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Original Article

Effect of the Use of an Endotracheal Tube (ETT) and Stylet versus an Endotracheal Tube (ETT) alone on first-Attempt Intubation Success and Duration

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ABSTRACT

Objective: To determine the effect of the use of an endotracheal tube and stylet versus an endotracheal tube alone on first attempt intubation success and duration.

Study Design: quasi-experimental study

Place and Duration of Study: Critical care Department of National Hospital and Medical Center, Lahore, Pakistan from Jun to Aug 20224.

Methodology: This quasi experimental study was done on 202 patients of either gender aged above 18 years, recruited from ICU of National Hospital, Lahore requiring ETT intubation. Written informed consent was taken from attendants. Demographic details of all patients were noted. Patients were divided into two Groups A (ETT+Stylet) and B (ETT only). Following parameters, SpO2 levels at start and end of intubation, total duration of intubation procedure, and success rate were noted.

Results: 1st attempt success rate noted was higher for Group-A 89(88.1%) vs B-76(75.2%), and this difference was statistically significant p=0.01. Time duration to complete intubation was also calculated to be significantly low for Group A patient 16.89 ±1.42 seconds vs 22.62 ±2.21 seconds, $p < 0.001$.

Conclusion: Our findings have suggested, that ETT+Stylet found to have more 1st-attempt success rate of intubation and it takes significantly less time to complete intubation in ICU setting, as compared when ETT used alone.

Keywords: Endotracheal tube, Intubation Duration, Intubation Success, Stylet,

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INTRODUCTION

Respiratory assistance is often necessary for patients referred to ICUs, and one of the most common maneuvers carried out in ICU is endotracheal intubation. According to INTUBE study, 45.2% patients had adverse event during intubation, even 3.1% suffered from cardiac arrest.[1] Increased 28-day death rates are associated with cardiovascular instability and hypoxemia, which are common after intubation. They can also have serious consequences such cerebral anoxia, cardiac arrest, and death. Those with peri-intubation adverse event had substantially greater death ratio. Therefore, individuals who are critically unwell are most at threat of intubation.[2] Complicated environments, different airway operative skill intensities, and patient's grave sickness are risk factors that raise the prospect of difficulties while intubating. If more than two tries are required for ETT intubation, it is considered as difficult and carries further higher risk of serious consequences.[1,2]

In operating room, tracheal intubation is done before to surgery in comfortable environment. However, it must be done right away in ICU during emergency situations under concerning circumstances. Critically sick patients may undergo tracheal intubation using different techniques. But most popular and standard of care is DL.[3] In skilled hands, it has high success rate; in less experienced hands, however, it lowers the likelihood of initial successful intubation in emergency situation when patient's health is bad and the operator is not skilled and also resulted in repeated intubations.[4] In order to minimise issues, it has also been proposed that the use of an endotracheal tube in conjunction with an intubating stylet facilitate tube insertion in cases when the endotracheal tube is difficult to pass.[5]

Recent reviews have looked at equipment designed to make tracheal intubation easier in intensive care unit. The stylet, introducer that fits into

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ETT and is both hard and flexible. Its purpose is to manipulate tube's shape, usually into shape of a hockey stick, so that it can pass through laryngeal inlet more easily. It also gives tube additional stiffness, which may facilitate its transit. Although stylet can improve intubation outcomes in operating rooms, there isn't much research on its efficacy at this time.[6]

Nevertheless, problems such mucosal bleeding, tracheal or esophageal perforation, and throat pain can result from the use of intubating stylets.[7,8] ETT alongwith stylet and bougie were used in one previous study.[9] Frequent use of stylets in ICU is still debatable, and current guidelines do not state clearly whether or not to use them for first-attempt intubation.[10]

We are conducting this study, comparing ETT intubation with or without stylet usage due to lack of local data and conflicts in previous results regarding stylet usage. Our outcomes 1st attempt success rate and time taken to complete the procedure, would be than applied for better patient care in ICU settings.

METHODOLOGY

This quasi-experimental study was conducted at the ICU of National Hospital, Lahore from 1st September 2024 to 1st October 2024. Sample size of 202 patients (101 in each Group) was calculated using WHO sample size calculator, using 5% Confidence level, 80% margin of error, 1st attempt success rate 87%9 for ETT+Stylet and 71.5%8 for ETT alone. 202 Patients meeting the selection criteria were randomly divided into 2 equal Groups, using lottery method. Study Group A(ETT+Stylet) and control Group B (ETT only). This study was conducted on 202 patients meeting the selection criteria.

Inclusion Criteria: Patients of either gender over 18 years of age, requiring endotracheal tube intubation in ICU.

Exclusion Criteria: Those who required intubation following cardiac arrest, prior intubation history during same ICU stay, age less than 18 years, and pregnant/lactating woman were excluded.

Ethical approval was taken from the IRB (REF: NHMC/HR/1045) dated 29-08-2024, National Hospital, Lahore.

The following data was taken including age, sex, BMI, quick Sequential Organ Failure Assessment score.[11] (Figure-1) at the time of intubation, reason for ICU admission, and pre-existing medical conditions. Patients were divided into two equal Groups A and B.

In Group A patients, tracheal intubation was performed using endotracheal tube paired with stylet designed with 'straight-to-cuff' configuration, featuring bend angle ranging from 25°-35°.However, in B Group tracheal intubation was conducted using only endotracheal tube without stylet. Rest of the procedure was remained same for both Groups. Size of laryngoscope blade (size 3 or 4) and size of ETT was decided by critical care resident on the basis of bedside assessment. Prior to intubation, fluid loading was done after excluding fluid overload and vasopressors were used if needed, preoxygenation using Bag-Mask ventilation was done. Patient was sedated by ICU nursing team using ketamine (1-2mg/kg) in case of haemodynamic instability or propofol (2-3mg/kg) in case of hemodynamic stability. Cricoid pressure was applied (Sellick manoeuvre) if needed and intubation was performed. After completion of intubation, time taken by intubation procedure was noted and ventilatory settings were done as decided by attending critical care doctor. Proper placement of ETT i.e. success rate was confirmed using clinical method (chest auscultation for bilateral breath sounds and absence of stomach inflation). Following parameters, SpO2 levels at start and end of intubation, total duration of intubation procedure, and success rate were noted (Figure-2).

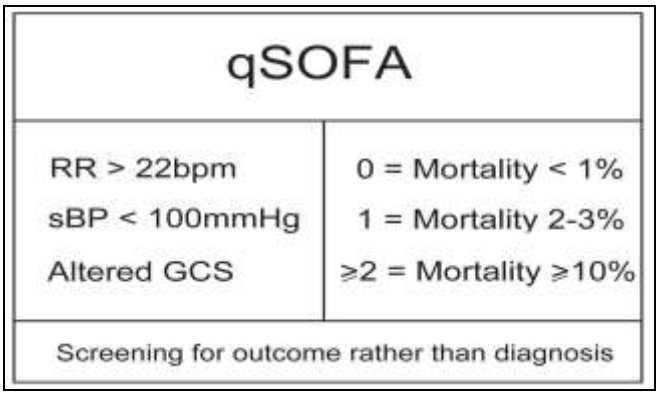

Figure-I: Quick Sequential Organ Failure Assessment Score12

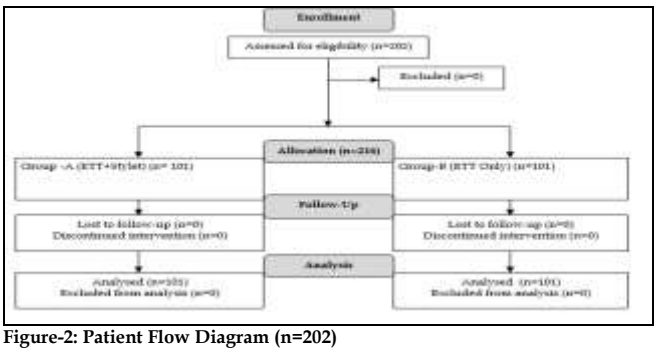

Figure-2: Patient Flow Diagram (n=202)

Data analysis was done using Statistical Package for the Social Sciences version 26. Quantitative variables like age, time taken by intubation procedure, SpO2 levels at start and end of intubation were presented as mean and standard deviation. Qualitative variables like gender, success rate, and reason for ICU admission were presented as frequency and percentages. Qualitative variables were compared among Groups using chi square, and quantitative variables were compared using independent sample t test. The *p* value ≤ 0.05 was taken as significant.

RESULTS

The demographic and baseline characteristics of the study participants are summarized in Table-I. The mean age in Group A was 51.53 ± 11.11 years, while in Group B, it was 51.51 ± 9.18 years. The mean BMI was comparable between Groups, with 21.92 ± 1.49 kg/m² in Group A and 21.97 ± 1.42 kg/m² in Group B. The mean qSOFA score was 2.14 ± 0.62 in Group A and 2.01 ± 0.58 in Group B. SpO_2 levels before intubation were similar, with 68.95 ± 11.19% in Group A and 68.16 ± 10.44% in Group B. However, post-intubation SpO_2 levels were significantly higher in Group A (92.10 ± 2.058%) compared to Group B (91.30 ± 2.166%), *p*-value 0.008.

Table-I: Comparison of quantitative variables among study Groups (n=202)

Parameters	Group A (n=101)	Group B (n=101)	*p*-value
Age (years) Mean±SD	51.53 ± 11.11	51.51 ± 9.18	0.98
Body Mass Index (kg/m2) Mean±SD	21.92 ± 1.49	21.97 ± 1.42	0.81
Gender			
Male	67 (66%)	72 (71%)	0.44
Female	34 (34%)	29 (29%)	
SPO2 (%) Before Intubation Mean±SD	68.95 ± 11.19	68.16 ± 10.44	0.60
qSOFA at Intubation Time Mean±SD	2.14 ± 0.62	2.01 ± 0.58	0.13
SPO2 (%) After Intubation Mean±SD	92.10 ± 2.058	91.30 ± 2.166	0.008

**SpO2: Peripheral Oxygen Saturation, Qsofa: Quick Sequential Organ Failure Assessment*

The diagnoses of patients admitted to the ICU are detailed in Table-II. Acute respiratory failure was more common in Group A (23.9%) than in Group B (11.9%). Post-surgical admissions were higher in Group B (13.9%) compared to Group A (5.9%). Septic shock was diagnosed in 9 patients (8.9%) in Group A and 14 (13.9%) in Group B. Cardiogenic shock accounted for 9 patients (8.9%) in both Groups. Other diagnoses included hemorrhagic shock (A: 8.9%; B: 7.9%), trauma (A: 7.9%; B: 8.9%), drug overdose (A: 9.9%; B: 4.9%), acute renal failure (A: 8.9%; B: 6.9%), coma (A: 6.9%; B: 3.9%), and other causes (A: 19.9%; B: 18.9%).

Table-II: Comparison of Diagnosis among Study Groups (n=202)

Diagnosis	Groups		*p*-value
	A n(%)	B n(%)	
Post-Surgery	6(5.9%)	14(13.9%)	0.125
Septic Shock	9(8.9%)	14(13.9%)	
Cardiogenic Shock	9(8.9%)	9(8.9%)	
Haemorrhagic Shock	9(8.9%)	8(7.9%)	
Trauma	8(7.9%)	9(8.9%)	
Drug Overdose	10(9.9%)	5(4.9%)	
Acute Renal Failure	9(8.9%)	7(6.9%)	
Acute Respiratory Failure	24(23.9%)	12(11.9%)	
Coma (GCS <8/15)	7(6.9%)	4(3.9%)	
Others	10(9.9%)	19(18.9%)	

1st attempt success rate noted was higher for Group-A 89(88.1%) vs B-76(75.2%), and this difference was statistically significant *p*=0.01. Time duration to complete intubation was also calculated to be significantly low for Group A patient 16.89±1.42 seconds vs 22.62±2.21 seconds, *p* <0.001 (Table-III).

Table-III: Comparison of study outcomes among Groups (n=202)

Outcomes	Group A (n=101)	Group B (n=101)	*p*-value
Success			
Yes n(%)	89 (88.1%)	76 (75.2%)	0.01
No n(%)	12 (11.9%)	25 (24.8%)	
Procedure Time (seconds)			
Mean±SD	16.89±1.29	22.62±2.21	<0.001

DISCUSSION

Endotracheal intubation, is one of the routine procedures needed to be done on daily basis. However, 1st attempt success rate varies depending on various factors. To increase the 1st attempt success rate of ETT intubation, numerous techniques are used.[13] In our study, we have utilized ETT intubation with stylet and compared it ETT intubation without stylet, in ICU patients requiring intubation.

We have studied total 202 patients, Group A-101 patients (ETT+Stylet) and B- 101 patients (ETT alone). Demographic details of patients among study Groups were equivalent, with no noteworthy variance noted. Mean age calculated in Group A and B was 51.53± 11.11years and 51.51± 9.18 years, respectively. In terms of patients' characteristics, average age of patients admitted in ICUs varies. Mean age calculated according to one study was 68 years, higher than our study mean age.[14] Another study has noticed mean age of 65 years, with more male patients, similar to our observation.[15] However, one study has calculated average age of ICU patients 53 years, close to our study populations average age.[16] These age variations, were mostly due to different age ranges studied. qSOFA has acceptable value in predicting mortality in critically sick septic patients, so we have measured qSOFA score in our study population at the time of intubation.[17]

Mean SpO2 calculated before intubation calculated was also alike among Groups. However, SpO2 after intubation calculated was high for Group A 92.10±2.058% as compared to Group B 91.30±2.166%, respectively (p=0.008). In current study, 1st attempt success rate noted was higher for Group-A 89(88.1%) vs B-76(75.2%), and this difference was statistically significant p=0.01. Time duration to complete intubation was also calculated to be significantly low for Group A patient 16.89±1.42 seconds vs 22.62±2.21 seconds, p=0.000.

Similar to our findings, one recent study noticed that 1st-attempt success rate noticed in stylet Group was higher 78.2% versus 71.5% in ETT only Group (P = 0.01). However, less patients 38.7% in stylet Group had complications, versus 40.2% in ETT only Group, however this difference was not significant; P = 0.64, similarly adverse events noticed was slightly higher for stylet Group 4.0% and 3.6%, respectively but this difference was also not significant; P = 0.76.8 Similar study was done on neonates, and found 81% success rate in stylet vs. 73% in ETT alone Group, but this variance was not statistically noteworthy. And time taken to complete intubation was less for stylet Group (16.2 ± 4.3 vs. 17.5 ± 5.0 s, p = .046).[18]

However, in another RCT comparing ETT+bougie versus ETT+Stylet and found that 1st-attempt ETT intubation success rate was greater when with bougie 96% as compared to stylet 82%. In this study, patients were incorporated from emergency department rather than ICU, which made the situation different from our study.[9] In another study, no noteworthy variances were detected in intubation procedure period between bougie and stylet approaches and declared that, use of bougie was not more effective than stylet during intubation. As a result, when choosing intubation method, one should take experience and personal choice of doctor into account.[19] With another RCT in favour of stylet use, and documented success rate was higher for stylet 83.0% versus bougie 80.4% and more patients 11.0% in bougie Group has SPO2 < 80%, compared with 8.8% in stylet Group.[20]

Another study was done, on 386 surgical patients who required general anesthesia and this study has noticed that stylet showed easy airway maintenance in 95.9% patients and 63.2% patients criticized throat pain and 67.4% about pharyngeal pain. Only 8.3% had sore throat and 11.4% had pharyngeal pain in control Group.[21]

Significant deficiencies in clinical practice were noted in one analysis, including inadequate patient identification, inadequate planning, shortage of qualified clinicians and tools, and failure to properly interpret intubation success. Nevertheless, no prior study has examined the present prevalence or effects of adverse peri-intubation events on patient survival.[2] To lessen the danger, following three steps should be taken; Prior to intubation, patient and team should have assessed for potential difficulty using tools such as MACOCHA score. They should also be prepared and optimized for difficulty by using checklist, getting necessary equipment, maximizing preoxygenation, and optimizing hemodynamics. Lastly, failure to restore oxygenation and lower the risk of cardiopulmonary arrest should be recognized and managed.[22]

It was noticed that use of stylet during ETT intubation considerably increases the success rate of first attempt and decreases the amount of time needed for intubation in ICU patients. Considering the significant risks associated with airway management, particularly in critically ill patients, our findings highlight the significance of employing efficient methods to maximize patient outcomes. Overall, results support the use of supplemental instruments such stylets in clinical settings to improve patient safety and efficacy of endotracheal intubation.

LIMITATION OF STUDY

This study has several limitations that should be considered. Firstly, non-randomized design could introduce

selection bias, affecting the validity of outcomes. Intubations were performed by different doctors, which may have led to variability in technique and operator experience, potentially influencing success rates. Additionally, we have not followed patients for complications comparisons and outcomes of patients. Further, research work would help to address this gap. Variability in patient conditions requiring intubation and use of different sedation agents may have influenced hemodynamic stability and overall intubation experience, which was not controlled in this analysis. These limitations suggest that further research is needed to confirm these findings and explore the impact of these factors on intubation outcomes.

CONCLUSION

Our findings have suggested, that ETT+Stylet found to have more 1st-attempt success rate of intubation and it takes significantly less time to complete intubation in ICU setting, as compared to ETT alone.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FI & MM: Data acquisition, data analysis, critical review, approval of the final version to be published.

SA & TH: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SM & AK & SK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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