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Research Article

**VENTILATION ASSOCIATED PNEUMONIA IN INTENSIVE  
CARE UNIT OF PEDIATRIC DEPARTMENT OF GANGARAM  
HOSPITAL LAHORE**

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**Abstract:**

*Ventilation-related pneumonia (VAP) is one of the major causes of weaning failure due to mechanical ventilation. Adequate treatment of VAP according to sensitivity and culture pattern leads to early extubation and weaning from mechanical ventilation.*

*Objective: To describe the frequency of VAP in pediatric intensive care units (PICU).*

*Study design: Hospital based descriptive study.*

*Place and duration: In the Pediatric Unit I of Sir Gangaram Hospital Lahore for one year duration from October 2017 to October 2018.*

*Methods: A total of 100 children from one month to 18 years of age were ventilated and studied for one year. All patients underwent radiographies and complete blood counts (total leukocyte count, differential white blood cell count) and blood tests including blood cultures were performed in all patients.*

*Conclusion: It was determined that 32 of 100 ventilated children had VAP and Pseudomonas was the most common organism in blood culture. Ventilation time was not a contributing factor to VAP development.*

**Key Words:** Ventilator, Pneumonia, Pseudomonas.

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**INTRODUCTION:**

Ventilator-associated pneumonia (VAP) refers to pneumonia in subjects requiring mechanical ventilation for at least 48 hours via an endotracheal tube or tracheotomy tube [1-2]. VAP differs from other types of infectious pneumonia due to different microorganisms, required antibiotics, diagnostic methods, recent prognosis and effective preventive measures [3]. The most important symptoms of VAP are fever, low body temperature, purulent sputum and hypoxia [4]. VAP should be suspected in any ventilated patient with high white blood cell count and new shadows on the chest radiograph. Blood culture can reveal organisms that cause VAP [5]. There are two strategies for VAP diagnosis. The first is to collect samples showing increased size in radiographs or with new leaks for trachea culture of patients ventilated with VAP symptoms [6]. The other is an invasive method and advocates bronchoscopy and bronchoalveolar lavage in suspected patients [7]. In both cases, VAP is not approved if cultures are negative and other causes of symptoms are investigated. *Pseudomonas aeruginosa* is the most common gram-negative bacterium causing VAP [8]. *Pseudomonas* has natural resistance to many antibiotics. *Klebsiella*, *Enterobacter* and *Citrobacter* are other bacteria that are resistant to routine antibiotics [9]. *Acinetobacter* is becoming more common and resistant to carbapenems such as imipenem and meropenem [10]. Methicillin-resistant *Staphylococcus aureus* is a growing cause of VAP.

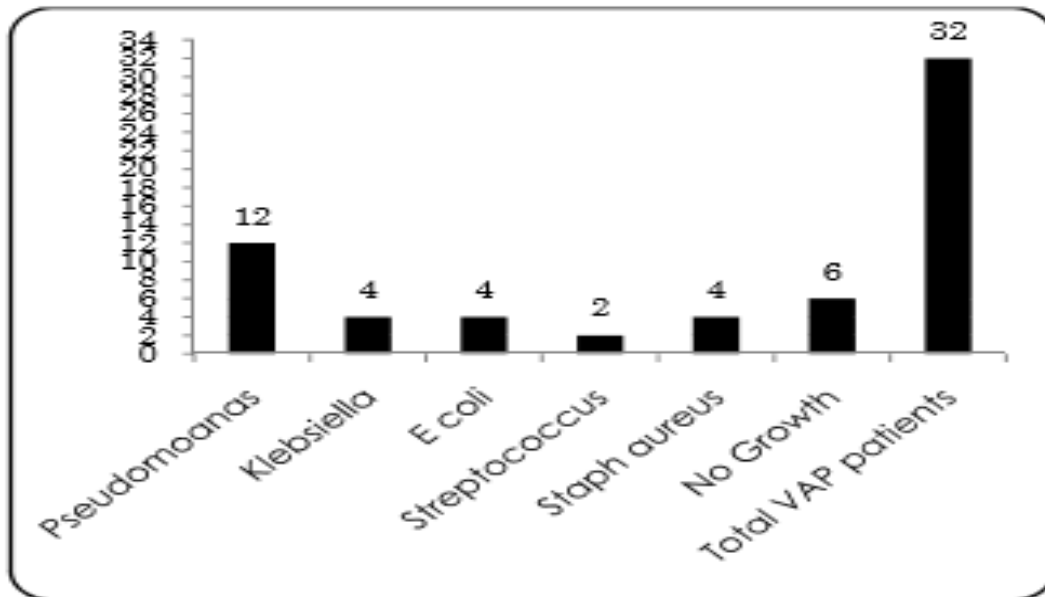
Fifty percent of the *Staphylococcus aureus* isolates were methicillin resistant in the intensive care setting. Three days after ventilation, the VAP is considered as early onset, while the VAP that occurs three days after the onset of ventilation is taken as a late-onset VAP.

**MATERIALS AND METHODS:**

This Hospital based descriptive study was held in the Pediatric Unit I of Sir Gangaram Hospital Lahore for one year duration from October 2017 to October 2018. A mechanically ventilated children of one month to aged 18 years were included. Children with mechanical ventilation and existing pneumonia are excluded. Statistical analysis: All data entered into the form were collected and tabulated in SPSS version 17.0. Frequencies were calculated and shown in graphs and tables where shown. Chi-square test was used for qualitative variables and  $p < 0.05$  was considered significant.

**RESULTS:**

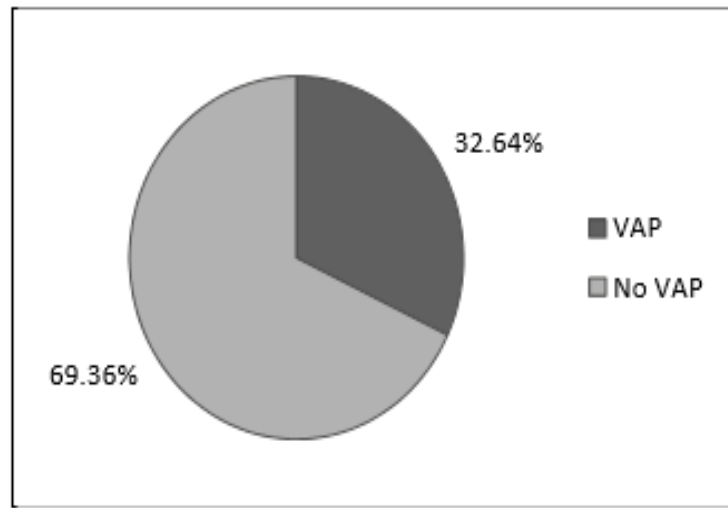
The age range of case studies ranged from 1 month to 14 years. The mean age ( $\pm$  SD) and median age were 5.47 ( $\pm$  5.90) and 2.94, respectively. 64 male, 36 female, male: female ratio was 1.7: 1. 74 patients were mechanically ventilated due to an increase in respiratory failure in 74 of 100 study cases. The remaining patients had apnea in 6% and neuromuscular block in 20%.



**Fig-1: Frequency of organisms in Blood Culture (n=32)**

Ventilation for respiratory reasons was more likely to develop VAP than those with other mechanical ventilation indications (p value less than 0.05). 14 patients (48%) with pneumonia were ventilated for 5-10 days, 12 (44%) patients were mechanically ventilated for 11 to 15 days and 6 (8%) patients for more than 15 days. The longer duration of mechanical ventilation was not associated with an increase in the frequency of VAP, and this was evident from the analysis of children ventilated for less than 10 days compared to those ventilated for more than 10 days. These results were not statistically significant (p value greater than 0.05).

There was fever in 12 cases (37.5%) and chest infection in 20 (62.5%) cases. Of the 32 patients with VAP, 13 (81%) had total white blood cells (p <0.05). Blood culture was positive in 26 patients with VAP. Pseudomonas is the main causative organism isolated in 12 patients (37%). Other common organisms that allowed their growth in blood cultures were E.Coli and Klebsiella (24%) each with p <0.05 (Figure 1). Radiological evidence was found in all patients with VAP and it was found to be an important diagnostic tool in the diagnosis of VAP. Twenty-two patients (69%) had reticulonodular evidence. Of the 100 patients, 32 developed VAP (Figure 2).



**Fig-2. Outcome of mechanical ventilation (n =100)**

25 patients (75%) with VAP were successfully treated and treated with intravenous antibiotics and supportive therapy. Drug-resistant pneumonia is the cause of death in these patients.

#### DISCUSSION:

VAP is the second most common nosocomial infection among pediatric patients in ICU. In our study, 100 patients were evaluated prospectively. This problem has not been elaborated in this part of the country. The study conducted by Zygun et al included 60 adult patients in their studies carried out for two years [11]. Shaukat et al have described a series of 464 patients for 6 years. The mean and median age of our study was  $4.53 \pm 3.60$  years and 3.68 years. In their study, Foglia et al. Identified mean  $5.47 \pm 5.90$  years and 2.94 years averages [12]. The ratio of women and men in our study was 1.7: 1. Shaukat et al. Found this relationship to be 2: 1.5 [13]. The duration of mechanical ventilation was 14.4

$\pm 12.8$  days. Curtains Saenz and colleagues have described an average of 13.64 days to be comparable. Kendirli and colleagues, found the duration of ventilation in studies  $18.8 \pm 14.1$  days. The main indication of ventilation in our study was respiratory failure in 74% of cases. Kendirli and his friends found respiration failure as a sign of ventilation can be compared with our study in 64.8% of cases [14]. As Diouf et al. Explained, radiological evidence of pneumonia was found on chest radiography in all patients. Gram-negative organisms were the most common infectious organisms causing VAP, followed by pseudomonas aeruginosa as a leading organism, followed by Klebsiella and E. coli. This was reported by Chenoweth et al. Can be compared with the work done by in contrast, Grisaru-Soen G et al. Found that most of the common pathogens of VAP were coagulase-negative staphylococci and that was Klebsiella. In this study, 32% of patients developed VAP. In another study

conducted by Zygun and colleagues, Yaun et al, we could not detect differences in early and late ventilation related organism in the organism compared with Cortinas Saenz et al [15]. The mortality rate in our study was around 19%. Mehta et al. Described 40% in their study, but this study was performed in an adult population with mechanical ventilation due to traumatic brain injury. In a study conducted by Yaun et al the basic idea behind the study is to determine the frequency and model of VAP in the PICU of two tertiary hospital hospitals with similar ventilation and weaning protocols, thus solving the strategy needed to prevent the onset of pneumonia during ventilation. The study was performed in a limited number of patients. To see the real image, a multi-centered study is required at national level in different hospitals in Pakistan.

### CONCLUSION:

It was concluded that VAP is not a rare condition in children admitted to the intensive care setting, leading to significant mortality and morbidity and difficulty in withdrawing the ventilator. We have found that both modes of ventilation time are not associated with an increase in the frequency of VAP. An early diagnosis of ventilation-related pneumonia is necessary to avoid complications.

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