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ORIGINAL ARTICLE

The Effect of Educational Interventional Program on the Rate of Development of Ventilator Associated Pneumonia among the Admitted patients at ICU of Tertiary Care Hospital Lahore (Interventional Study)

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ABSTRACT

Background: Ventilator Associated Pneumonia (VAP) is one of the frequent infections associated with health care in intensive care units (ICU) prolongs the hospital stay, increases care costs and mortality, and is caused by the migration of oro-pharyngeal microorganisms onto the pulmonary parenchyma.
Aim: To determine the effect of educational intervention on the rate of occurrence of ventilator associated pneumonia in patients admitted in Intensive Care Unit (ICU)**.**
Place and duration of study: Study was conducted in ICU of Jinnah Hospital, a tertiary care public sector hospital in Lahore, Pakistan for a period of 12 months from August 2019 to July 2020.
Study design: Interventional Study.
Methods: A total of **270** Patients were enrolled in the study and were divided into two groups, (pre and post educational intervention group)**.** Information about patient's VAP rate, its distribution and patient's length of stay in hospital collected for both groups.
Results: Of total 270 enrolled patients, 115(42.6%) were males and 155 (57.4%) were females. The overall rate of VAP was observed 43(15.9%), among them 27(20%) was in pre- interventional group and 16(11.9%) in post interventional group during treatment and stay in ICU.
Conclusion: It was concluded that educational intervention played a significant role in controlling the VAP among the patients admitted in the ICU.
Keywords: Educational intervention, Nosocomial Infection, Ventilator Associated Pneumonia and Intensive Care Unit

INTRODUCTION

Ventilator-Associated Pneumonia (VAP) is a type of pneumonia that develops 48 hours or longer after mechanical ventilation, given by means of an endotracheal tube or tracheostomy. VAP results from the invasion of the lower respiratory tract and lung parenchyma by microorganisms. Intubation allows oral and gastric secretions to enter the lower airways[1]. VAP is a common nosocomial infection in ICUs with an infection rate between 6% to 52% and in some places, it reaches as high as 76%, and VAP is the main cause of morbidity, mortality and enhanced cost of management in ICUs[2]. Among nosocomial infections VAP is found to be more prevalent din both developed and developing countries. WHO report 2011 indicated that the rate of death due to VAP varies between 7% - 30% with management costs ranging from US$ 10,000 to 25,000 per patient[3].

The high rate of mortality among the patients admitted to ICUs is not because of their own disease but most commonly due to of NIs. Globally patients with assisted ventilation develop VAP ranging from 9% to 27% and it is the main cause of death[4]. It was found that usually VAP is developed 2–3 days after insertion of an endotracheal tube and mechanical ventilation[5]. Patients usually develop a fever, altered bronchial sounds, changes in sputum, white blood cell counts reduced and causative microorganisms are often identified[5]. A study done in the US by Shrupky found that the rate of VAP was between 1.2-8.5 per 1,000 ventilator days.[6] Rosenthal et al found higher incidence of VAP 13.6/1,000 ventilator days[7]. However studies conducted in Asian countries showed different rates ranging from 3.5-46 infections per 1,000 ventilator days[8]. Mathai et. al. in a study carried out in India found much high rate of VAP (40.1/1,000 ventilator days).[9] Many studies indicated that VAP usually developed during the first 5 days of mechanical ventilation and the mean period of VAP development is 3.3 days after insertion of endotracheal tube and mechanical ventilation[6,7,8].

Chughtai and coworkers indicated in their study that after surgery, a large number of patients developed hospital-acquired pneumonia and VAP during their stay in the hospital[10]. Several studies showed that prolonging hospitalization and health care costs ranged from US$12,000 to US$40,000 per individual[11].

Many researchers have also argued that length of stay in ICU, period of use for ventilation, prolong use of muscle relaxants were the extra risk factors for development of VAP. This finding was augmented by a study conducted in ICU on 51 patients who were on mechanical ventilator for more than 48 hours and found that the rate of VAP increased when a patient put on a mechanical ventilator for a long time.[12] The original ailment of the patient plays a significant role in the rate of VAP. It was found that VAP incidence was 44.6% in burns patients with inhalational injury and 27% without inhalational injury[12]. Similarly, a study conducted in Iran on trauma patients revealed that risk of VAP was more in type 2 diabetes[14]. A study conducted by Liu et al revealed that older patients with age 65 and above, length of staying in ICU for more than 9 days, and more than 4 days patients on ventilator were associated with greater risk for VAP[15]. Another researcher found that positive fluid balances and obligatory ventilator mode were associated with high risk for VAP and they also indicated that the position of patient played an important role in the development of VAP[16]. A randomized trial by Strom and coworkers in Odense University Hospital, Denmark evaluated the effect of sedation, interrupted sedation, and no-sedation on ventilation time and revealed that sedative have no statistically significant effect on the development of VAP[17].

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METHODS

This interventional study was conducted at ICU of a tertiary care public sector, Jinnah Hospital, Lahore, Pakistan for a period of 12 months from August 2019 to July 2020. Patients (270) were divided into two groups (pre and post educational intervention). It should be interventional and control Patients requiring ventilator associated pneumonia after 48 hours of admission in the ICU identified during 6- month period following Infection. Prevention and Control training session was imparted and then compared with retrospective data of same duration. All patients 16 years and above admitted in ICU for more than 48 hours included in the study according to the defined criteria. Immuno-compromised patients and those suffering from chronic infection before admission in ICU were excluded. Date of infection, patient demographic information and device use, collected for VAP. During this period, information about patient's ventilator associated pneumonia rate, its distribution and patient's excess length of stay in hospital was collected by using following method: Patient's VAP rate was calculated by dividing the number of VAP cases by the total number of patients in the ICU (×100). Written consent was taken before data collection. All statistical analyses were performed with SPSS version 21.0.

RESULTS

Figure 1 showed descriptive statistics of age of participants. According to this figure, the majority of patients 58/270 were of 25 to 30 years old, followed by 39/270 patients of 20-25 and 36/270 participants were between age of 30-35 years. Patients with younger age group and those who were above 70 years were very few in number.

Figure 1: Descriptive statistics of age of participants

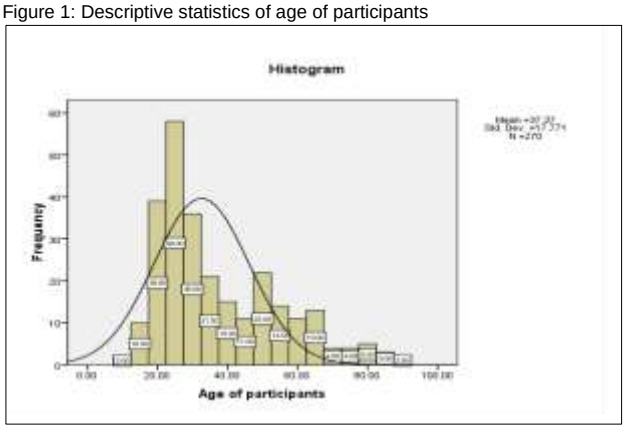

Figure 2: Information about gender of participants

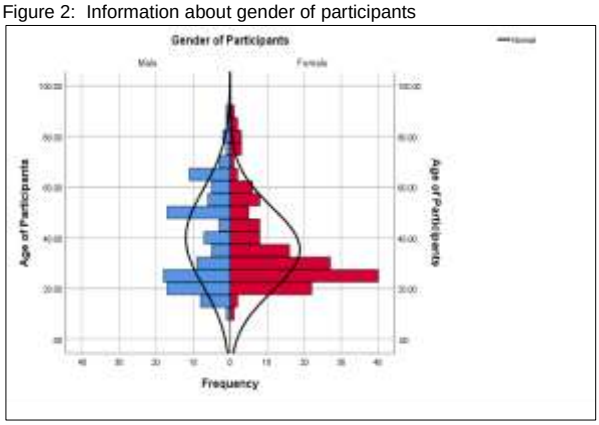

Figure 1 showed population pyramid of age and Gender of participants. It is clear from this figure that majority of female and male patients were in the range of 20-40 years, female being maximum with age range from 24 to 28 years followed by 28-32 years. Similarly, maximum number of patients among male group was in age group of 18 to 28 years.

Table 1: Information about length of patient's stay in different process at ICU

Group	n	Mean	Std. Deviation	Std. Error Mean
Age				
Group I	135	35.9926	17.51566	1.50751
Group II	135	38.7407	17.98339	1.54776
ICU Admission Days				
Group I	135	8.8926	11.48042	.98808
Group II	135	6.7241	6.33769	.54546
Ventilators Days				
Group I	135	7.7259	11.15038	.95967
Group II	135	5.3870	5.57854	.48012

Group I – Pre Intervention Control Group
Group II – Post Intervention Group

Figure 3: Frequency Distribution of Participant's Remained on Ventilator (n=270)

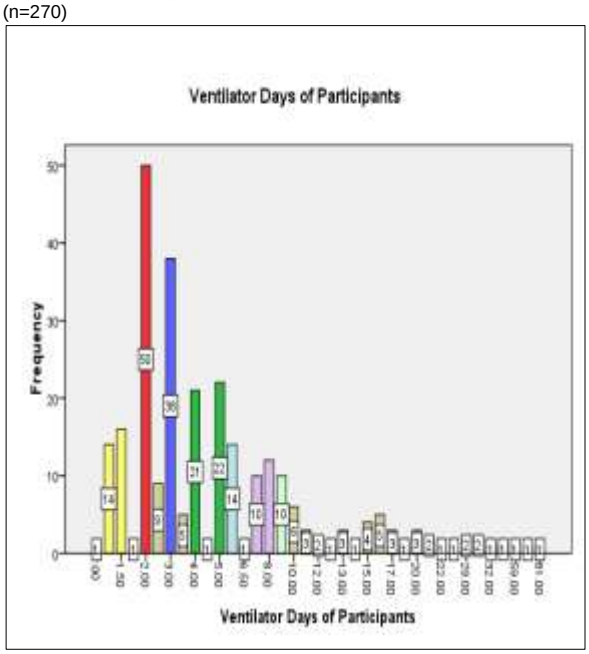

Table 1 showed that out of 270 patients, 135 Group II patients belonged to pre and 135 post intervention groups. Their mean was 8.8926 and 6.7241 respectively, standard deviation (Std.) 11.48042 and 6.33769 respectively. Regarding ventilator day mean was 7.7259 and 5.3870 respectively in pre and post intervention groups, with standard deviation (Std.) 11.15038 and 5.57854 in these two groups.

Figure 3 showed ventilator days of participants in ICU. It showed that 50(18.5%) participants were on ventilator for 2 days, while 38(14.1%), 21(7.8%) and 22(8.1%) participants remained on ventilator for 3, 4 and 5 days, respectively.

Table 2 Showed association (cross tabulation) of VAP * groups**.** According to this table, 27 (20%) patients in group I and 16 (20%) of group II suffered from VAP. While 108(80%) and 119 (88.1%) did not showed any sign and symptoms of VAP in group I and II, respectively. According to Pearson Chi-Square test, the association of VAP*groups was non-significant.

Table 2: Association of VAP * Groups

Crosstab

VAP	Group		Total	P-Value	Pearson Chi-Square
	Group I	Group II			
Yes	27 (20.0%)	16 (11.9%)	43 (15.9%)	3.347[a]	.095
No	108 (80.0%)	119 (88.1%)	227 (84.1%)		
Total	135 (100.0%)	135 (100.0%)	270 (100.0%)		

0 cells (.0%) have expected count less than 5. The minimum expected count is 21.50.
Group I (Patient's VAP Pre Education Intervention)
Group II (Patient's VAP Post Education Intervention)

DISSCUSSION

Nosocomial infections are one of the problematic tasks in the intensive care units especially in developing countries due to deficiency of surveillance system.[18] VAP is a lung infection that occurs among people that require ventilation breathing machines in the hospitals. The VAP occurs in almost fifty percent of all cases who acquired pneumonia in a health facility. So it can be said that VAP is mostly responsible for HAI (Hospital Acquired Infection) among patients admitted in ICU and is an important cause of mortaltiy.[19] It occurs among patients who are intubated and are on mechanical ventilation for ≥48 hours. The risk of developing VAP is most common in first five days on mechanical ventilation. The VAP incidences depends upon expertise of healthcare workers of ICU, the studied population and the level of antibiotic exposure[20].

Present study revealed that majority of the female and male patients were in the range of 20-40 years (maximum number was 18 to 28 years) as shown in Figure 2. It was found during study that in pre interventional group and post interventional group, the mean age of patients was 35.9926±17.51566 years and 38.7407±17.98339 years, respectively (Table 1). But a study carried out by Mitsogianni and collaborators (2016) revealed that in both groups, majority was elderly patients. Same study revealed that the mean age of the patients in pre interventional groups, was 56.8±18.6 years while in post interventional groups the mean age of the patients was 56.5±19.7[21]. This discrepancy in age of patients in the present study was due to the reason that majority of the patients admitted in ICU during this study period was of young age.

The results of this study highlighted that among ICU patients, 18.5% patients were on ventilator only for 2 days while 14.1%, 7.8% and 8.1% participants remained on ventilator for 3, 4 and 5 days, respectively (Figure 3). This study further confirmed 20.0% patients in group I and 11.8% patients in group II suffered from VAP with the insignificant p value (p- 0.095) (Table 2). A similar study on awareness and practices regarding nosocomial infections among nurses conducted in a tertiary care health facility of Lahore by Mudassar and fellows (2019) reported that, those patients who were on ventilators were more susceptible to nosocomial infections due to contaminated health equipment, a leading source of infection. They also elucidated in their study that prevalence of VAP among ICU patients was 15.9%[22]. These findings are comparable with result of this study (Figure 3), while a study undertaken by Babbar and coworkers (2019) showed that mainstream (62%) of the patients admitted in the intensive care unit developed VAP[23]. However, the findings of a study by Masih et al (2016) exhibited better results than present study as they confirmed that only 5.69% patients admitted in intensive care unit developed VAP.[24] In a study "Safety measures taken by the nurses regarding prevention of HAI in ICUs" Kirtil and Akyuz (2018) reported that the incidence of VAP was 27.1%[25]. A result of a study conducted by Phu (2018) elucidated that 9.9% patients on ventilator developed pneumonia[26]. A study performed by Gadallah and teammates (2017) reported that frequency of VAP was 24.8 and 17.68 per 1000 days which reduced significantly after intervention program.[27] Although findings of all these studies varied but they do confirm the importance of VAP development in ICU patients.

This Study further highlighted that prevalence of HAI was 20.0% in group I and 11.1% in group II which confirmed the usefulness of educational intervention. However, association, determined by Chi-square Test was found insignificant (p=4.060). (Table 2) The results of a study conducted by Salam and partners (2013) was comparable with our study who reported a reduction in nosocomial infection after educational intervention. According to them, frequency of nosocomial infection was 37.2% before intervention and was reduced to 15.1% after intervention with significant results ($p<0.001$)[28]. Similarly, findings of a study performed by Goyal and Chaudhry (2019) and Gadallah and teammates (2017) also highlighted the positive impact of educational intervention ($p\leq0.005$)[29,27]. Abramczyk and associates (2011) also elucidated the significance of educational intervention and found that before intervention, the frequency of nosocomial infection was 34.9% which reduced to 26.7% after educational intervention of health care workers[30].

CONCLUSION

It was concluded that ventilator associated VAP among patients admitted in the ICU is dependent on duration of hospital stay but educational intervention played a significant role in controlling its development. This intervention could be applied to reduce VAP.

Limitation of the study: This study was conducted only in one ICU of tertiary care hospital and the limitation of this study was limited number of its sample size. Large sample size would be more representative.

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Declaration of Interests: None.

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