NOSOCOMIAL PNEUMONIA IN MECHANICALLY VENTILATED PATIENTS

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ABSTRACT

Ventilator associated pneumonia (VAP) is a disease caused by different microorganisms and is associated with high mortality. The objective of this study was to ascertain the causative organisms of VAP and the mortality associated with this disorder. It was a prospective comparative study of 100 patients who underwent ventilatory support at a tertiary care teaching hospital (Combined Military Hospital Rawalpindi) from 1st July, 2000 to 30th June 2001. Patients who developed clinical signs of pneumonia are investigated by bronchoalveolar lavage(BAL) and blood culture. In patients who were diagnosed as a case of VAP, microorganisms were identified by BAL (79%) and blood culture (21%). Patients who developed VAP were followed as well as the controls that do not developed VAP. Mortality among both groups was recorded. Outcome of the study showed organisms including Pseudomonas aeruginosa (26%), Staphylococcus aureus (20%), Acinetobacter spp. (9%), Proteus spp. (6%), Haemophilus spp. (6%), Escherichia coli (6%), Klebsiella spp. (3%), Streptococcus pneumoniae (3%), Corynebacteria spp. (3%), and Polymicrobial flora (9%). The mortality among the patients of VAP was 50% compared to 30 % among the patients without VAP. But this difference is non-significant. In conclusion VAP is developed by diverse groups of microorganisms with Pseudomonas aeruginosa, Staphylococcus aureus and Acinetobacter spp amongst the commonest pathogens. VAP is associated with higher percentage of mortality.

Keywords: Pneumonia, mechanical ventilation, intensive care unit, mortality

INTRODUCTION

A nosocomial infection is defined as an infection occurring within an institutional setting (e.g. hospital, nursing home), which is not present or incubating at the time of admission. Nosocomial infections mainly include urinary tract infections, respiratory tract infections and vascular catheter infections [1]. Nosocomial pneumonias are common in intensive care unit patients, especially those who receive mechanical ventilation [2]. The factors responsible for increase predisposition of mechanically ventilated patients for nosocomial pneumonia are impaired host defenses, breech of mucocutaneous barrier by endotracheal intubation, endotracheal suction, intravascular catheterization and multiple drug therapy [3].

Nosocomial pneumonia is fairly common in intensive care unit settings and its incidence varies from 20-26% in various studies [4,5]. The main causative agents are Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella, Enterobacter species, and Escherichia coli and Haemophillus influenzae. These pathogens show resistance to commonly prescribed antibiotics like third generation cephalosporin, imepenem, vancomycin and aminoglycosides [6]. The problem of antimicrobial resistance is of greater importance in the developing

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countries because of clustering, higher rate of infection and gross over prescribing of antibiotics [7]. There is failure of regulatory authorities as well.

There is evidence that mechanical ventilation is the principal risk factor for lower respiratory tract infection [8]. The occurrence of pulmonary infection in ventilated patients could affect the prognosis. However, despite recent publications [9,10] the question of whether ventilator associated pneumonia (VAP) affects ICU mortality requires more investigations. There is evidence that patient who need more than 48 hours of mechanical ventilation represents a selected population with particularly severe associated pathologies leading to a fatality rate of more than 40% [11].

Demonstration of relationship between death and VAP is a difficult task epidemiologically. Indeed, in ventilator-associated patients, it is very difficult to distinguish between the deaths caused by VAP and deaths occurring while VAP was present at the time of death but not directly the cause. Moreover, multiple noninfectious diseases can mimic the clinical presentations of VAP. In one study, there was failure to prove that VAP is the cause of any excess mortality in mechanically ventilated patients [10]. On the other hand there is a study showing that mortality rate was increased [12].

The goal of our study was:

To determine the common pathogens responsible for nosocomial pneumonia.

To evaluate the effects of nosocomial pneumonia on mortality of patients being mechanically ventilated.

PATIENTS AND METHODS

This was a prospective study of 100 patients who received ventilatory support. The study had been conducted in the Intensive Care Unit, Combined Military Hospital, Rawalpindi from the period of 1st July 2000 to 30th June 2001.

Inclusion Criteria

Sex	:	Male / Female
Age	:	More than 15 years
Weight	:	All weights
Disease	:	Patients undergoing mechanical ventilation due to any cause for which they were admitted in intensive care unit.

Exclusion Criteria

Age	:	<15 years
Disease	:	Patients already having pulmonary infections at the time of admission.

While placing the patients on ventilator, the patients were sedated by using inj. thiopentone sodium or inj. midazolam or narcotics like inj. morphine or inj. pethidine. Endotracheal Intubation was achieved by using either depolarizing neuromuscular blockers like inj. suxamethonium or nondepolarizing agents like inj. pancuronium or inj. atracurium. Patients who required continued postoperative ventilatory supports were already had endotracheal tube in place, while using the same technique. Comatosed patients without any muscular efforts were intubated without using any muscle relaxant. A disposable cuffed endotracheal tube made up of polyvinyl chloride was used. Patients were placed on Adult Star Ventilator (Infrasonic Inc. San Diego California USA). In all the patients who had been clinically suspected to develop nosocomial pneumonia, fiberoptic bronchoscopy had been done while using KARL STORZ Germany, 11001 BN, bronchoscope.

All the patients placed on ventilatory support during the one-year period were included in this study. At the time of entry in intensive care unit or placing a patient on ventilator the following data was recorded:

- History including name, age, sex, chronic lung diseases.
- Daily laboratory investigations including haematocrit, serum albumin, serum creatinine and electrolytes.
- Daily X-ray chest.
- Level of consciousness according to Glasgow Coma Scale.

The patients were followed and search was maintained for the development of any sign of pneumonia. The diagnosis of pneumonia was suspected when the patients showed at least three of the following criteria [4].

- Fever (temperature > 38.5□ C)
- Purulent tracheobronchial secretions.
- Leukocytosis (>12000/ mm 3)
- Leukopenia (4000/ mm3)
- New, progressive or persistent (24 hrs) infiltrate on the chest radiograph

All the patients who developed pneumonia were further investigated by means of the following:

- Fiberoptic bronchoscopy within twenty-four hours after the clinical diagnosis of pneumonia made. Bronchoalveolar lavage samples were obtained for culture.
- Blood culture.

The following observations were made:

- Identification of the common bacteria causing pneumonia and their sensitivity.
- The patients outcome, whether the patient lived or died after mechanical ventilation were recorded for the patients developed pneumonia and was compared with the outcome of the patients who did not developed pneumonia.

Each patient's Data was recorded on a proforma, the sample of which is shown in annex-1. It was then analyzed in tabular form. Data was presented as percentages. Mortality was assessed by x^2-test using SPSS 10.0.

RESULTS

Total 100 patients were studied. Mean age was 43 $\pm$ 10 years. 34 patients developed Ventilator Associated Pneumonia (VAP), out of those 17 died and 17 were discharged from hospital. From the rest of 66 patients who did not developed VAP, 20 died and 46 were discharged from hospital.

The diagnosis was confirmed by bronchoalveolar lavage technique in 79% cases and blood culture in 21%. The common microorganisms identified included Pseudomonas aeruginosa (26%), Staphylococcus aureus (20%), Acinetobacter spp. (9%), Proteus spp. (6%), Haemophillus spp. (6%), Corynebacterium spp. (3%), Streptococcus pneumonia (3%), Escherichia coli (6%), Klebsiella spp. (3%), and Polymicrobial flora (9%).

The mortality among VAP patients was 50% while that among non VAP patients were 30%. But this different is statistically insignificant as p-value >0.05. The relative risk of mortality was 1.66, and the attributable risk was 20%.

DISCUSSION

The ventilator associated pneumonias are nosocomial infections with high mortality percentage and diverse groups of bacteria being involved. These bacteria are usually resistant to many of the routine antibiotics available in Pakistan [13].

Our study included patients of either sex and the indication of ventilatory support include both post surgical (59%) as well as medical disorders (41%). Most of the studies included both groups of patients. An important exception in our study is the absence of post cardiopulmonary bypass patients.

The VAP is diagnosed by BAL (79%) and blood culture (21%). Main problem is the differentiation of VAP with pulmonary edema, both cardiogenic and non cardiogenic type. Violen et al had reported diagnoses of VAP in 80 % of the patients by BAL and 18 % by blood culture 4. His diagnostic criteria also included other methods like pleural aspirate and autopsy. Our study showed generally the same results with higher yield for BAL and lower for blood culture. Bregen et al [14] had reported 22% with BAL but he did not include the patients with positive blood culture into VAP which were 13% of all patients.

The diagnoses of VAP are crucial to start the effective antibiotics because most of these patients receive empirical antibiotics and only 30% had adequate one [15]. This antimicrobial therapy is an independent risk factor for the patient's outcome. [15,16] So early recognition of the causative organism is the mainstay of management.

Our study's results showed Pseudomonas aeruginosa (26%), Staphylococcus aureus (20%) , Acinetobacter spp (9%), Proteus spp (6%), Hemophilus spp (6%), E. coli (6%), Klebsiella spp (3%) and polymicrobial flora (9%). Violan et al [4] had reported Pseudomonas aeruginosa 31%, Staphylococcus aureus 30%, and Haemophillus influenzae 19.5%. Bregeon et al [14] had reported a high rate of Staphylococcus aureus 28.5%, both methicillin resistant and sensitive organisms, and Pseudomonas aeruginosa 16%, and Enterobacter percentage species 12%. Our study showed higher rate of Staphylococcus aureus and Pseudomonas aeruginosa which is quite consistent with the studies mentioned above. The slight variation in the results is because our population is different, method of bacterial culture is different as well as the causative organisms are different for different countries, hospitals, and wards [17]. General trends in nosocomial pneumonia are evolving towards more resistant and more difficult to treat pathogens.

Annexure-1

Nosocomial Pneumonia in Mechanically Ventilated Patients in the Intensive Care Unit, Combined Military Hospital Rawalpindi. Its Main Causative Microorganisms and Effects on Patients Survival.

(Proforma used for the study)

Name, Age, Sex :
Primary disease for which
ventilatory Support is required :
Coexisting disease :
Ventilatory support initiated on :
Nosocomial pneumonia : Yes ( ) No ( )
Organisms identified on BAL/culture :
Patient's outcome : Successfully weaned ( ) Died ( )

Table-1: Diagnosis of VAP

Diagnostic technique	Patients	Percentage
BAL	27	79
Blood culture	07	21
Total	34	100

Table-2: Microorganisms responsible for VAP in this study

Gram-negative bacteria	
Pseudomonas Aeruginosa	9 (26%)
Acinetobacter Spp.	3 (9 %)
Proteus Spp	2 (6%)
Haemophilus Spp	2 (6%)
Escherichia Coli	2 (6%)
Klebsiella Spp.	1 (3%)
Miscellaneous	2 (6%)
Gram-positive bacteria	
Staphylococcus Aureus	7 (20%)
Streptococcus Pneumoniae	1 (3%)
Corynebacteria Spp.	1 (3%)
Miscellaneous	1 (3%)
Polymicrobial Flora	3 (9%)

Table-3: Comparison of mortality between VAP and non-VAP

	Patients	Died	Discharged
VAP	34	17(50%)	17
NON-VAP	66	20(30%)	46

It was always a thought that VAP is associated with higher mortality rate but studies on VAP revealed that only a few investigations focusing on patient's prognosis have sufficiently taken into account the numerous risk factors for death present in this kind of severely ill population. Our study also showed higher mortality percentage for VAP (50%) as compared to control (30%). But this difference is not significant. This gives a relative risk of 1.66 and attributable risk of

20%. Numerous studies have reported a higher fatality rate for patients developing VAP [4,18,19,20]. Our study was a comparative prospective study with a stronger design. Fagon et al [10,12] had reported an increased fatality rate attributable to VAP with attributable mortality of 27% and relative risk of [2]. Fagon et al had demonstrated 71% mortality in 1989, but this had reduced to 53% in 1994. A mortality rate of as low as 24% was given by Baker [21], their diagnostic criteria was BAL. The latest study of Bregeon et al [14] had not attributed VAP as the independent risk for mortality, but their study was multivariate analysis and a case control retrospective study.

There are enough arguments in the literature today to say that VAP has an overall effect on patient's mortality. Although mortality is decreasing because of the effectiveness of antibiotics, better management of mechanical ventilation or improvement in haemodynamic and other organ failure support, the fact that VAP does appear as a risk factor for death must be interpreted with caution because of the presence of multi organ failure in these critically ill patients.

CONCLUSION

I concluded that Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter spp., polymicrobial flora were the most common microorganisms found in the patients of Ventilator associated pneumonia. The percentage of mortality in mechanically ventilated patients who developed VAP is high (50%) as compared to these who did not develop VAP (30%). But this difference is not significant.

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