MONITORING OF ENDOTRACHEAL TUBE CUFF PRESSURE IN OCCURRENCE OF VENTILATOR ASSOCIATED PNEUMONIA IN NEURO-CRITICALLY ILL PATIENTS

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Introduction

Neurocritically ill patients are highly susceptible to respiratory complications due to impaired consciousness, compromised airway reflexes, and neuromuscular dysfunction, predisposing them to oropharyngeal secretion aspiration and pneumonia. Ventilator-associated pneumonia (VAP), defined as pneumonia developing after 48 hours of mechanical ventilation, is a significant healthcare-associated infection in ICUs, associated with increased morbidity, prolonged ventilation and hospitalization, and a mortality rate ranging from 10% to over 50%. VAP pathogenesis involves micro-aspiration of contaminated secretions above the endotracheal tube (ETT) cuff, facilitated by disrupted airway defenses and biofilm formation. Maintaining ETT cuff pressure between 20 and 30 cm H2O, as recommended by organizations like ATS and IDSA, is crucial to prevent leakage. Despite these guidelines, there is no universally accepted standard for ETT cuff pressure monitoring frequency to maintain this accepted range, highlighting the need to investigate the relationship between monitoring practices and VAP incidence in this vulnerable population.

Aim of the work

The aim of this study was to compare infrequent endotracheal tube cuff pressure monitoring (immediately after intubation, every 8 hours, and when clinically indicated) with more frequent endotracheal tube cuff pressure monitoring (immediately after intubation, every 4 hours, any intervention with the patient and when clinically indicated) on the incidence of ventilator associated pneumonia in neuro-critically ill patients.

Patients and Methods

This observational comparative prospective cohort study enrolled 80 mechanically ventilated neurocritically ill adults (≥18 years) admitted to Alexandria University hospitals' ICUs. Trauma patients intubated <24 hours were included, while those with prolonged pre-screening ventilation, pre-existing lung conditions, immunodeficiency, or pregnancy were excluded. Participants were divided into two equal groups (n=40). The study group (Group 1) received endotracheal tube cuff pressure monitoring and adjustment to 30 cmH2O every 4 hours, and the observation group (Group 2) every 8 hours. Baseline data, including demographics and CPIS (<7), were collected. Daily VAP assessment using CPIS (0-14) was performed for seven days. VAP incidence, the primary outcome, was compared between groups using a chi-square test. All patients received standard VAP prevention bundle measures..

Results

Comparison was done between mean readings between the two groups over the 7 days showed that The more frequent monitoring of the endotracheal cuff pressure (every 4 hours) compared to monitoring of the endotracheal cuff pressure (every 8 hours) has shown consistent readings in both groups and steady along time, but there is a difference in the pattern of change in readings which has higher mean values in the study group (group1) than the observation group (group2) but it is not statistically significant. (Table 1)

Table 1: Mixed design repeated measures analysis of variance (ANOVA) test comparison of average endotracheal tube cuff pressure at different readings between the two groups.

	Group			
	Group2 (observation group)		Group1 (study group)	
	Mean	SD.	Mean	SD.
Mean Day1	22.05	1.82	24.28	2.15
Mean Day2	22.23	1.66	24.53	2.34
Mean Day3	22.67	1.90	25.26	2.23
Mean Day4	22.47	1.77	24.95	2.04
Mean Day5	22.31	2.38	24.63	2.14
Mean Day6	22.46	1.91	24.55	2.03
Mean Day7	22.29	2.04	25.25	2.18

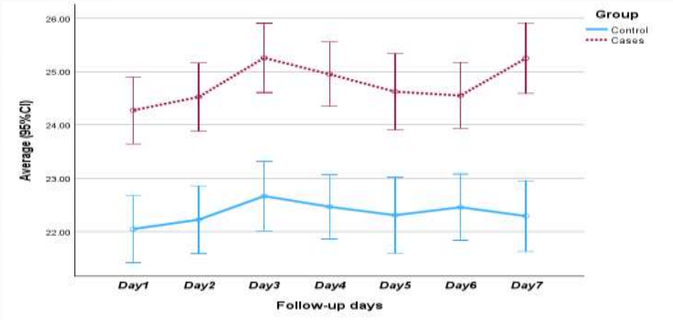

Figure 1: Error bar chart displaying results of mixed design repeated measures analysis of variance (ANOVA) test. Average endotracheal tube cuff pressure at different follow-up days 1-7 with respective 95% confidence interval (CI) separately for study and observation group.

Daily VAP assessment using CPIS (0-14) was performed. VAP incidence was compared between groups. (table 2)

Table 2: Comparison between Group1 (study group) and Group2 (observation group) groups according to CIPS score over time.

	Group (n.=80 patients)			
	Group2 (observation group)		Group1 (study group)	
	(CIPS < 7)	(CIPS >or=7)	(CIPS < 7)	(CIPS >or=7)
Day1	40	0	40	0
Day2	40	0	40	0
Day3	39	1	38	2
Day4	34	6	37	3
Day5	31	9	35	5
Day6	28	12	31	9
Day7	24	16	30	10

The occurrence of VAP by the 7th day was 26 cases of the 80 studied cases, The observation group (group2) had 16 cases of VAP out of 40 patients and the study group (group1) had 10 cases out of 40 patients. A chi-square test was performed to compare the proportion of patients with VAP in the study group (group1) 25% incidence rate vs. the observation group (group2) 40% incidence rate and results for the occurrence of VAP by Day 7 are: Chi-square statistic ($\chi 2$): 2.051 Degrees of freedom (df): 1 p-value: 0.152 Since the p-value (0.152) is greater than the significance level (α=0.05) There is no statistically significant difference in the incidence rate of VAP between the observation group and the Study group by Day 7.

Conclusion

This study demonstrated that maintaining endotracheal tube cuff pressure at 30 cm H2O through monitoring every 8 hours did not result in a greater incidence of under-inflation (pressures <20 cm H2O) compared to a 4-hour monitoring schedule. This study did not find a statistically significant difference in VAP incidence between the two monitoring frequencies. So, it is suggested to use the 8 hours interval without compromising patient safety or increasing the risk of micro aspiration and subsequent VAP. This less frequent monitoring schedule also offers the potential benefit of reducing nursing workload, allowing for more efficient allocation of nursing resources.