Survey

Ventilator-associated pneumonia: Study of clinical outcome

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Abstract

Introduction: Ventilator-associated pneumonia (VAP) is a nosocomial pneumonia that develops within 48 hours or more of mechanical ventilation. It is also associated with significant morbidity including increased ventilatory days, intensive care unit (ICU) stay and higher medical cost that leads to high mortality rate in ICU. **Aim:** To evaluate the clinical outcome of the patients diagnosed with VAP and also to identify the risk factors for VAP. **Methodology**: This retrospective study included 27 patients admitted in Medical and casualty ICU's from August 2013 to April 2014 who were diagnosed with various diseases and later developed VAP. The patient's demographic data and diagnosis based on Centres for Disease Control and prevention (CDC) criteria were collected. **Results**: Among 27 patients, 20 were male patients and 7 were female patients. The order of organism according to the frequency in the current study was found to be *Acinectobacter*, *Klebsiella*, *Pseudomonas aeruginosa*, *methicillin resistant Staphylococcus aureus*, *Streptococcus pneumonia*, *Hemophilus influenza*, *Enterobacter* sp. Twenty two patients had late onset VAP and five patients had early onset VAP. Overall the survival was 52%. **Conclusion**: The incidence and the mortality of VAP are high in the current ICU setup. The mortality rate in the current study was 48% and the patients who survived had a longer ICU stay due to ventilator dependence.

Keywords: Mechanical ventilation, ventilator-associated pneumonia.

Introduction

Ventilator-associated pneumonia (VAP) is described as the commonest hospital-acquired infection in mechanically ventilated patients.[1] It is defined as nosocomial pneumonia that develops after 48 hours or more of instituting mechanical ventilation. It is also associated with significant morbidity (27%) including increased ventilatory days, intensive care unit (ICU) stay and higher medical cost that leads to high mortality rate in ICU.[2] The onset of VAP can be divided into 2 types: early and late. Early-onset VAP occurs 48 to 96 hours after intubation and is associated with antibiotic-susceptible organisms. Late-onset VAP occurs more than 96 hours after intubation and is associated with antibiotic-resistant organisms.[3] VAP is a nosocomial infection that is associated with poor clinical and economic outcomes. The aim of this study was to evaluate the clinical outcome of the patients diagnosed with VAP and also to identify the risk factors for VAP in our setup.

Methodology

This was a retrospective study conducted in a teaching hospital of South India from August 2013 to April 2014. A total of twenty seven patients who were diagnosed with VAP using Centres for Disease Control and prevention (CDC) guidelines, from Medical and Casualty ICU were included in the study. The patients' demographic data, duration of stay in ICU, mode of ventilation, oxygenation and ventilation status, culture and sensitivity

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reports of endotracheal secretions (ET) and re-intubation status were recorded. Clinical outcome was determined on the basis of survival and death. Descriptive statistics were used to describe both continuous and categorical variables. Chi square test was performed to check the association between the categorical variables. $P < 0.05$ was considered significant.

Results

This was a retrospective study of twenty seven patients over a period of eight months at a tertiary hospital in South India. The mean (± SD) age of the patients was 53±21 years. Among 27 patients, 20 (74%) were male patients and 7 (26%) were female patients. Table 1 shows the duration of ICU stay, duration of mechanical ventilation and the PaO_2/FiO_2 ratio on the day of VAP diagnosis of the patients. The ICU stay and ventilator days were more than two weeks in patients who were diagnosed to have VAP.

Table 1: Duration of mechanical ventilation, ICU stay and PaO_2/FIO_2 ratio of patients who developed VAP

Parameter	Mean ± SD
Duration of ICU stay (days)	20 ± 5
Duration of mechanical ventilation (days)	17 ± 4
PaO_2/FiO_2	210 ± 72

Primary illness *(Figure 1)* of the patients was organophosphorus (OP) poisoning, pulmonary oedema, postoperative status, meningoencephalitis, chronic obstructive pulmonary disease and liver dysfunction. Among these, 33% patients had OP poisoning as the diagnosis.

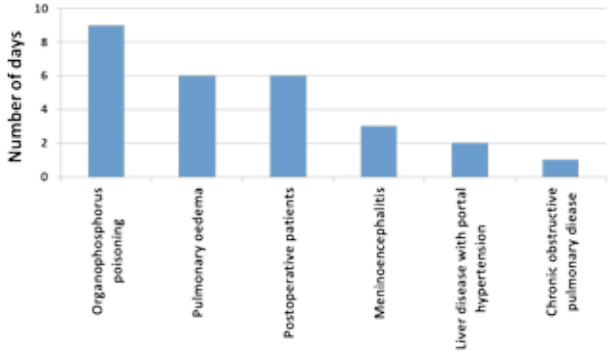

Figure 1: Primary diagnosis of patients

It was observed that 81.5% were gram negative organisms and 18.5% were gram positive organisms responsible for nosocomial pneumonia. The organisms grown were Acinectobacter baumanii (40.7%), Klebsiella pneumoniae (25.9%), Pseudomonas auregenosa (14.8 %), methicillin resistant staphylococcus aureus (MRSA) (3.7%), Streptococcus pneumonia (7.4%), Hemophilus influenza (3.7%), Enterobacter sp (3.7%) *(Figure 2)*.

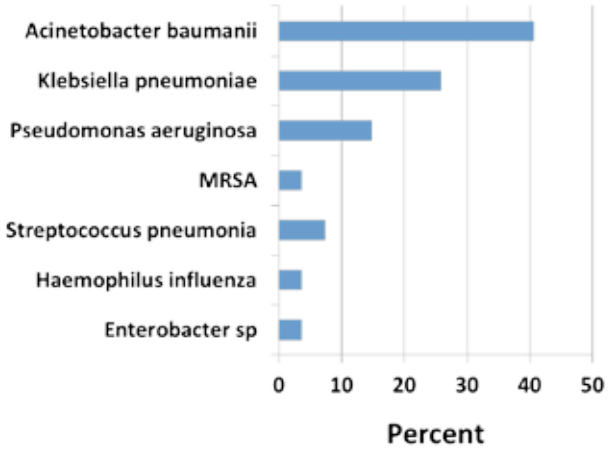

Figure 2: Organisms isolated from tracheal secretions

Reintubation was found to be a risk factor for VAP. Most of the reintubated patients were tracheostomised and had longer stay on ventilator. Rintubation shows a significant association with tracheostomy ($P < 0.05$). Twenty two (81%) patients had late onset VAP and five patients (19%) had early onset VAP *(Figure 3)*. Overall survival rate was 52% *(Figure 4)*.

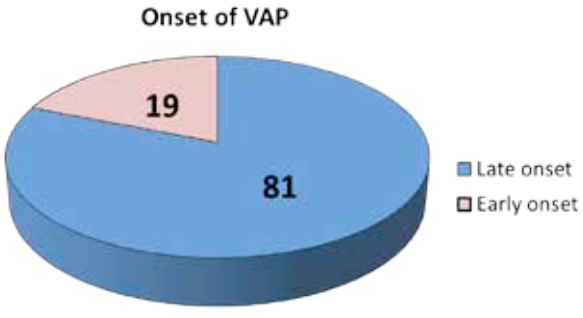

Figure 3: Time of onset of VAP

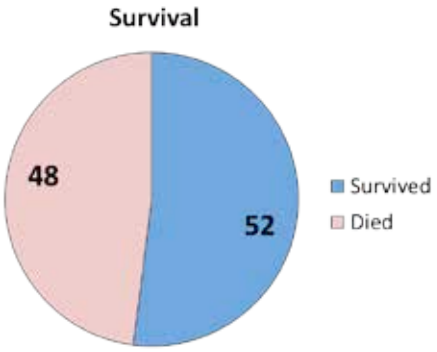

Figure 4: Survival rate

Discussion

VAP cases arise recurrently and are associated with substantial morbidity in ICU patients. There is absence of a gold standard criterion even now to diagnose VAP which makes VAP to be an unobtrusive clinical syndrome.[5]

In 2014, Kalanuria *et al* reported that the frequency of pathogens causing VAP are *Pseudomonas* (24.4 %), *S. aureus* (20.4 %, of which > 50 % MRSA), Enterobacteriaceae (14.1 % – includes *Klebsiella* spp., *E. coli*, *Proteus* spp., Enterobacter spp., Serratia spp., Citrobacter spp.) Streptococcus species (12.1 %), Hemophilus species (9.8 %). and Acinetobacter species (7.9 %).[5] In the present study, Acinetobacter species (40%) was most frequent. Steven *et al* reported crude ICU mortality rates of 24 to 76% for VAP at a variety of institutions.[2] In this study survival was 52% among patients who had VAP.

Preventive care plays a major role in the VAP care and VAP bundle approach has been shown to be widely used. The 5-element Institute of Healthcare Improvement (IHI) VAP bundle includes: Head of bed elevation, oral care with chlorhexidine, stress ulcer prophylaxis, deep venous thrombosis prophylaxis, and daily sedation assessment and spontaneous breathing trials.[5] Four of the seven components of the mandatory care of ICU patients, also called ICU bundle, (mnemonic 'FASTHUG'), are directed towards prevention of nosocomial pneumonia, stressing its importance. Jean Chastre *et al* studied bacterial colonisation in 25 endotracheal tubes and found that 96% had partial bacterial colonisation and 84% were completely coated with bacteria in a biofilm or glycocalyx.[6] There were 10 patients who were tracheostomised and 14 re-intubated in the present study and this might have increased VAP rate and mortality.

In the clinical pulmonary infection score (CPIS), only time dependent changes in the PaO_2/FiO_2 ratio early in VAP may provide some predictive power for VAP outcomes in clinical trials, namely clinical failure and mortality.[7] In the present study, PaO_2/FiO_2 was lesser in these patients with VAP which could be used as an indicator for the improvement and deterioration.

Conclusion

VAP is common and is associated with significant morbidity in critically ill patients. Most patients develop late onset VAP. Acinetobacter sp is the commonest organism isolated. Reintubation during the course of treatment is one of the risk factors of VAP. The patients who survive have a longer ICU stay due to the ventilator dependency.

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