation failure.[17,18] Neurologic impairment and hypercapnia are independent risk factors. Prophylactic methylprednisolone administration based on the quantitative cuff leak test has been shown to prevent reintubation. Extubation failure and reintubation increase the risk of nosocomial infections by prolonging the hospital stay. Hence, proper precautionary care is paramount in avoiding the need for reintubation and thereby minimizes the associated complications in the critically ill.

The limitations of this study include the small sample size and the lack of sufficient detail to capture the more important complications. Furthermore, a few patients were pre-intubated before reporting to the in-hospital setting. Against this backdrop, the current study was performed with the aim of benchmarking the extubation failure and the complications associated with reintubation and the measures that can be adopted to achieve successful extubation, thereby contributing to the growing body of research data available in literature in this sector.

CONCLUSION

Reintubation is associated with more procedural complications such as hypoxia and hypotension and the ICU team must be prepared for such complications. Laryngeal edema was also an observed complication in a few patients. Procedural complications in the second reintubation could not be studied due to the small sample size of reintubation. Furthermore, it was noted that extubation failure with needed reintubation leads to increased morbidity, prolonged hospital, and ICU stay which increases the risk of nosocomial infections, especially ventilator-associated pneumonia, and also imposes an economic burden on the patient. For successful extubation, the interventionist should focus on competent airways, minimize secretions, and assess the cough muscle strength that will help clear the airway post-extubation and the adequacy in cardiovascular reserve.

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