ijlpr 2022; doi 10.22376/ijpbs/lpr.2022.12.6.SP25.L73-78

International Journal of Life science and Pharma Research

ISSN 2250-0480

Research Article

Semi-Recumbent Positioning For Pneumonia

Effects of Various Degrees of Semi-Recumbent Positioning in Prevention of Ventilator-Associated Pneumonia

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Abstract: Ventilator-associated pneumonia (VAP) is one of the common complications occurring in patients predominantly in intensive care units. It is a respiratory tract infection that develops in patients who are intubated for more than 48 hours to 72 hours. It is commonly caused by pseudomonas aeruginosa, If the infection occurs within the first 48 to 72 hours, it is called "early-onset" and if after 72 hours is termed as "late-onset"[1]. Even though there are innumerable methods to decrease the infection and its associated morbidity we wanted to examine whether any changes in position were effective in its reduction. The experimental study was conducted on 30 samples collected in a consecutive manner. The study was performed in the Intensive care unit of a medical college hospital for a period of 2 months**.** The study included both male and female patients between 18 – 55 years who underwent mechanical ventilation for >48 hrs. Following inclusion criteria, patients were screened and randomly divided into 3 equal groups, Group A (35-degree recumbency), Group B (40-degree recumbency), and Group C (45-degree recumbency). The degree was measured by a protractor which was confirmed with available protractor software. The pre and the post (Clinical Pulmonary Infection Scores) CPIS scores were noted. The demographic variables were similar between the groups. There was a significant reduction of scores in Group B and C than A (p value <0.001) there were no major side effects. There were no dropouts. We conclude that both 40-degree and 45-degree recumbency significantly decrease CPIS scores than 35 degrees. Even though Group C is better than group B it's statistically insignificant.

Keywords: Intensive Care Unit, Ventilator, Pneumonia, Physiotherapy and Position Semirecumbency

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Received On 18 September 2022

Revised On 11 October 2022

Accepted On 14 October 2022

Published On 20 October 2022

Funding This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

Citation E. Shanmugananth, Zam Zam. Tsmo, Rekha.K, Naiya Doshi. Gopal Nambi. S and Parthasarathy.S* , Effects of Various Degrees of Semi-Recumbent Positioning in Prevention of Ventilator-Associated Pneumonia.(2022).Int. J. Life Sci. Pharma Res.12(6), L73-78 http://dx.doi.org/10.22376/ijpbs/lpr.2022.12.6.SP25.L73-78

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1. INTRODUCTION

Ventilated Associate Pneumonia is the second most common complication in critically ill patients, affecting 27% of ICU patients and it accounts for about half of all antibiotics given in intensive care units. Patients in the intensive care unit are at risk of dying not only from their critical illness but also from secondary processes such as nosocomial infection[2].The Mortality rate of Ventilated associated pneumonia is from 33% to 55%. The risk for Ventilatory Associated Pneumonia is greatest at 3% per day for the first five days,2% per day for 6-10 days,1% per day after day 10. The attributable risk of death has decreased and is more recently estimated at 9-13% largely because of the implementation of preventive strategies[3-8]. VAP is typically characterized by fever, purulent secretions, leukocytosis, increased respiratory rate, decreased tidal volume, and increased minute ventilation. These symptoms and signs may develop gradually or suddenly. VAP is especially common in people who have acute respiratory distress syndrome (ARDS)[1]. VAP primarily occurs in those intubated through (endotracheal tube, nasogastric tube, nasal intubation, tracheotomy) which allow free passage of bacteria into lower segment of lungs in a person who are immunocompromised. There is evidence that states mechanically ventilated patients stomach is often colonized by pathogens. In healthy patients, administration of drugs for stress ulcer prophylaxis facilitates gastric colonization with pathogens[8,9], whereas gastric acidity effectively prevents colonization instomach[10.] Patient with VAP are unable to provide any history because they are either sedated or their ability to communicate is impaired by the tubes. Treatment of VAP highly depends on causative agent responsible for the infection, and widely antibiotics prescribed before detaching the particular bacteria. (Vancomycin + ciprofloxacin). Prevention of ventilator associated pneumonia is must, It is necessary to implement various strategies to prevent exposure of the patient to the resistant bacteria, there are a few ways for limiting infection during the intubation period which is proper hand washing and hygiene procedures to be maintained. Sterile techniques for invasive procedures isolate individuals with known resistant organisms, aggressive weaning protocols, reducing the amount of sedation, changing the position of the bed, and making it more comfortable[11.12]. There are various treatment techniques used by physiotherapists in ICU. Whereas, Positioning for ICU patients plays a vital role. There are certain positions the promote the development of VAP and it is important for clinicians to understand that gastroesophageal reflux and pulmonary aspiration of oropharyngeal contents, even clearance of airway secretions can be highly affected by body positioning[3]. Elevation of the head end of the bed minimum of 30 degrees was used as a preventive strategy to lower the risk of aspiration[10]. The semi-recumbent position has been introduced in clinical practice to primarily avoid reflux of gastric contents and pulmonary aspiration of pathogens. The physiologic aim of the positioning is optimizing oxygen transport through its effects of improving ventilation/perfusion matching, increasing lung volumes, and preventing complications. Reducing the work of breathing, decreasing airflow resistance, increasing strength and quality of cough[10,11].

Various authors suggest that range of 30–45 degrees of semi-recumbent positioning is effective in the prevention of VAP. Positioning mechanically ventilated patients in an adequate semi-recumbent position is a low-cost and apparently easy-applied measure to prevent newVAP[11]. Although with current guidelines prevention of ventilator-associated pneumonia is considerable, since mortality rate is still high. Since there was evidencthat e found the semi-recumbent position accurately on preventing VAP, we proposed this study to compare the various angles of semi-recumbent positioning in the prevention of VAP. So the effective and safer intervention could be followed in clinical practice and thereby greater benefits could be obtained by patients. Even though there are studies that establish the use of semirecumbent position there are no direct comparisons of different degrees and their effects. Hence we tried with a primary outcome measure reduction in a two-week treatment regimen.

2. MATERIALS AND METHODS

2.1 Study Description

This study was conducted in a tertiary care medical center from 2019-20. The research protocol was in accordance with the declaration of Helsinki and was approved by the institutional research and ethical committee. An experimental study was performed on 30 mechanical ventilated patients. Samples were selected using the Consecutive convenient sampling method.

2.1 Inclusion and Exclusion Criteria

Inclusion criteria: The study included both male and female patients between 18 – 55 years who underwent mechanical ventilation for >48 hrs from the ICU. Exclusion criteria Study excluded those diagnosed with pneumonia at the time of intubation, acute pulmonary edema, patients who are re-intubated, acute myocardial infarction, cardiac arrhythmias, open heart surgeries, unstable cardiovascular injuries, and uncooperative patients.

2.2 Data Collection

Following the selection criteria patients were screened and randomly divided into 3 groups of recumbency, group (35 degrees), group (40 degrees), and Group C (45 degree) in 10 patients in each group. Ethical approval was obtained prior to initiation of the study by the institutional ethics committee and all the participants or the attendants were clearly explained about the study procedure, informed and written consent from the patient or patients relatives were obtained. Baseline data including age, gender, admission diagnosis, ventilatory mode, radiological features suggesting pneumonia are noted. CPIS scores were noted. Standard care was followed in the form of routine nursing care, pharmacological therapies, bronchodilators, antibiotics inhalational therapy as prescribed by a concerned physician. The change in ventilator parameter is adjusted by the intensive care physician as real-time care, according to the condition of the patient. After receiving the medical request and signed consent form by a physician for chest physiotherapy treatment.

2.3 Randomization and Grouping

The random assignment was done using a computer-generated random number. The protocol includes Group A which contains 10 patients treated with 35 degrees of semi-recumbent positioning and conventional chest physiotherapy, Group B contains 10 patients treated with 40 degrees of semi recumbent positioning and conventional chest physiotherapy Group C contains 10 patients treated with 45 degrees of semi-recumbent positioning and conventional chest physiotherapy.

The angle of semi recumbency was adjusted with a protractor app and confirmed manually with a protractor. (Fig 1) A reduction of scores by 20 % was taken as significant.

3. STATISTICS ANALYSIS

With a target population of 30000 patients and a 1 % incidence of ICU admissions, a 95% confidence level, and a 5 % margin of error, we found a sample size of 16 is enough for the study. We recruited 30 to adjust for dropouts. The mean and the standard deviation were analyzed by ANOVA using SPSS software 20.0 (USA). The non-parametric data were analyzed with Kruskal Wallis tests. Any side effects and the outcomes were noted.

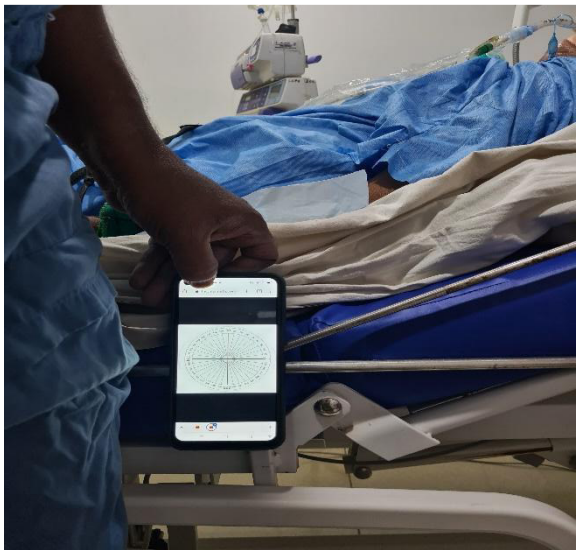

Fig 1 shows the technique of angulation

Conventional chest physiotherapy includes Chest percussion and vibration, Suctioning, and Positioning. A clinical pulmonary infection score (CPIS) was noted before and after the treatment schedule.

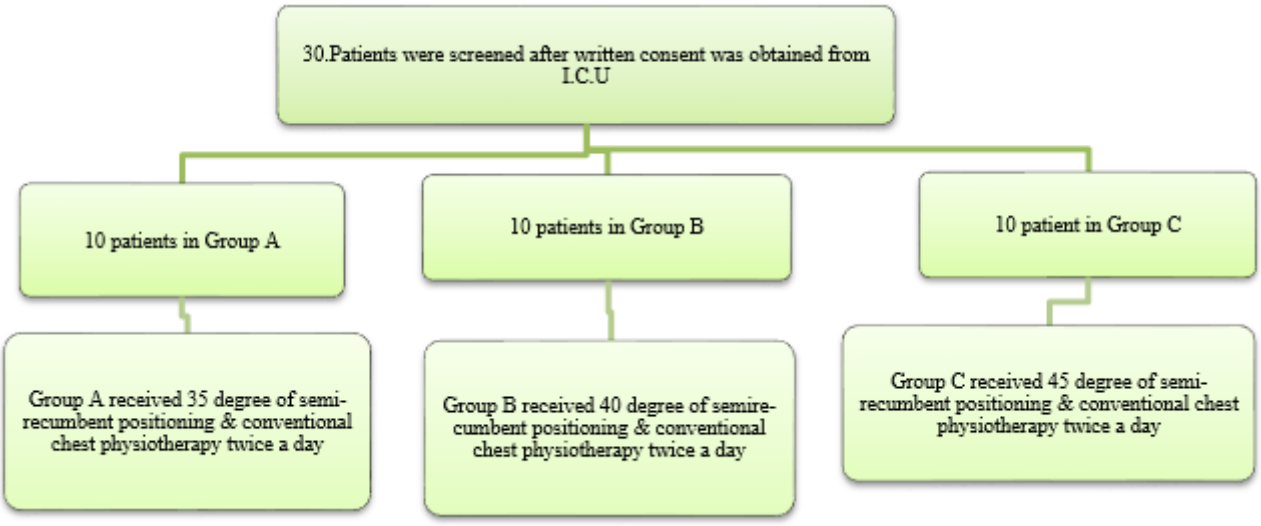

Fig 2 shows the study flow diagram

4. RESULTS

The demographic data used were analyzed through descriptive statistics The mean age was comparable between the two groups. The level of significance was considered through mean difference and ANOVA was applied. The CPI scores were significantly less in Groups C and B than A. The scores were better in C than B but without statistical significance. (see tables 1 &2)
(See Figures 2 &3)

Table 1: Showing Age distribution

GROUP	NUMBER	MEAN AGE	SD
A	10	32.1	11.47
B	10	33.8	11.30
C	10	32.7	11.82

Table 2: CPI – SCORES – SD – Standard deviation			
GROUP	PRE TEST	POST TEST	P VALUE
A	3.0	2.5	0.1
B	2.5	1.8	0.001
C	2.7	1.8	0.001

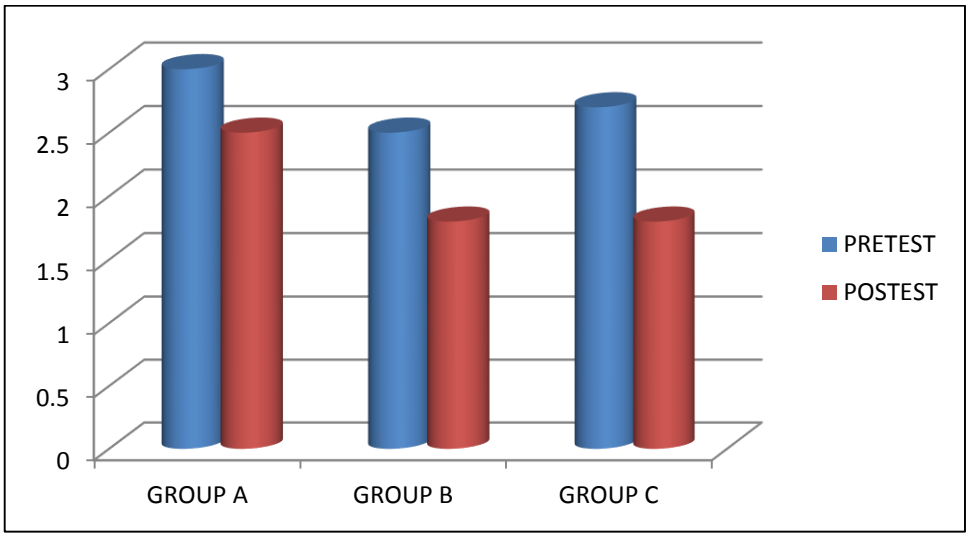

Fig 2: Within Group differences between PRE & POST Values

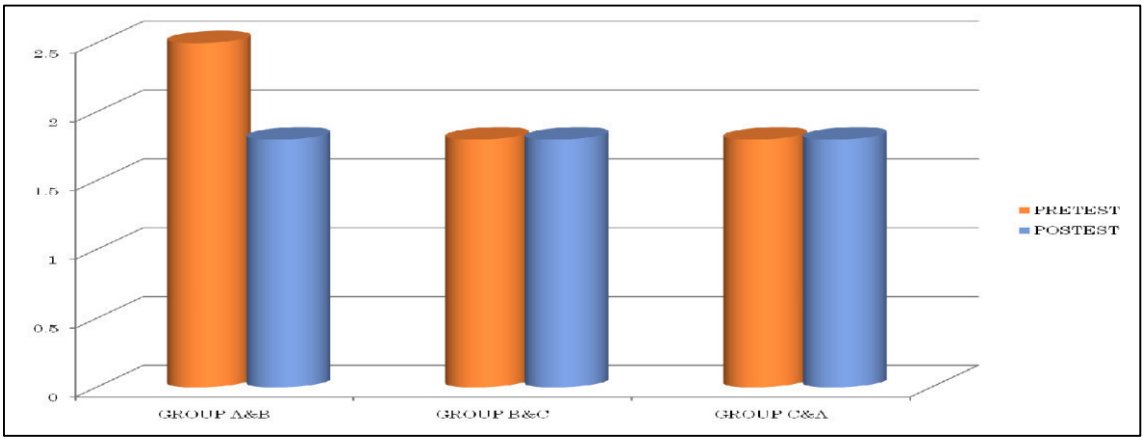

Fig 3: Between the groups difference PRE & POST Values

5. DISCUSSION

Ventilator-associated pneumonia (VAP), is a lung infection that affects patients who are mechanically ventilated for more than 48 hrs[1]. On referral from old studies, the has been performed in patients who fulfilled the inclusion criteria. This study was conducted on 30 patients with 10 members in each three groups. The outcome used are clinical pulmonary infection score. After 5 days of treatment, there was a significant reduction in clinical pulmonary infection score. The groups were synchronized with age and gender. All the participants were treated with standardized programs. Patients in Group B&C was more significant statistically than Group A. This means 45 degree of semi-recumbent position along with conventional chest physiotherapy was highly effective in the prevention of ventilator-associated pneumonia. Hess et al have proposed various procedures such as the use of rotational beds, prone lying, and semi-recumbent position to prevent ventilator-associated pneumonia and concluded that semi-recumbent positioning in 45degree is more effective in patients with ventilated-associated pneumonia. Another study investigated the effectiveness of physiotherapy in preventing pulmonary complications for intubated patients receiving mechanical ventilation and concluded that physiotherapy helps to facilitate earlier weaning, reduces the reoccurrence of complications, and shortens the length of hospital stay. Ibanez et al &Orozco-levi et al stated that when semi-recumbent is compared with supine position, the semi-recumbent position essentially prevented pulmonary aspiration while decreasing Gastroesophageal reflux disease in patients who are mechanically ventilated through nasogastric tube[11]. Thomas ST Li, Gavin M. Joynt et al proposed the study on Semi-recumbent position in ICU and stated that some angle of bedrest elevation is necessary to prevent VAP. Although it is possible that a smaller angle is sufficient, currently a target of 30-45 degrees appears reasonably effective[11]. Metheny, RN,PhD Rita et al investigated the effectiveness Head-of-Bed Elevation in Critically ill Patients and stated that the optimal HOB elevation to balance the risks for aspiration in a population of critically ill, tube-fed patients receiving mechanical ventilation. They also suggested that studies be conducted to compare the commonly recommended 30^0 to 45^0 HOB elevations to lower

and more achievable levels (such as 10^0 to 30^0). HOB elevation of 45^0 in patients who are receiving mechanical ventilation and tube feedings. For critically ill patients at less risk for aspiration maintain a HOB elevation of at least 30o unless medicallycontraindicated[13]. Another study also proposed a study on ventilator-associated pneumonia: the potentially critical role of emergency medicine in prevention and suggests that semi recumbent positioning may improve oxygenation and maximize ventilator efforts by decreasing abdominal compression on the lung bases. Current guidelines recommend 30° to 45° of backrest elevation, although high-level evidence exists only for 45° or greater semirecumbency[18-25.] The most significant factor in the study was that the attending physician was unaware of the angle of recumbency and this fact adds credibility to our findings. The methodology by application of software and confirming with manual methods adds credibility to our study.

6.1 VAP-Strategies

There are some viable choices for VAP prevention: 1. reduce ventilator timings; 2. provide intensive dental and oral hygiene; 3. aspirate subglottic secretions; 4. optimize positioning and encourage movement; 5. administer prophylactic probiotics. We have tried to target the fourth reason. What's more important is the clinical management of VAP which is dependent on antimicrobial treatment. Many microbes have been identified as the causal agent of VAP. Gram-negative bacteria such as P. aeruginosa, Escherichia coli, Acinetobacter species, and K. pneumoniae are common pathogens of VAP, as are Gram-positive bacteria such as Staphylococcus aureus. The use of probiotics has recently emerged as a new strategy in the fight against VAP. Probiotic bacteria are widely thought to reduce the progress of VAP through local and systemic actions that improve gut barrier, boost host cell antimicrobial peptides, and so on[2]. Here, in our study, our focus is on non-pharmacological methods. The significant limitation was that the sample size could have been large with multicentric patients to establish the fact.

6. CONCLUSION

Through this study, we concluded that semi-recumbent positioning has an effect and helps in reducing the clinical pulmonary infection score. In comparison between three angles of recumbency of 35,40 and 45 degrees along with conventional physical therapy, we found significance in the groups 40 and 45 which were better than 35. There was no significant difference between 40 and 45 with conventional physical therapy. As a result, when comparing the mean range of 40 degrees with conventional physical therapy, 45 degrees shows more but statistically insignificant improvement. As a result, it is suggested that semi-recumbent positioning at 45 degrees can be the preferred option for decreasing ventilator-associated pneumonia.

7. ACKNOWLEDGEMENT

Thankful to IQAC / Research cell - Sri Balaji Vidyapeeth, MGMCRI.and Special Thankful to Deanship of scientific research**,** Dept of Physical therapy and Health Rehabilitation, College of Applied Medical Sciences, Prince Satam Bin Abdul Aziz University, Akharj, Saudi Arabia.

8. AUTHORS CONTRIBUTION STATEMENT

SE – concept and design
ZZT and RK – data collection
GNS- statistics and supervision
SPS – manuscript and communication

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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