

Frequency of Ventilator Associated Pneumonia in Patients Admitted at a Tertiary Care Hospital of Pakistan

Hamna Javed*, Haider Zaigham Baqai**, Fahad Hassan*, Ayesha Afzal***

* Benazir Bhutto Hospital Rawalpindi

** Rawalpindi Medical College & Allied Hospitals, Rawalpindi

*** University of Health Sciences Lahore

Abstract

Objective

To determine the frequency and outcome of Ventilator Associated Pneumonia (VAP) in patients requiring mechanical ventilation (MV) admitted at the Intensive Care Unit (ICU) of a tertiary care hospital in Pakistan.

Methods

This descriptive cross-sectional study was done at Benazir Bhutto Hospital Rawalpindi within a duration of 8 months from April-2019 to Dec-2019. We included 150 adult patients of age >20 years from ICU of hospital who were on MV for > 2 days. The diagnosis of VAP was made according to the criteria given by IDSA/ATS guidelines. The frequency, microbial spectrum and outcomes of VAP patients were noted for each patient.

Results

Mean age of patients was 51.4±11.7 years. There were 107 (71.3%) male patients. VAP was diagnosed in 23 (15.3%) patients, of which 09 (6.0%) patients developed early VAP while 14 (9.3%) developed late VAP. Sepsis occurred in 08 (34.7%) VAP patients versus 22 (17.3%) in non-VAP patients (p-value 0.05), tracheostomy was done in 4 (17.3%) VAP patients versus 1 (0.78%) non-VAP patients (p-value <0.0001), re-intubation done in 8 (34.7%) VAP patients versus 10 (7.8%) non-VAP patients (p-value <0.0001). There was no significant difference in mortality in VAP and non-VAP patients. Common microbes causing VAP were *P. aeruginosa* isolated in 08 (34.7%) patients, *A. baumannii* in 05 (21.7%), *MRSA* in 04 (17.3%) patients.

Conclusion

Ventilator associated pneumonia is a serious and common complication in patients who require prolonged ventilation. VAP considerably increase the morbidity and mortality in ventilated patients. In present study, *P. aeruginosa*, *A. baumannii* and *MRSA* were microbes causing VAP in ventilated patients.

Keywords

Ventilator a pneumonia, microbial spectrum.

Introduction

Patients who are admitted in Intensive Care Unit (ICU) are always at a higher mortality risk, either due to complications of primary illness or due to secondary complications that develop during the hospital stay.¹ Hospital Acquired Infections (HAIs) are the commonest complications that occur during ICU stay. HAIs occur in 27% of all critically ill patients and in up-to 86% of mechanically ventilated patients.^{2,3}

Among the different forms of HAIs, the most important HAIs in ICU is Ventilator Associated Pneumonia (VAP). VAP considerably increases the length of hospital stay, duration of Mechanical Ventilation MV, treatment cost, long term disability, and mortality in these patients.⁴⁻⁶ VAP is typically defined as the pneumonia diagnosed after 48 hours of starting MV.⁷ VAP frequency varies from 5% to 40% in patients on MV for >2 days among different published studies. This variability varies from country to country and the definition used to define VAP.^{7,8} VAP frequency is high in developing countries as compared to modern world.⁹

Due to absence of country based surveillance systems in Pakistan, the exact frequency of VAP and its associated outcomes are not known. More-over little data is there regarding the frequency and outcome of VAP from Pakistan. The development of VAP care bundles has greatly helped to reduce the frequency of VAP. The present study was conducted to determine the frequency and outcomes of VAP in patients requiring MV admitted in the ICU of a tertiary care hospital in Pakistan.

Methods

This descriptive cross-sectional study was done in Benazir Bhutto Hospital Rawalpindi within a duration of 8 months from April-2019 to Dec-2019. We included 150 adult patients of age >20 years from ICU of hospital who were on MV for > 2 days. Patients admitted in ICU having pneumonia at the time of admission and required MV during stay were excluded. This study approval from hospital ERC was taken.

Correspondence Author: Hamna Javed,
House 36, Street 10, Sector E, DHA Phase 1,
Islamabad, Pakistan.
Email: drhamna.fahad@gmail.com

The diagnosis of VAP was made according to the criteria given by IDSA/ATS guidelines; duration of MV >2 days, fever >38°C, leukocyte count >12,000 mm³, presence of purulent sections on suctioning and pulmonary infiltrates on plain chest X-rays. VAP was further divided into two categories; early VAP; if the onset was after 2 days of intubation but was within 5 days of intubation. Late VAP; if the onset was after 5 days of intubation.¹⁰

After confirmation endotracheal swabs were taken in sterile containers were sent to hospital laboratory for confirmation and determination of microbial spectrum of causing organisms.

The primary study objective was frequency and outcomes of VAP patients. while microbial spectrum was secondary study objective. The following criteria was used to diagnose acute respiratory distress syndrome (ARDS); worsening of the respiratory symptoms, development of bilateral opacities on chest X-rays, and oxygenation impairment (PaO₂ / FiO₂ ≤300 mmHg on PEEP or CPAP ≥5.0 cmH₂O). Sepsis was diagnosed on positive blood culture reports.

We used SPSS v25 software for data interpretation. Chi-square test was applied to compare complications rate such as ARDS, sepsis, pneumothorax, atelectasis, tracheostomy, re-intubation, and mortality in VAP with non-VAP patients.

Results

Mean age of patients was 51.4±11.7 years. There were 107 (71.3%) male patients. Regarding presenting disease, 56 (37.3%) patients were admitted with respiratory disorders, 39 (26.0%) with cardiovascular, and 36 (24.0%) with neurologic disorders. VAP was diagnosed in 23 (15.3%) patients, of which 09 (6.0%) patients developed early VAP and remaining 14 (9.3%) developed late VAP (Table 1).

There was significant difference in morbidity in VAP versus non-VAP patients. Sepsis occurred in 08 (34.7%) VAP patients versus in 22 (17.3%) non-VAP patients (p-value 0.05), tracheostomy was needed in 4 (17.3%) VAP patients versus in 1 (0.78%) non-VAP patients (p-value <0.0001), re-intubation was required in 8 (34.7%) VAP patients versus in 10 (7.8%) non-VAP patients (p-value <0.0001). There was no significant difference in mortality in VAP and non-VAP patients (p-value 0.24) (Table 2).

There were 18 (78.2%) patients for whom endotracheal swabs were sent to the hospital laboratory for determination of microbial spectrum. Most common microbes were *P. aeruginosa*, diagnosed in 08 (34.7%) patients, *A. baumannii* in 05 (21.7%) and *MRSA* in 04 (17.3%) patients. Other bacterial isolates were *K. pneumoniae*, *E. coli*, *S. aureus* and *H. influenzae* (Table 3).

Discussion

VAP is reported to be the commonest HAI among intubated patients which significantly increases the morbidity and mortality.

Table 1. Demographic and Baseline Data of 150 ICU Patients

Variables	n=150 (100%)
Mean Age (Years)	51.4±11.7
<i>Gender</i>	
Male	107 (71.3%)
Female	43 (28.7%)
<i>Diagnosis on Admission</i>	
Respiratory Disorders	56 (37.3%)
Cardiovascular Disease	39 (26.0%)
Neurologic Disorders	36 (24.0%)
Gastrointestinal Disorders	12 (8.0%)
Trauma	03 (2.0%)
Post-surgery	04 (2.6%)
VAP	23 (15.3%)
Early VAP	09 (6.0%)
Late VAP	14 (9.3%)

Table 2. Outcome of VAP Patients Compared with non-VAP Patients

	VAP (n=23)	Non-VAP (n=127)	p-Value
ARDS	3 (13.0%)	05 (3.9%)	0.07
Sepsis	08 (34.7%)	22 (17.3%)	0.05
Pneumothorax	02 (8.6%)	05 (3.9%)	0.31
Atelectasis	07 (30.4%)	26 (20.4%)	0.28
Tracheostomy	04 (17.3%)	1 (0.78%)	0.0001
Re-Intubation	08 (34.7%)	10 (7.8%)	<0.0001
Mortality	05 (23.8%)	16 (12.5%)	0.24

Table 3. Microbial Spectrum of Ventilator Associated Pneumonia

Type of Specimen	n=23 (%)
Endotracheal	18 (78.2%)
Expectorated	3 (13.0%)
Blood	2 (8.7%)
Bacterial Isolate	
Pseudomonas aeruginosa	08 (34.7%)
Acinetobacter baumannii	05 (21.7%)
MRSA	04 (17.3%)
Klebsiella pneumoniae	02 (8.6%)
Streptococcus pneumoniae	01 (4.3%)
Escherichia coli	01 (4.3%)
Haemophilus influenzae	01 (4.3%)
Non-specific	01 (4.3%)

MRSA= methicillin resistant staphylococcus aureus

In present study we found VAP in 15.3% patients. Studies have reported a gradual increase in the prevalence of VAP. Studies from Europe conducted in 2007, reported VAP prevalence rate of 7.0%, while those conducted in 2013 to 2015 reported VAP in 8.0% to 9.0% of patients. While a study conducted in Italy presenting data of 27 ICUs, reported VAP prevalence from 12.8% to 17.0%.¹⁰ Studies conducted in different countries have also reported difference in prevalence rate of VAP among ventilated patients. Like a study from Egypt reported that VAP occurred in 35.41% patients.¹¹ While a study conducted in gulf countries reported VAP in 4.8/1000 patients.¹² A study conducted in Karachi Pakistan reported VAP in 30.5% patients, and another study from Multan reported VAP in 31.0% patients who required MV during ICU stay.¹³ Another study conducted in Rawalpindi reported VAP in 22.5% patients.¹⁴

In our study, onset of VAP was early in 39.1% patients, while the onset of VAP was late in remaining 60.9% patients. Ishtiaq *et al.* also reported similar outcomes, in their study frequency of early VAP was 39.6% and that of late VAP was 60.4%.¹⁴ While a study by Blot *et al.* reported early onset VAP in 46.6% patients and late onset VAP in 53.4% patients.¹⁰

Regarding patient outcomes, we found that VAP is associated with poor outcomes. Sepsis occurred in 34.7% patients who developed VAP and in only 17.3% non-VAP patients. We also found higher rate of tracheostomy (17.3% in VAP versus 0.78% non-VAP), and re-intubation in VAP patients (34.7% in VAP versus 7.8% in non-VAP patients). Mortality rate was higher in VAP patients but this difference was not significant (23.5% in VAP and 12.5% in non-VAP patients).

A study conducted by Haidar *et al.* on frequency and outcomes of VAP reported tracheostomy in 19.35% of VAP and 2.9% of non-VAP patients, incidence of sepsis was 32.2% in VAP and 8.69% in non-VAP patients, and mortality rate was 25.8% in VAP and 13.04% in non-VAP patients, They did not found any significant difference in re-intubation rate, pneumothorax and atelectasis between the VAP and non-VAP patients.¹⁵

Regarding microbial spectrum, the most common isolate in present study was *P. aeruginosa* followed by *A. baumannii*

A study by Sosa-Hernandez *et al.* reported *A. baumannii* MDR in 47.9% patients of VAP, *P. aeruginosa* in 18.80% patients, *Staph. aureus* in 4.2% and *klebsiella pneumoniae* in 4.2% patients.¹⁶ Werarak *et al.* also reported *A. baumannii* as the commonest organism causing VAP, they found it in 50.9% patients of VAP, *Pseudomonas aeruginosa* in 34.5% patients, *klebsiella pneumoniae* in 24.5% and *E. Coli* in 6.4% patients.¹⁷ While a study by Barbier *et al.* found *Staph. saureus*, followed by *p. aeruginosa* and *Enterobacteriaceae* as the commonest organisms responsible for VAP.¹⁸

The frequency of VAP and spectrum of organisms causing VAP

varies from region to region so identification of microbes in particular setting is crucial to determine the common etiologic agents and to start empirical anti-biotics until the culture reports are available.

Conclusion

Ventilator associated pneumonia is a serious and common complication in patients who require prolonged ventilation. VAP considerably increase the morbidity and in ventilated patients. In present study, *P. aeruginosa*, *A. baumannii* and *MRSA* were microbes causing VAP in ventilated patients.

References

1. Li G, Cook DJ, Thabane L, Friedrich JO, Crozier TM, Muscedere J, *et al.* Risk factors for mortality in patients admitted to intensive care units with pneumonia. *Respir Res.* 2016;17(1):80.
2. Dasgupta S, Das S, Chawan NS, Hazra A. Nosocomial infections in the intensive care unit: Incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India. *Indian J Crit Care Med.* 2015;19(1):14-20.
3. Alcan AO, Korkmaz FD, Uyar M. Prevention of ventilator-associated pneumonia: Use of the care bundle approach. *Am J Infect Control.* 2016;44(10):e173-e6.
4. Cardoso T, Ribeiro O, Aragao I, Costa-Pereira A, Sarmiento A. The impact of healthcare-associated infection on mortality: failure in clinical recognition is related with inadequate antibiotic therapy. *PLoS One.* 2013;8(3):e58418.
5. Olanipekun T, Snyder R. Mortality Risk in Ventilator-Acquired Bacterial Pneumonia and Nonventilator ICU-Acquired Bacterial Pneumonia: Impact of Antimicrobial Timing and Associated Healthcare Cost. *Crit Care Med.* 2019;47(10):e851-e2.
6. Kalanuria AA, Zai W, Mirski M. Ventilator-associated pneumonia in the ICU. *Crit Care.* 2014;18(2):208.
7. Mehta A, Bhagat R. Preventing ventilator-associated infections. *Clin Chest Med.* 2016;37(4):683-92.
8. Zimlichman E, Henderson D, Tamir O, Franz C, Song P, Yamin CK, *et al.* Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. *JAMA Intern Med.* 2013;173(22):2039-46.
9. Papazian L, Klompas M, Luyt C-E. Ventilator-associated pneumonia in adults: a narrative review. *Intensive Care Med.* 2020:1-19.
10. Blot S, Kouleuti D, Dimopoulos G, Martin C, Komnos A, Krueger WA, *et al.* Prevalence, risk factors, and mortality for ventilator-associated pneumonia in middle-aged, old, and very old critically ill patients. *Crit Care Med.* 2014;42(3):601-9.
11. Othman AA, Abdelazim MS. Ventilator-associated pneumonia in adult intensive care unit prevalence and complications. *The Egyptian J Critical Care Med.* 2017;5(2):61-3.
12. El-Saed A, Al-Jardani A, Althaqafi A, Alansari H, Alsalman J, Al Maskari Z, *et al.* Ventilator-associated pneumonia rates in critical care units in 3 Arabian Gulf countries: a 6-year surveillance study. *Am J Infect Control.* 2016;44(7):794-8.
13. Haider SA, Mushtaq MA, Akhtar Z, Sultan A, Salman Z, Waris S. Prevalence of ventilator acquired pneumonia in an Intensive Care Unit (ICU). *Infect Dis J Pak.* 2019;28(1):12-14
14. Ishtiaq W, Ilyas A, Assad S, Qadeer A, Ghazanfar H, Sulehria T, *et al.* Spectrum of ventilator associated pneumonia with effect on intensive care unit's patient outcome. *Pak Armed Forces Med J.* 2017;67(4):518-23.
15. Haider SA, Mushtaq MA, Akhtar Z, Sultan A, Salman A, Waris S. Prevalence of ventilator acquired pneumonia in an intensive care unit (ICU). *Infect Dis J Pak.* 2019;28(1):12-4.
16. Sosa-Hernández O, Matías-Téllez B, Estrada-Hernández A, Cureño-Díaz MA, Bello-López JM. Incidence and costs of ventilator-associated

pneumonia in the adult intensive care unit of a tertiary referral hospital in Mexico. *Am J Infect Control*. 2019;47(9):e21-e5.

17. Werarak P, Kiratisin P, Thamlikitkul V. Hospital-acquired pneumonia and ventilator-associated pneumonia in adults at Siriraj Hospital: etiology, clinical outcomes, and impact of antimicrobial resistance. *J Med Assoc*

Thai. 2010;93(Suppl 1):S126-38.

18. Barbier F, Andremont A, Wolff M, Bouadma L. Hospital-acquired pneumonia and ventilator-associated pneumonia: recent advances in epidemiology and management. *Curr Opin Pulm Med*. 2013;19(3):216-28.



30 Westrige 1, Rawalpindi
Phones: 0333 5124967
Email: info@pakmedinet.com

1st Database of Pakistani Medical Journals on Internet

<http://www.pakmedinet.com>

Featuring:-

- Abstracts of Medical Journals of Pakistan including their new and old issues,
- Research Guidelines for young doctors,
- Problem causes,
- Discussion Forum and views of doctors on research titles
- Help for young doctors to find research references for their desertations and thesis
- And many more...

You can access Infectious Diseases Journal of Pakistan at:

<http://www.pakmedinet.com/journal.php?id=idj>