



ORIGINAL RESEARCH PAPER

Anaesthesiology

ENDOTRACHEAL TUBE CUFF PRESSURES AMONG INTUBATED PATIENTS - A PROSPECTIVE OBSERVATIONAL STUDY

KEY WORDS: Endotracheal tube, Cuff Pressure, Pilot balloon palpation, Manometer

Dr. Kamreddy Anusha

Senior Resident, Department Of Anaesthesiology And Critical Care, Gandhi Medical College And Hospital, Secunderabad, Telangana State

Dr. Pitta Paramjyothi

Professor & HOD, Department Of Physiology, Government Medical College Siddipet Telangana State

ABSTRACT

Intubation is frequently required in many patients presenting to Emergency Medicine Department/Casualty. Manual palpation of pilot balloon is routinely used to determine the appropriateness of cuff inflation. It being a subjective method, there is always a risk of under/overinflation of cuff. In this study we objectively measured the cuff pressures in intubated patients in casualty. In this prospective observational study, cuff pressures of 240 adult intubated patients in casualty were objectively measured using a hand-held manometer of which 162 patients were those who were intubated in casualty and 78 patients were those who were intubated elsewhere and were referred to our hospital. An ideal pressure range of 20-30 cm H₂O was used for analysis. Mean cuff pressure in those who were intubated in casualty was 41.5±19.1 cmH₂O. Mean cuff pressure in those who were intubated elsewhere and were referred to our hospital was 56.4±35.3 cm H₂O. The mean measured cuff pressures were significantly different from the recommended standard value of 25cm H₂O (range-20-30cm H₂O) (p<0.05, one sample t-test). Among 162 patients intubated in casualty, only 71 patients (43.82%) were found to have cuff pressures in recommended range and among 78 patients who were intubated elsewhere and were referred to our hospital, only 18 patients (23.07%) were found to have cuff pressures in recommended range. Most patients whether intubated in casualty or received in intubated condition were found to have excessive cuff pressures. This study emphasizes the importance of objective cuff pressure assessment.

INTRODUCTION

Intubation is frequently required in many patients presenting to Emergency Medicine Department/Casualty. Endotracheal Tube cuff serves the purposes of preservation of Positive Pressure Ventilation and Positive End Expiratory Pressure, prevention of aspiration of secretions from upper airway and gastric contents, centering the tube to avoid trauma by its tip to the tracheal mucosa.

Manual palpation of pilot balloon is routinely used to determine the appropriateness of cuff inflation. It being a subjective method, there is always a risk of under/overinflation of cuff. Underinflation can predispose to aspiration and overinflation carries risks of tracheal mucosal and cartilaginous injuries which can lead to post-intubation hoarseness, sore throat¹, stridor,² blood-stained expectoration,³ tracheoesophageal fistula,⁴ tracheal stenosis⁵ and rupture.⁶

Possible damage from inappropriately high cuff pressures is a well-known hazard in long-term (days) ventilated patients but is a less recognized problem in short-term (hours) intubated patients. Nevertheless, there are reports demonstrating that mucosal damage also occurs in short-term (1-3 hours) intubated patients³.

In a study by Nordin et al⁷, conducted in intubated rabbit models, structural damage to trachea began to occur after only 15 minutes of intubation with high cuff pressures. Further the risk of compromised tracheal mucosal blood supply is high among patients presenting to emergency department in hemodynamically unstable conditions. The narrow time window to damage emphasizes the importance of appropriate cuff pressure assessment immediately after intubation in casualty.

The pressure of the cuff against the tracheal wall depends on the compliance of the trachea and cuff. Pressure measured at the pilot balloon of an ET tube cuff can be considered a good estimate of the pressure exerted onto the tracheal mucosa by the cuff.⁸ In this study, we objectively measured the cuff pressures in intubated patients in casualty.

After obtaining institutional ethical committee approval, the study was carried out in Gandhi Hospital, secunderabad. In this prospective observational study, cuff pressures of 240 adult intubated patients aged more than 18 years in casualty were objectively measured using a handheld manometer. Among these, 162 patients were those who were intubated in casualty and 78 patients were those who were intubated elsewhere and were referred to our hospital. An ideal pressure range of 20-30 cm H₂O was used for analysis.⁹

After intubating and inflating the cuff by the routine pilot balloon palpation method, cuff pressure was measured objectively by a handheld manometer and noted. For the patients who were intubated elsewhere and were referred, cuff pressure on arrival was measured and noted. Cuff pressure was then readjusted as required to the recommended range of 20-30cmH₂O. The manometer used in our study was AMBU Cuff Pressure Indicator. It has an air vent button and inflator bulb to adjust cuff pressure quickly and easily.



RESULTS

Mean cuff pressure in those who were intubated in casualty was 41.5±19.1 cm H₂O which was significantly different from the recommended standard value of 25cm H₂O (range-20-

METHODOLOGY

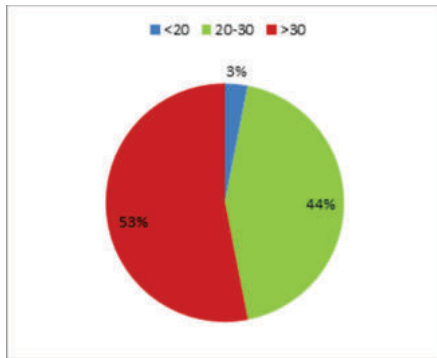
30cm H₂O) (p<0.05 one sample t-test).

Mean cuff pressure in those who were intubated elsewhere and were referred to our hospital was 56.4±35.3 cm H₂O which was also significantly different from the recommended standard value of 25cm H₂O (range-20-30cm H₂O) (p<0.05 one sample t-test).

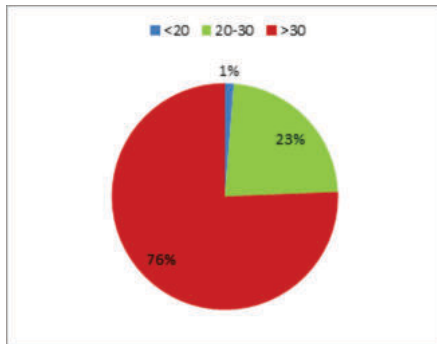
Among 162 patients intubated in casualty, only 71 patients (43.82%) were found to have cuff pressures in recommended range and among 78 patients who were intubated elsewhere and were referred to our hospital, only 18 patients (23.07%) were found to have cuff pressures in recommended range.

Table- Cuff Pressure Ranges Observed

	<20 cm H ₂ O	20-30 cm H ₂ O	>30 cm H ₂ O	
A-intubated in casualty	5 patients (3.08%)	71 patients (43.82%)	86 patients (53.08%)	162 patients
B-received in casualty in intubated state	1 patient (1.28%)	18 patients (23.07%)	59 patients (75.64%)	78 patients



A-Cuff Pressures Among Patients Intubated In Casualty



B- Cuff Pressures Measured On Arrival To Casualty Among Patients Intubated Elsewhere And Referred

DISCUSSION

The endotracheal cuff pressure must be high enough to seal the trachea to prevent any kind of micro or frank aspiration and must also be low enough to allow perfusion of tracheal mucosa.¹⁰ Endoscopic studies have shown a correlation between elevated cuff pressures and mucosal lesions¹¹. On the otherhand inadequate seal with low cuff pressures puts the patients at risk for micro-aspiration which is considered a major pathogenic mechanism for ventilator associated pneumonia.¹² Thus, a narrow range of cuff pressures is required to maintain a safe endotracheal seal without compromising the tracheal mucosal blood supply.

Anaesthesiologists are primarily responsible for airway management. In emergency situation, although the main focus is on stabilizing the patient, unless specific attention is paid to cuff pressure, there is always a risk of inappropriate

pressure and its consequences. Nordin⁷ histologically examined trachea of intubated rabbit models with cuffs inflated to various pressures. After only 15 minutes, structural damage started to occur with pressure higher than 30 cm H₂O. This timeframe may even be lower in emergency situations where most of the patients are in hemodynamically unstable condition with already compromised perfusion.

Although palpation of endotracheal tube pilot balloon is a common practice,^{13,14} several studies have demonstrated inability to accurately determine the cuff pressure by palpation alone.¹⁵⁻¹⁸

Mean cuff pressure in those who were intubated in casualty was 41.5±19.1cm H₂O in our study, which is consistent with study by Sengupta et al¹⁹ who reported a mean cuff pressure of 46±26cm H₂O in intubated patients under anaesthesia.

In our study, among the patients intubated in casualty, 53% had higher than recommended pressures when measured with the handheld manometer. Among patients who were received in intubated state, initial cuff pressure measured on arrival was higher in 76% of the patients. Such high percentage of higher cuff pressures emphasizes the need for appropriate assessment of cuff pressures.

Cuff pressure measurement with a manometer is simple with instantaneous result and the cuff pressure can be readjusted to the recommended safe range.

Limitations Of The Study

Some of the limitations of our study

- It is a single centre study
- In order to maintain uniformity in the study, we only included patients with endotracheal tubes. Patients with tracheostomy tubes were not included, although similar principles of maintaining safe cuff pressures holds good in them too.

CONCLUSION

Most patients whether intubated in casualty or received in intubated condition were found to have excessive cuff pressures. This study emphasizes the importance of objective cuff pressure assessment

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