

Airway Management Skills in Emergency Services

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ABSTRACT

Introduction

Endotracheal intubation in critically ill and injured patients is a high-risk procedure in an Emergency Room (ER). The risk of complications increases with repeated or prolonged attempts, making first attempt success primary goal for airway management in these patients. The primary objectives were to compare first pass success during intubation among various specialties with different level of airway management training and education.

Methods

This was a quantitative, observational, cross-sectional study conducted at Tribhuvan University Teaching Hospital for one year. The intubators completed an intubation data collecting form post intubation. After a failed first attempt, alternative methods such as using experienced intubators for subsequent intubation attempts were performed.

Results

In the emergency room, 265 attempts of endotracheal intubation were made on total 224 patients. Most common causes for intubation were stroke (49 [21.8 %]), sepsis (39 [17.20 %]), COPD (28 [12.20 %]), and head traumas (24 [10.90 %]). During endotracheal intubation, 185 (82.58%) patients had a successful first-attempt success, and 39 (17.41 %) patients required ≥ 2 attempts. First pass success was least among medical officers (13/20 (65%)), compared to other senior specialties ($p=0.01$).

Conclusion

With more training and education on the airway, first-pass success during endotracheal intubation increased. All front-line workers should consider it an ethical commitment to stay updated through lifelong learning, an obligation that should be made easier by governing bodies enforcing a thorough airway management training programs.

Keywords

Airway, complications, emergency physicians, emergency intubation, first attempt success, technique

INTRODUCTION

Controlling the airway quickly and safely is important for the effective care of critically ill and injured patients in the emergency room. Endotracheal intubation remains the gold standard in emergency airway management. The incidence of failed intubation was much higher i.e. about 1 in 50–100 in an early research on ER intubations.¹ Patients that require intubation in the emergency room are often hemodynamically unstable, hypoxic, and rarely nil per oral (NPO). The history, physical exam, and information are sometimes insufficient or limited in an emergency airway crisis. In addition, there is a limited amount of time to do a complete airway examination.² While patient-related aspects increase the likelihood of difficulties during airway care in critically ill patients, operator-related concerns should also be recognized and prepared for.

In Nepal, there is relatively little literature on quality assurance evaluations of intubations in the emergency room.^{3,4} The goal of our research was to find out about current airway management methods, success rates, medication used and acute complications of endotracheal intubations. Most importantly, first pass success was compared between various specialties with different level of training and education on airway.

METHODS

The Institutional Review Committee (IRC) of Institute of Medicine gave approval for the study of airway management in the ER. Treating the patient according to the standard institutional protocol for the management of the airway were done. The intubators were given instructions on how to fill out the intubation data collection form and the definitions of the problems were thoroughly clarified at the start of the research period.

The authors created an intubation data collecting form to gather data prospectively for this investigation. Patients presented to Tribhuvan University Teaching Hospital (TUTH), ER with acutely critically ill status in need of emergency intubation with written informed consent given by the legal guardians were the inclusion criteria for this study. Patients who arrived in the ER already intubated, terminally ill patients requiring airway treatment with a "Do Not Resuscitate" status, and patients with a Tracheostomy tube or stump requiring airway management were all excluded from the study. Information gathered included demographic data, indication for intubation, methods of intubation (RSI vs Crash), pharmacologic agents used, number of attempts needed for successful intubation, specialty of the intubators and immediate complications of intubation. In order to conduct this research, we divided intubation techniques into two categories

i.e. 1st pass success and success after ≥ 2 times. Some operational definitions of terms used were: -

- Attempts- Passage of the laryngoscope blade into the mouth.
- 1st pass success - Successful endotracheal placement of tube on 1st attempt.
- Success after ≥ 2 attempts - Successful endotracheal placement of tube after ≥ 2 attempts.
- Complications- Complications should occur within 10 minutes of completion of the intubation.
 - Desaturation- Oxygen saturation (SpO_2) below 90% before or after intubation.
 - Cardiac arrest- Loss of pulses during or immediately after intubation following Ventricular Tachycardia/ Ventricular Fibrillation (VT/VF).
 - Hypotension- Decrease in systolic blood pressure < 90 mm Hg that was not explained by other factors (eg, acute hemorrhage).
 - Aspiration- Witnessed regurgitation of gastric contents during intubation.
 - Equipment failure- Loss of light in the bulb of laryngoscope during intubation, suction failure, or defect in a pilot balloon.

Intubators with varied specialty did intubations in ER, which are enlisted below according to their experiences in descending order: -

- Medical officers (MO)- Medical graduates with MBBS degrees; first-line health workers
- Doctor of Medicine (MD) residents- (Post-graduate residents)
 - MD in General practice and Emergency Medicine residents (GP & EM)
 - MD in Anesthesia and Critical Care Medicine (EM posting)
- Doctorate of Medicine (DM) (Post-doctoral residents)
 - DM in Emergency medicine (EM)
 - DM in Critical Care Medicine (CCM) (EM posting)
- Faculty of Department of General Practice and Emergency Medicine (GP & EM)

Data collection was done from March 15, 2020 to March 14, 2021. Microsoft Excel 2018 program was used to enter and evaluate all of the data. Statistical significance was determined as a P-value of < 0.05 , and when feasible, 95 % confidence intervals (CI) were provided. Results were expressed in percentage (%). χ^2 -test was used to compare categorical data. SPSS (Statistical Package for the Social Sciences) version 25 was used for statistical analysis. The results are presented in a descriptive fashion.

RESULTS

Out of 242 patients, 18 (7.43%) refused written informed consent and only remaining 224 patients

Table 1. Demographics, indications and method of intubation of patients (n=224)

Characteristic	Frequency (%)
Age	
<18 years	11 (4.91)
≥18 years	213 (95.08)
Sex	
Male	134 (58.82)
Female	90 (40.17)
Indications for intubation	
Stroke	49 (21.80)
Sepsis	39 (17.20)
Pneumonia/COPD	28 (12.20)
Head injury	25 (10.90)
HE and GI bleed	17 (7.10)
Asystole and cardiac arrest	14 (6.60)
CKD	13 (6.20)
Op poisoning and other poisoning	13 (6.20)
Seizure related	7 (3.20)
Other	19 (8.60)
Methods of intubation	
RSI	147 (65.62)
Crash	77 (34.37)
Cricothyrotomy	1 (0.44)
Total	224

were enrolled in our study. There were 11 patients (4.91%) in the pediatric age group (<18 years) and 212 (94.64%) in the adult age group (≥18 years). The demographics of the study participants are shown

in Table 1. Because our institute has a separate pediatric emergency center for non-traumatic patients, we solely collected trauma-related intubations in the pediatric group.

The most prevalent causes for overall intubation were stroke (49 [21.8 %]), sepsis (39 [17.20 %]), COPD (28 [12.20 %]), and Head traumas (24 [10.90 %]) as stated in Table 1.

RSI was performed in 147 /224 (65.62 %) patients and Crash intubation done in 77/224 (34.37 %) patients. There was 1(0.44%) case of burn witnessed in our study requiring a Surgical airway (Emergency Cricothyrotomy). The most commonly used induction agents were Propofol, Ketamine, and Midazolam 68 (46.25 %; [CI 38.19–54.31]), 44 (29.93 %; [CI 22.52–37.33]), and 35 (23.80%; [CI 19.92–30.69]) respectively. Fentanyl was used most of the time in terms of analgesia 140 (95 %). Rocuronium was the more commonly used muscle relaxant than succinylcholine in our study, with 107 vs 39 (72.78 % vs 26.53 %).

During endotracheal intubation, there were total of 265 attempts. Of them, 185/224 (82.58%) patients had a successful first-attempt success, whereas, 39/224 (17.41 %) patients required ≥2 attempts, with 35/224 (15.62%) patients intubated on the second attempt and 2/224 (0.89 %) patients intubated on 3rd attempt and 1/224 (0.44%) patient required 4 attempts for successful endotracheal intubation.

In our study, 241/265 (90.94%) of the total intubations were performed by doctors working in ER. As indicated in Table 2, Medical officers had the lowest first-attempt success rate (13/20 (65%)), while

Table 2. Intubations done according to the specialty

Intubators specialty	Number of intubators	1 st attempt success	Success after ≥2 attempts	Number of intubations (% of total intubation)
DM EM Resident	2	71/78 (91.02%)	11/11 (100%)	89 (33.58%)
MD GP&EM Resident	6	83/106 (78.30%)	26/26 (100%)	132 (49.81%)
Anesthesia & Critical Care Resident + DM in CCM Resident	2+1	20/22 (90.90%)	2/2 (100%)	24 (9.05%)
Medical officers (MO)*	20	13/20 (65%)	-	20 (7.54%)
Total	31	185/224 (82.99%)	39/224 (17.41%)	265
		$\chi^2 = 80.35$, df= 3, p = 0.01	$\chi^2 = 22.61$, df= 2, p = 0.01	

Table 3. Intubation related complications (n=102)

Complications	Frequency (%)	CI	≥2 attempts	
Desaturation	36 (35.29%)	26.01-44.56	28	χ^2 value =18.26, df=4, p=0.01
Hypotension	22 (21.56%)	13.58-29.55	15	
Esophageal intubation	17 (16.66%)	9.43-23.89	17	
VT /VF	14 (13.72%)	7.04-20.40	6	
Aspiration	7 (6.8%)	1.95-11.76	5	
Equipment failure	6 (5.88%)	1.31-10.44	6	

residents of DM in EM had the highest first-attempt success rate (71/78 (91.02%)) followed by residents of Anesthesia & Critical care (20/22(90.90%)) which was statistically significant ($P=0.01$). The maximum number of intubations were done by MD in GP & EM doctors' group 132(49.81%).

Intubation-related complications were seen in 56 patients (25 %; CI- 19.32-30.67), with 11 patients (19.64 %) having one complication and three patients (3.57 %) having ≥ 3 . The most common complications were desaturation and hypotension, and there was a relation between complications and increase in number of intubation attempts. ($P=0.01$) as shown in Table 3. The number of complications positively correlated with the number of increases in intubation attempts ($P=0.01$). Cardiac arrest (VT/VF), which happened in 14 individuals, was the most severe acute complications in our study. Among them, eight of these patients were in agonal state, and intubation did not appear to be the cause of their deaths.

DISCUSSION

Airway management if not done correctly, would likely result in failure of all other resuscitative efforts. Therefore, all intubating team must be highly competent enough to perform this task successfully. To minimize complications, studies propose that airway managers should prioritize first attempt endotracheal intubations.⁵

Intubations in the ER are required at any time with little time for preparation and thus may often be performed by less experienced practitioners. Even in established hospitals in Nepal, most of the emergency intubations are provided by Medical Officers (MO) working in ER, and many are recent graduates of medical school.⁶ Our study showed, poor first pass success rates of Medical officers 13/20 (65%) compared to the other senior residents. Shortage of practical skill development trainings on endotracheal intubation could be the cause of the failure. Even though theory may be grasped, but they don't always know, how to put it into practice when the situation calls for it, and they fail to do so. Therefore, improving airway management skills requires creating effective training and assessment programmes.⁷ Local professional associations and government agencies should establish programs to teach health care providers on early airway management skills on a regular basis.

The most prevalent technique for achieving airway control was RSI 147/224 (65.62 %), which is consistent with other studies too.^{8,9} RSI has repeatedly demonstrated a better success rate and a lower or equal rate of adverse effects when compared to non-RSI techniques.⁹ In our study, most of the intubations in ER were done by post-

graduate residents than MBBS graduates (91.69% vs 8.3%). Increased familiarity with RSI, continuous emergency airway management education, and larger penetration of residency-trained doctors might all contribute to an increase in the rate of RSI in our research, but that may not replicate the scenario in most of the hospitals of Nepal, where MO's are the first-line health care givers.⁶ Again, the need of standardize protocol with checklist and mandatory trainings to gain competency to recognize types of intubation are to be emphasized.

According to our study, medication selection has shifted over time. In situations where, RSI medications were utilized, we found that midazolam and succinylcholine were traditionally used in more than 90% of all the encounters.^{3,4} Concerns about hyperkalemia, which can develop in individuals with renal failure, severe sepsis, myopathies, crush injury or burns, may limit enthusiasm for succinylcholine usage.¹⁰ Our findings imply that rocuronium is becoming more comfortable and familiar due to its benefits, which include a quicker onset, less side effects, prolong safe apnea time and the ability to reverse the effects using Sugammadex.¹¹ On the contrary, for patients with suspected difficult airway in emergency, especially in trauma patients, Succinylcholine remains the drug of choice due to its limited neuromuscular blocking activity of maximum 15 min vs 50 min of Rocuronium.¹²

Our complication rate was lower than reported elsewhere (56/224 patients (25%).¹³ Inadvertent esophageal intubations were observed to occur at a rate that matches earlier reports of emergency intubations 17 (16.66% CI 15.86-17.46).¹⁴ Equipment failure occurred in 6 (5.88%) patients. Human errors that cause difficulties during endotracheal intubations can be fully avoided by thoroughly checking and optimizing devices prior to intubation and practicing mock drills for preparation of the same.

This research has a number of drawbacks. Despite our best efforts to gather data prospectively, only 86.1% of respondents completed the data collecting form. We had to retrospectively record for 31 intubations to get the information we needed. As a result, some of the data is susceptible to the recall bias. The level of experience of the intubating doctor and prior training and workshops attained were not enquired. Another drawback is that the data form we utilized was filled out by intubating doctor himself, thus there was a risk of problems being under-reported. This study is only a descriptive evaluation of the airway management procedures. Finally, these data were gathered from a single facility where emergency medicine residents get extensive airway instruction and are constantly monitored by attending faculties. It's possible that extrapolating to another ER may not be appropriate.

CONCLUSION

With more training and education on the airway, first-pass success during endotracheal intubation increased. First-line health care workers lacked enough knowledge and expertise in airway management, necessitating periodic and mandatory training sessions. All front-line workers should consider it an ethical commitment to stay updated through lifelong learning, an obligation that should be made easier by governing bodies enforcing a thorough airway management training program.

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CONFLICT OF INTEREST

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