ORIGINAL ARTICLE

MICROBIOLOGICAL PATTERN OF VENTILATOR ASSOCIATED PNEUMONIA

Shamshad Ali, Khalid Waheed, Zafar H Iqbal
Department of Pulmonology, Jinnah Hospital, Lahore, Pakistan

Background: Ventilator associated pneumonia (VAP) is an important and common complication of mechanically ventilated patients. It is the leading cause of morbidity and mortality in Intensive Care Units (ICU) worldwide. The aim of study was to determine the pattern of bacteria involved in VAP in intensive care unit of Jinnah hospital Lahore. **Methods:** It was descriptive case series study, conducted over a period of one year on mechanically ventilated 50 patients. American Thoracic Society (ATS) guidelines recommend quantitative/semi-quantitative culture of endotracheal aspirates (ETA) or bronchoscopic aspirates/washing from the infected lung segments for the diagnosis of VAP. Hence this study was conducted to identify the types of bacteria involved in VAP in our ICU. Patients enrolled were clinically and radiologically suspected VAP, admitted in the ICU of Jinnah Hospital/Allama Iqbal Medical College (AIMC) Lahore. Bronchial washings were taken with the help of Fiber optic bronchoscope. Wherever bronchoscopy was not possible, subglottic secretions were collected with the help of sterilized catheter and sucker. Collected samples were sent to the Pathology laboratory of AIMC for aerobic culture and sensitivity. **Results:** Major pathogenic bacteria isolated were Gram negative (74%). Among this group *E. coli*, *Pseudomonas*, *Klebsiella* and *Acinetobacter* were the commonest organisms. Gram positive bacteria were 20%, *Staphylococcus aureus* (MRSA) and β-haemolyticus streptococci were the major isolate. In 4% cases mixed growth and in 2% cases no growth was reported. **Conclusion:** Major pathogenic organisms of VAP in our ICU are Gram negative bacteria. The Bacteriological culture of endobroncheal aspirates is helpful in the diagnosis and management of VAP. Emperic antibiotic therapy for VAP should cover Gram negative organisms.

Keywords: Ventilator Associated Pneumonia (VAP), Fiber Optical Bronchoscope (FOB), Intensive Care Unit (ICU), Endotracheal Aspirates (ETA), Culture and Sensitivity (C/S)
J Ayub Med Coll Abbottabad 2015;27(1):117–9

INTRODUCTION

Ventilator associated pneumonia is defined as infection of lung parenchyma which develops 48 hours or more after mechanical ventilation and not present or incubating at the time of initiation of mechanical ventilation.[1] It is a leading cause of morbidity and mortality in ICU. Incidence of VAP varies greatly from 7–47% of intubated patients. Overall VAP is associated with attributed mortality up to 30%.[2] It is typically categorized as early onset occurring in the first 4 days of mechanical ventilation and late onset occurring from the 5th day onward. Early onset VAP is commonly caused by antibiotic sensitive community required organisms while late onset VAP is caused by antibiotic resistant nosocomial organisms.[3]

Risk factors for the development of VAP include prior antibiotic therapy, pre-existing sinusitis, contaminated ventilator circuits or decreased gastric acidity in ventilated patients.[4]

Ventilator associated pneumonia is difficult to diagnose because of lack of respiratory symptoms in sedated patients. ATS guidelines recommended that quantitative/semi-quantitative culture of ETA or bronchoscopic aspirates from the infected lungs segments should be sent for C/S for the diagnosis and management of VAP.[5] This study was conducted to identify the type of bacterial pathogen involved by semi-quantitative method and noting its sensitivity patterns.

The objective of this study was to determine the frequency pattern of bacteria involved in VAP.

MATERIAL AND METHODS

It was descriptive case series carried out over a period of one year from January to December 2011. Study was conducted in the ICU of Jinnah Hospital Lahore in patients on mechanical ventilation with clinical and radiological suspicion of VAP. Jinnah Hospital Lahore is a tertiary care hospital of Allama Iqbal Medical College (AIMC), Lahore. Data was collected after informed consents of relatives of patients were obtained. The only invasive procedure was bronchoscopy. These patients were already on ventilator and no extra risk was involved, rather it was beneficial to remove the mucus plugs leading to resolution of pneumonia in some cases.

Patients on mechanical ventilation for more than 48 hours, of either gender or any age with the suspicion of VAP having developed new shadows in chest radiograph at least 48 hours after mechanical

ventilation. Patients with two out of the following three findings were also included in the studied: Fever ≥38 °C, Purulent Bronchial Secretions, and WBC more than 10,000/mm³ or <3000/mm³

Patients with suspected pneumonia at the time of admission, immuno-compromised, and those diagnosed of pulmonary Tuberculosis were not included in the study.

Bronchial washings were taken with the help of fiberoptic bronchoscope. Between 10–30 ml of sterilized normal saline was flushed into the infected lung lobe/bronchopulmonary segments. Instilled saline was sucked back and collected in sterilized containers. Wherever bronchial washing was not possible, subglottic secretions were collected with the help of sucker and sterilized suction catheter. Tracheobronchial secretions were collected by advancing a sterilized catheter through endotracheal tube/tracheostomy tube until resistance was met and then suction was applied.[1] Collected secretions were sent to the Pathology Laboratory AIMC Lahore, for pyogenic bacterial culture and sensitivity. Semi-quantitative culture method was applied and results were reported.

RESULTS

Fifty patients were enrolled as per inclusion criteria. The mean age of patients was 40.0±16.1 years. Among these 30 (60%) were male and 20 (40%) were females. Out of total fifty patients 26(52%) were admitted with surgical problems and 24 (48%) with medical problems. Late onset VAP was suspected in 38 (76%) cases and early onset VAP in 12 (24%) cases.

Gram stain results showed 37 (74%) Gram negative and 10 (20%) Gram positive bacterial infection. In 2 (4%) mixed growth and in 1 (2%) no growth was reported. Bacterial profile according to culture report showed *E.coli* 13 (26%), *Pseudomonas* 12 (24%), *Klebsiella* 9 (18%), *Staphylococcus aureus* 8 (16%), *Acinetobacter* 2 (4%), mixed growth 2 (4%), and no growth reported in 1 (2%) cases.

Among the 37 cases of Gram negative organisms 13 (35%) were *E. coli*, 11 (30%), 9 (24%) *Klebsiella* and 4 (11%) were *Acinetobacter*. In Gram positive organisms 8/10 *Staph. aureus* (60% MRSA, 20% MSSA) and 2/10 (20%) were β-haemolyticus *streptococci*.

DISCUSSION

Ventilator associated pneumonia is an important cause of morbidity and mortality in ICU. Incidence of VAP varies greatly in intubated patients depending upon risk factors.[2] ATS guidelines for the management of adults with VAP recommend that lower respiratory tract samples should be sent for C/S and prompt empiric therapy should be started. Combination antibiotics therapy should be used if patient is likely to be infected with multidrug resistant pathogens.[6]

In this study frequency pattern of bacterial pathogen involved in VAP was studied. Bronchoscopic samples minimize airway contamination and provide accurate alveolar cell sampling. Non-FOB samples include tracheobronchial aspirates or mini BAL.[7–8]

Predominant bacterial pathogens isolated were Gram negative bacteria in 37 out of 50 patients included in the study. Gram positive bacterial growth was observed in 10 patients; 2 patients had mixed growth and in one patient no growth was reported. Results of this study are similar to many international studies conducted in cases of VAP.

Chastre *et al* compiled microbiological data of 24 published studies that used bronchoscopic diagnostic method to confirm 1689 cases of VAP. They noted that overall Gram negative bacteria represented 58% of isolates and Gram positive cocci made up to 35%.[9]

Sopena *et al* studied the prevalence of specific pathogens responsible for hospital acquired pneumonia including VAP across varying patient populations, hospital units, geographical areas and time periods. In their study overall Gram negative bacteria represented the major part of isolates.[10]

According to Chastre *et al*[1] in their study, the most common pathogen were Gram negative *E. coli* (26%), *Pseudomonas aerogimosa* (24%) and *Staph. aureus* (20%). These findings are comparable with the results of our study. Bapcock *et al* compared the causes of VAP in a community hospital in 753 cases of VAP. They found that common isolates were *Pseudomonas*, *Acinetobacter* and *Staph. aureus*.[11] Similar findings are also noted in our study.

Polymicrobiology of VAP in the current study was 4%, it is in consonance with the results of Combes *et al*.[12] In 2% cases no growth was reported. It could be due to atypical bacterial infection. According to ATS guidelines for the management of adults with hospital acquired, ventilator associated and health care associated pneumonia published in 2005, most cases of VAP were caused by standard bacterial pathogens but atypical bacteria were also involved.[13] Similar results were reported by Chastre *et al*.[1]

According to Fagon *et al* delay in the initiation of appropriate antibiotic therapy can increase the mortality of VAP.[14] Effective infection controls measures should be taken to reduce the chance of infection.[15] Non-invasive ventilation should be used whenever possible in selected cases with respiratory failure.[16]

Bacterial profile of bronchoscopic and non-bronchoscopic samples is comparable and yield by this method is comparable with bronchoscopic specimens in our study. This was also noted by Rajasekhar *et al*.[5] Rajasekhar *et al* in 2006 studied the role of quantitative cultures of non - bronchoscopic samples in VAP. They concluded that a culture of lower respiratory tract samples obtained by non-bronchoscopic method is a good alternative to bronchoscopic samples in the bacteriological diagnosis of VAP.[5]

Limitations of our study may be attributed to lack of resources at our disposal as we used semi-quantitative method of bacterial culture. Atypical bacterial culture; and viral and fungal cultures were not performed.

CONCLUSION

Results of this study revealed that major pathogenic bacteria in our ICU are Gram negative organisms. Among this group *E. coli* is the commonest pathogen. In order of frequency the other pathogenic organisms cultured were, *Pseudomonas aeruginosa*, *Klebsiella*, *Staph. aureus* (MRSA & MSSA). FOB and Non-FOB methods are equally useful in the diagnosis of VAP. Empirical antibiotics should cover Gram negative pathogens. Further large scale studies are required in this regard.

REFERENCES

1. Chastre J, Fagon JY. Ventilator associated pneumonia. Am J Respir Crit Care Med 2002;165:867–903.
2. Bonten MJ, Bergmans DC, Ambergen AW, de Leeuw PW, van der Geest S, Stobberingh EE, *et al*. Risk factors for pneumonia, and colonization of respiratory tract and stomach in mechanically ventilated ICU patients. Am J Respir Crit Care Med 1996;154:1339–46.
3. Doern GV, Brown SD. Antimicrobial susceptibility among community- acquired respiratory tract pathogens in the USA: Data from PROTEKT US 2000–01. J Infect 2004;48:56–65.
4. Weinstein RA. Hospital acquired infections. In: Kasper DL, Braunwald E, Fanci AS, *et al*, editors. Harrison's principal of internal medicine. 16th ed. New York: McGraw-Hill, 2005:777.
5. Rajasekhar T, Anuradha K, Suhasini T, Lakshmi V. The role of quantitative cultures of non-bronchoscopic samples in ventilator associated pneumonia. Indian J Med Microbiol 2006;24:107–13.
6. Ibrahim EH, Ward S, Sherman G, Schaiff R, Fraser VJ, Kollef MH. Experience with a clinical guideline for the treatment of ventilator-associated pneumonia. Crit Care Med 2001;29:1109–15.
7. Hilbert G, Gruson D, Vargas F, Valentino R, Gbikpi-Benissan G, Dupon M, *et al.* Noninvasive ventilation in immunosuppressed patients with pulmonary infiltrates, fever, and acute respiratory failure. N Engl J Med 2001;344:817–22.
8. Paradisi F, Corti G, Cinelli R. Streptococcus pneumoniae as an agent of nosocomial infection: treatment in the era of penicillinresistant strains. Clin Microbiol Infect 2001;7 Suppl 4: 4–42.
9. Fagon JY, Chastre J, Domart Y, Trouillet JL, Pierre J, Darne C, *et al.* Nosocomial pneumonia in patients receiving continuous mechanical ventilation. Prospective analysis of 52 episodes with use of a protected specimen brush and quantitative culture techniques. Am Rev Respir Dis 1989;139:877–884.
10. Sopena N, Sabria M. Multicenter study of hospital-acquired pneumonia in non-ICU patients. Chest 2005;127:213–9.
11. Babcock HM, Zack JE, Garrison T, Trovillion E, Kollef MH, Fraser VJ. Ventilator-associated pneumonia in a multi-hospital system: Differences in microbiology by location. Infect Control Hosp Epidemiol 2003;24:853–8.
12. Combes A, Figliolini C, Trouillet JL, Kassis N, Wolff M, Gibert C, *et al.* Incidence and outcome of polymicrobial ventilator-associated pneumonia. Chest 2002;121:1618–23.
13. American Thoracic Society. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005;171:388–416.
14. Fagon JY, Chastre J, Wolff M, Gervais C, Parer-Aubas S, Stephan F, *et al.* Invasive and noninvasive strategies for management of suspected ventilator-associated pneumonia: a randomized trial. Ann Intern Med 2000;132:621–30.
15. Weinstein RA. Epidemiology and control of nosocomial infections in adult intensive care units. Am J Med 1991;91:179S–184S.
16. Esteban A, Frutos-Vivar F, Ferguson ND, Arabi Y, Apezteguia C, Gonzalez M, *et al.* Noninvasive positive-pressure ventilation for respiratory failure after extubation. N Engl J Med 2004;350:2452–60.
17. Varun Goel, Sumati A Hogade, SG Karadesai Ventilator associated pneumonia in a medical intensive care unit. Microbial and susceptibility pattern of isolated micro organisms and outcome. Indian J Anaesth. 2012;56(6):558–62.

Address for Correspondence:

Dr. Shamshad Ali, Department of Pulmonology, Jinnah Hospital Lahore-Pakistan.
Email: drshamshadali@hotmail.com