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Airway management practices among emergency physicians: An observational study

M. Jishnu, Sanjeev Bhoi*, Ankit Kumar Sahu, Soorya Suresh, Praveen Aggarwal

Department of Emergency Medicine, All India Institute of Medical Sciences, New Delhi, India
**Corresponding author*

Abstract:

OBJECTIVES: Emergency airway management is an integral part of patient stabilization. It is an essential skill for an emergency physician to master. There is a paucity of literature on airway management from low-to-middle-income countries like India where emergency medicine (EM) specialty is still in its infancy. We conducted this study to identify the existing airway management practices among emergency physicians in our tertiary care center. This study could pave the way for national airway registries.

METHODS: This prospective, observational study was conducted in the emergency department (ED) of a tertiary care center in India for 16 months. We included 166 patients who underwent emergency endotracheal intubation in the ED, irrespective of their age or underlying condition. The patients were observed for 15 min after intubation to identify any associated adverse events. We collected data about patients' demographic profile, indication for intubation, techniques of airway management, medications used, specialty of the physician performing intubation, use of preintubation and postintubation checklists, vitals before and after intubation, and any adverse events following intubation.

RESULTS: A total of 166 patients who required definite airway management in the ED were recruited for the study. The mean age of patients was 45.5 ± 20.1 years. Males comprised 61.4% of the patients. One hundred and forty-four patients were nontrauma cases and the remaining 22 cases were related to trauma. The most common indication for emergency airway management was altered mental status among nontrauma encounters and traumatic brain injury among trauma patients. Rapid sequence intubation (RSI) was the most common method employed (72.9% of cases). The most common agents used for induction and paralysis were etomidate and rocuronium, respectively. Direct laryngoscope was used in about 95% of cases. The first pass success rate in our study was 78.3%. EM residents were able to perform orotracheal intubation for all patients and none required a surgical airway. The incidence of adverse events within 15 min of intubation was 58.4%. Common complications observed were desaturation, right mainstem bronchus intubation, and equipment failure. Postintubation cardiac arrest occurred in around 5% of cases.

CONCLUSION: RSI remains the most common method employed for emergency airway management. There exists heterogeneity in the practice and its associated complications. Hence, regular surveillance, quality improvement, and training are imperative to provide good patient care.

Keywords:

Airway management, emergency physicians, intubation, observational study

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ORCID:
MJ: 0000-0003-0813-7362
SB: 0000-0002-5392-1976
AKS: 0000-0002-3232-9308
SS: 0000-0003-3622-1270
PA: 0000-0002-4611-5458

Address for correspondence:
Dr. Sanjeev Bhoi, Department of Emergency Medicine, All India Institute of Medical Sciences, New Delhi - 110 029, India.
E-mail: sanjeevbhoi@gmail.com

Introduction

Airway management is the priority in the stabilization of a critically-ill patient. It is an important part of the skill set of an emergency physician, which if not done properly can lead to significant morbidity and mortality.[1] Rapid sequence intubation (RSI), defined as intubation after rapid induction and paralysis, is a

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Box-ED section

What is already known on the study topic?

- Airway management is an important life-saving procedure performed by emergency physicians
- Rapid sequence intubation is performed by emergency physicians to stabilize the airway in critically ill patients.

What is the conflict on the issue? Has it importance for readers?

- Emergency medicine as a specialty is still growing in low-to-middle-income countries and there is a paucity of data from these countries about emergency airway management practices.

How is this study structured?

- This was a single-center, observational study of 166 patients who underwent airway management in the ED of a tertiary care center in India.

What does this study tell us?

- Emergency physicians are capable of securing a definitive airway in critically ill patients with a first-pass success rate comparable to that of anesthesiologists
- Development and adherence to airway management protocols may improve the existing practices
- Ongoing surveillance is needed to develop airway management protocols and resident training programs to provide quality care to patients.

widely adopted method of securing the airway.[2-6] Emergency Medicine (EM) is a fast-growing specialty in India with more residents now trained in EM and trauma care. Airway management in the emergency department (ED) is different from that in a controlled environment like an operating room (OR). With proper training, nonanesthesiologists are now just as capable of mastering the airway.[7]

Quality of care provided during a lifesaving procedure like endotracheal intubation should be monitored by closely observing the process.[4] Continuous surveillance is essential to define current practices in intubation and their influence on the outcome. Such surveillance can provide a benchmark for outcomes, including success and adverse event rates.[8] There are large multicentric studies and airway registries in existence in this regard.[8-10] However, research output on airway management from low-to-middle-income countries like India is still limited.

This study was conducted to identify current practices in emergency airway management, first-pass success rates and adverse events associated with the procedure. The data from our study can form the foundation for similar studies on ED-based airway management techniques in this part of the world. National airway registries can be formulated to analyze the gaps in the existing practices, develop institutional protocols, and enhance residency training programs.

Methods

This was a prospective, observational study carried out in the ED of a tertiary care teaching center in New Delhi, India. Institute Ethics Committee approval for the study was obtained on June 28, 2018 (Reference number: IEC 266/28.06.2018). Our ED caters to patients of all age groups presenting with trauma and nontrauma emergencies. We receive an average of 100,000 annual ED visits, of which around 10% are critically ill patients. Literature on airway management in the ED from India was limited. Thus, we planned an exploratory study based in India for the first time, with convenience sampling rather than a formal sample size calculation. Data collection was carried out from July 2018 to October 2019. We recruited 166 patients who underwent emergency endotracheal intubation in the ED, irrespective of their age or underlying condition. These patients were observed for 15 min after intubation to identify any associated complications. The authors did not interfere with airway management. Written consent was obtained from the next of kin or legally acceptable representative. We excluded patients who were intubated outside the ED and for whom consent was not provided.

Data were collected as per our pro forma which included the patients' demographic profile, indication for intubation, the technique of airway management, medications used, specialty of the physician performing intubation, airway assessment using LEON criteria, use of preintubation checklists for equipment and drugs, vitals before and after intubation, adverse events following intubation.

IBM SPSS statistical software (version 26.0.Armonk, NY, USA: IBM Corp) was used for data analysis. Data were tested for normality using the Shapiro–Wilk test and presented as mean (standard deviation), median (minimum-maximum), and frequency (percentage) as appropriate. No analytical tests were applied in any subgroups.

Results

A total of 166 patients who required definite airway management were recruited for the study. The mean age of patients included was 45.5 ± 20.1 years. Males

comprised 61.4% of total cases. Out of 166 cases observed, 144 were nontrauma cases and remaining 22 cases were related to trauma. The most common indication for emergency airway management among nontrauma encounters was altered mental status (GCS score ≤9). The most common indication among trauma cases was traumatic brain injury (68.2%) [Table 1].

RSI was the commonly employed method in our ED (72.9%). Oral intubation without any medication was carried out in 28 (16.9%) cases. Out of these 28 cases, 24 were crash intubation during cardiac arrest and the rest four were awake intubation.

Prior assessment of the patient by LEON criteria was performed in 75 cases, of which 13 were predicted to be difficult airways. Predicted difficulties were neck trauma, neck motion restriction by manual inline stabilization (MIS), carcinoma tongue, obesity, and short neck. The patient was placed in a flat position in the majority of cases (83.1%). Preintubation checklists for devices, drugs, and equipment were used in 71 (42.8%) cases. The most common device used for preoxygenation was bag valve mask. Apneic oxygenation through nasal prongs was used in 18 (10.8%) cases. Sedative agents used for induction were etomidate (47%), ketamine (24.7%), propofol (7.8%), fentanyl (1.8%), and midazolam (1.8%). Rocuronium was the most commonly used paralytic agent (64.5%) [Table 2].

Direct laryngoscope was used in about 98% of cases. BURP (backward upward rightward pressure) maneuver was used for better visualization of the glottis in about 23% of cases. MIS was performed in 21 of the 22 traumatic encounters. MIS was not applied in one case of penetrating abdominal injury with hemorrhagic shock. Cuffed endotracheal tube (ET) was used in 97% of cases. Five-point auscultation alone was performed for confirmation of tube placement in 140 (84.3%) cases. Clinical confirmation with five-point auscultation along with waveform capnography was used in 24 (14.5%) cases [Table 3].

In our study, all intubations were carried out by EM residents and their first-pass success was 78.3%. The

Table 1: Patient characteristics, indication and methods of intubation (*n*=166)

	n (%)
Age (years), mean±SD	45±20
Age distribution (years)	
<18	11 (6.6)
18–65	125 (75.3)
>65	30 (18.1)
Gender	
Male	102 (61)
Female	64 (39)
Indication for emergency airway management	
Nontraumatic condition (*n*=144)	
Altered mental status (GCS≤9)	52 (36.1)
Respiratory failure	42 (29.1)
Cardiac arrest	24 (16.7)
Hemodynamic instability	21 (14.6)
Others	5 (3.5)
Traumatic conditions (*n*=22)	
Traumatic brain injury	15 (68.2)
Polytrauma	3 (13.6)
Neck trauma	2 (9.1)
Hemorrhagic shock	2 (9.1)
Methods of airway management	
RSI	121 (72.9)
DSI	7 (4.3)
Oral intubation without medication	28 (16.8)
Sedation without paralysis	10 (6.0)

SD: Standard deviation, GCS: Glasgow Coma Scale, RSI: Rapid sequence intubation, DSI: Delayed sequence intubation

Table 2: Different airway management practices (*n*=166)

Parameter	Frequency, *n* (%)
Difficult airway assessment before intubation using LEON criteria	75 (45.2)
Difficult airway predicted before intubation	13 (7.8)
Patient position during intubation	
Flat	138 (83.1)
Head up/bed tilted	16 (9.6)
Pillow/occipital pad used	11 (6.6)
Ramped position	1 (0.6)
Airway opening maneuver	
Head tilt and chin lift	144 (88.6)
Jaw thrust	19 (11.4)
Chin lift alone	3 (1.8)
Preintubation checklist usage	71 (42.8)
Pretreatment with fentanyl	36 (21.6)
Preoxygenation time of ≥3 min	158 (95.2)
Method used for preoxygenation	
BVM	154 (92.8)
NIV	10 (6)
NRBM	2 (1.2)
Apneic oxygenation	18 (10.8)
Sedative agent used for induction	
Etomidate	78 (47)
Ketamine	41 (24)
Propofol	13 (8)
Midazolam	3 (2)
Fentanyl	3 (2)
No sedative	28 (17)
Paralytic agent used	
Rocuronium	107 (64.5)
Succinylcholine	16 (9.6)
Cisatracurium	5 (3)
No paralytic agent	38 (22.9)

BVM: Bag valve mask, NIV: Noninvasive ventilation, NRBM: Non rebreather mask

mean time for intubation (time duration of intubation after induction till achieving definite airway) was 2.65 ± 1.27 min in nontrauma cases and 2.19 ± 0.60 min in trauma cases [Table 3]. EM residents were able to perform orotracheal intubation for all patients and none required surgical airways.

The incidence of adverse events within 15 min after intubation was 58.4%. Common adverse events observed were desaturation (22.6%), right mainstem bronchus intubation (20.6%), and equipment failure (14.4%) [Table 4]. Equipment failure was related to laryngoscope blade or light malfunction, ET tube cuff leak, and ventilator malfunction. Postintubation cardiac arrest occurred in around 5% of patients.

Table 3: Equipments used, first pass success and adverse events (*n*=166)

Variable	*n* (%)
Type of laryngoscope used	
Macintosh	158 (95.2)
Miller	5 (3)
Video laryngoscope	3 (1.8)
Adjunct used during intubation	
Nonrigid stylet	79 (47.6)
Gum elastic ET tube introducer	74 (44.6)
No adjuncts used	13 (7.8)
BURP used in	38 (22.9)
Manual inline stabilization application	21 (12.7)
Type of ET tube used	
Cuffed	161 (97)
Uncuffed	5 (3)
Size of the tube used (mm), mean±SD	7.8±5.2
ET tube placement confirmation methods	
Clinical confirmation alone	140 (84.3)
Waveform capnography alone	1 (0.6)
Clinical + waveform capnography	24 (14.5)
Clinical + ultrasound guided	1 (0.6)
First pass success rate	130 (78.3)
Time taken for intubation (min), mean±SD	
Trauma cases	2.19±0.60
Nontrauma cases	2.65±1.27
Incidence of adverse events following intubation	97 (58.4)

BURP: Backward upward and rightward pressure, ET: Endotracheal tube, SD: Standard deviation

Table 4: Incidence of various adverse events following intubation (*n*=166)

Adverse event	Incidence, *n* (%)
Desaturation	22 (13.3)
Right mainstem bronchus intubation	20 (12.0)
Equipment failure	14 (8.4)
Bradycardia	11 (6.6)
Hypotension	10 (6.0)
Cardiac arrest	9 (5.4)
Aspiration of gastric contents	7 (4.2)
Esophageal intubation	4 (2.4)

Discussion

We studied 166 patients who underwent endotracheal intubation in the ED of a tertiary care teaching hospital in North India. All patients included in our study were intubated by emergency physicians trained in airway management. Majority of our patients were adults, whereas pediatric patients constituted only 6.6% of our study population which is consistent with similar studies.[3]

Altered mental status and traumatic brain injury were the common indications for endotracheal intubation among nontrauma and trauma patients, respectively. This finding correlates with that of the study by Brown *et al*.[2] At the same time, a study by Walls *et al*.[4] described cardiac arrest, followed by overdose as the most common indications for emergency endotracheal intubation.

RSI has emerged as the preferred method of endotracheal intubation in emergency conditions. In the ED, the status of the patient as well as the setting is vastly different from the controlled environment of an operating room where elective endotracheal intubation is performed. More than 70% of our patients underwent RSI which is in agreement with available data.[2,3,5,11] We found that only 4% of our patients underwent delayed sequence intubation (DSI). This was done in patients with preexisting hypoxia. Data on DSI in emergency settings are limited. There are a few studies showing DSI to be effective in securing the airway of hypoxic patients.[12]

Etomidate (47%) followed by ketamine (24.7%) were the most common agents used for induction in our setting. A study by Brown *et al*. supports our findings.[2] Rocuronium was used as a paralytic agent in 65% of cases, followed by succinylcholine (10%). In the past, succinylcholine was the preferred paralytic agent and was considered superior to rocuronium in RSI.[13,14] Nowadays, there is a growing trend toward the use of rocuronium in emergency settings.[2,15,16] Li *et al*. described rocuronium as a better agent than succinylcholine owing to its longer duration of action and fewer contraindications.[16]

The first pass success rate was 78.3% in our ED. Few studies have shown first-pass success rates of 70%–90%.[17,18] A systematic review and meta-analysis[8] set a benchmark of 84% as the first pass success rate. The difference in rates could be due to the performers in our study having varied levels of training and experience in airway management. Prior assessment of patients for the anticipation of a difficult airway is expected in all cases.[10,17] However, it was practiced in only 45% of our patients. This may also explain the lower first-pass success rate as compared to the benchmark of 84%.

Studies have also shown that the introduction of RSI by emergency physicians helped to achieve higher first-pass success rates which are comparable to that of anesthesiologists.[7,19]

Direct laryngoscope was used for glottis visualization in more than 95% of cases, whereas video laryngoscope was used in only 2% of cases. Some studies suggest the use of video laryngoscopes to increase the first pass success rate and to minimize the incidence of esophageal intubation.[20] At the same time, no significant difference was found with video laryngoscope as compared to direct laryngoscope in terms of first-pass success rates in the hands of an experienced performer.[21] Video laryngoscopes are still preferred in managing difficult airways.[22]

The COVID-19 pandemic and the surge of patients requiring emergency endotracheal intubation led to the search for methods to minimize the aerosol generation and thus reduce the risk of transmission of infection. The use of video laryngoscopes was suggested as a method which allows the performer to maintain a distance from the patient and achieve a successful outcome.[23]

Clinical confirmation of correct tracheal tube placement was commonly done by 5-point auscultation. The use of waveform capnography for the purpose of tracheal tube confirmation is quite low when compared to similar studies.[9] This disparity can be attributed to the failure to arrange capnography probes during the preparation step, limited availability of capnography probes, and performer preference for clinical auscultation.

Meantime for intubation in our study was 2.65 min among nontrauma cases and 2.19 min among trauma cases which are comparable to existing data.[2,8,24]

Intubation-associated adverse events were noted in about 58% of cases. Major events observed were desaturation, right mainstem bronchus intubation, equipment failure, bradycardia, hypotension, postintubation cardiac arrest, and esophageal intubation. The incidence of adverse events in our study group was higher compared to other studies conducted in ED settings.[2,17] This variation can be due to several factors such as underlying comorbidity, unanticipated airway difficulty due to lower rates of preintubation airway assessment and differences in procedural skills. Preintubation checklist usage in our study was limited which contributed to equipment failures and other postintubation adverse events. The lack of an institutional protocol on airway management practices may explain the poor adherence to the use of preintubation checklists.

Limitations

This was a single-center observational study with a sample size of only 166 patients. Pediatric and trauma cases formed a minority of our study participants; hence, the results cannot be generalized to these populations. Our study could not adequately explore a few patient-related factors (such as morbid obesity and pregnancy) and performer characteristics (such as level of training and experience in airway management). There is a need for large, multicentric ED-based studies to address these aspects in detail. This would help design a nationwide emergency airway registry to form protocols and set benchmarks in the field of emergency airway management.

Conclusion

Airway management practices have come a long way with methods like RSI. However, there still exists heterogeneity in the practice. Trained emergency physicians can manage the airway in critically ill patients with a comparable first-pass success rate to that of anesthesiologists. This study helped identify a few flaws in the system and possible solutions for better outcomes. There is a need for regular emergency airway audits and continuous quality improvement to address patient safety issues.

Author contributions statement

SB and PA conceived the study. JM and SS undertook the recruitment of participants and data collection. AKS provided statistical advise and analyzed the data. JM and SS drafted the manuscript and all authors contributed substantially to its revision. SB chaired the data oversight committee and takes responsibility for the paper as a whole.

Conflicts of interest

None Declared.

Ethical approval

This study protocol has been approved from ethical angle by Institute Ethics Committee, AIIMS, New Delhi w.e.f.28.06.2018 (IECPG-266/28.06.2018).

Consent to participate

Written consent was obtained from the next of kin.

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