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Original Research Paper

Incidence and outcome of Ventilator-Associated Pneumonia in adults after Cardiac Surgery

Cardiology

KEYWORDS: Ventilator-associated pneumonia (VAP), cardiac surgery, mechanical ventilation

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ABSTRACT

Introduction: Ventilator-associated pneumonia (VAP) is the most common and serious nosocomial infection that threatens patients who have undergone cardiac surgery. VAP in the cardiac intensive care unit increases mechanical ventilation hours, which subsequently increases the length of stay in the intensive care unit. Studies have shown a significant increase in morbidity and mortality in patients with VAP.

Material & methods: This study was performed on randomly selected 100 patients, kept on ventilatory support for more than 48 hrs over a period of six months in postoperative intensive care unit (ICU) of a tertiary cardiac care centre. We investigated the incidence of VAP in adults after cardiac surgery and its impact on morbidity and mortality.

Conclusion : The incidence of ventilator-associated pneumonia is high. Patients undergoing cardiac surgery are at high risk and need special attention towards prevention. VAP leads to increased mortality in ICU patients after cardiac surgery, with late-onset VAP associated with poor prognosis as compared to the early-onset variety. Targeted strategies aimed at preventing VAP should be implemented to improve patient outcome and reduce length of intensive care unit stay.

INTRODUCTION

Ventilator-associated pneumonia (VAP) refers to bacterial pneumonia developed in patients who have been mechanically ventilated for a duration of more than 48 h. as per Centers for Disease Control (CDC) criteria[1]. VAP was diagnosed upon new and/or progressive pulmonary infiltrates on chest radiograph plus two or more of following criteria: fever or hypothermia, leucocytosis, purulent tracheobronchial secretions and reduction of partial pressure of arterial oxygen/fraction of inspired oxygen of 15%or higher in the past 48 hours. There is significant increase in mortality in patients who had VAP as high as 20 % in some studies.[2] VAP increases mechanical ventilation hours and causes significant increase in mortality.[3,4] Patients who have undergone cardiac surgery and a stay in the intensive care unit (ICU) usually need long-time mechanical ventilation; they represent a special subpopulation at high risk for VAP.[5] We performed this study to investigate the incidence and outcome of patients, who developed VAP after cardiac surgery in our ICU.

OBJECTIVE:

To assesses the incidence of VAP in post operative cardiac surgery patients.

To review the outcome in the form of mortality and morbidity in post operative patients of cardiac surgery with Ventilator-associated pneumonia (VAP).

METHODS

We studied 100 post operative cardiac surgery patients randomly, kept on ventilatory support for more than 48 h. The study was conducted over a period of six months in postoperative intensive care unit (ICU) of a tertiary cardiac centre. Cases included were patients of both sexes who were kept on mechanical ventilator for more than 48 h, having the age of >15 years. Patients who died or developed pneumonia within 48 h or those who were admitted with pneumonia at the time of admission and patients of ARDS (Acute Respiratory Distress Syndrome) were excluded from the study. Age, sex, date of admission to ICU, date of initiating mechanical ventilation were recorded .The criterion which we used was VAP was based on the modified CPIS system.[6] VAP was diagnosed when a score of ≥6 was obtained in the clinical pulmonary infection scoring system (CPISS).

CPIS points	0	1	2
Tracheal secretions	Rare	Abundant	Purulent
Leukocyte count (mm^3)	>4,000 and <11,000	<4,000 and >11,000	<4,000 or >11,000 + band forms
Temperature (°C)	>36.5 and <38.4	>38.5 and <38.9	>39 or <36
PaO_2/FIO_2 ratio (mmHg)	>240 or ARDS	-	≤240 and no ARDS
Chest radiograph	No infiltrate	Diffuse infiltrate	Localized infiltrate
Culture of tracheal aspirate	Negative	-	Positive

CPIS: Clinical pulmonary infection scoring

Patients were divided in two groups: the VAP group and the non-VAP group. The VAP group was classified into two groups, early-onset type (within 48–96 h) and late-onset type (>96 h). Demographic data and perioperative risk variables were collected for all patients.

A prospective observational cohort study of 100 patients who were mechanically ventilated for more than 48 hours were evaluated to find out the development of nosocomial pneumonia and morbidity associated with it.. Data were subjected to univariate analysis using chi-square and t-test. Level of significance was set at 0.05.

RESULTS

26 out of 100 patients developed ventilator associated developed ventilator associated pneumonia, majority of them between four days to 14 days.

The results are tabulated as below

Table 1. Demographic data of the study patients

	No of cases	VAP	Percentage of VAP (%)
Male	62	15	24.19
Female	38	11	28.9
TOTAL	100	26	26

In our study, males predominated (62%), but the incidence of VAP was higher in females, though it was statistically not significant.

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Table 2: Comparison of duration of mechanical ventilation and incidence of VAP

Days on ventilator	CASES	VAP	PERCENTAGE (%)
<15	76	15	19.73
>15	24	11	45.83
TOTAL	100	26	26

This study shows that duration of mechanical ventilation is an important risk factor for VAP, with greater incidence (45.83 vs 19.73 %) of VAP in patients requiring > 15 days of ventilation.

Table 3: Outcome of mechanically ventilated patients

OUTCOME	VAP (%)	NON VAP (%)	TOTAL	p value
Tracheostomy	8 (30.77)	4 (5.40)	12	.06
Duration of MV (in days)	22.6	12.4	-	.08
Duration of ICU stay (in days)	28.6	14.6	-	.1

Out of 26 patients who developed VAP, 8(30.77%) required tracheostomy indicated for prolonged need of mechanical ventilation. The duration of mechanical ventilation for the VAP group was significantly high. Similarly, the VAP group also had significantly longer duration of ICU stay.

Table 4: Outcome of patients of ventilator associated pneumonia

outcome	Early onset VAP	Late onset VAP	Total	Non VAP
EXPIRED	3	7	10	18
SURVIVED	7	9	16	56
TOTAL (%)	10 (30)	16 (43.75)	26 (38.46)	74 (24.32)

The mortality rate in our study was found to be 38.46 % in the VAP group compared to 24.32% in the non-VAP group which was statistically significant, leading to increased mortality in ICU patients. Early onset VAP had significantly less mortality compared to late onset VAP (30 % vs 43.75)

DISCUSSION

Hospital-acquired pneumonia (HAP) is the pneumonia after 48 h or more after admission, which did not appear to be incubating at the time of admission.[7] Ventilator-associated pneumonia (VAP) is the second most common form of HAI after blood stream infection.[8] Ventilator-associated pneumonia (VAP) is defined as a nosocomially acquired pneumonia in the patients mechanically ventilated for more than 48 h[1]. CPB and cardiac surgery induces many changes in the body that may include hemodynamic instability, pulmonary edema, as well as a surge of cytotoxins with resultant capillary leak syndrome. These changes affects body defense and increases the risk of VAP. Increase pulmonary blood flow, lung plethora, significant left to-right shunt, or pulmonary venous obstruction are common peri operative problems that can affect lung vasculature and pulmonary blood flow, which may also increase the risk of respiratory infection after cardiac surgery.[9]

Diagnosis of VAP can still miss about a third of VAPs in the ICU compared to autopsy findings and can incorrectly diagnose more than half of patients, likely due to poor inter observer agreement between clinical criteria.[10]

In recent studies of Kollef et al & Fagon JY et al [11,12] the reported incidence of VAP was low, ranging from 15 to 30% which is comparable to our study with 26 %.

Duration of mechanical ventilation is an important risk factor for VAP, with greater incidence (45.83 vs 19.73 %) of VAP in patients requiring > 15 days of ventilation which is similar to other studies of Rello J et al.[13] The mean duration of ventilation can effectively be reduced by administrating a proper weaning protocol. Among the various methods of weaning, spontaneous breath trial has been proved to be very effective as compared with the intermittent mandatory ventilation (IMV) because of the fact that IMV promotes respiratory fatigue.[14,15] A once-daily trial of spontaneous breathing and a prolonged period of rest may be the most effective methods of weaning to recondition respiratory muscles that may have been weakened during mechanical ventilation.[16,17]

In our study patients with VAP required tracheostomy more frequently than other mechanically ventilated patients (30.77 vs 5.40 %). Thus tracheostomy was studied as an outcome of VAP and need of prolonged mechanical ventilation. Tracheostomy has also been stated as a risk factor by some studies.[18,19] However, some studies state that early and planned tracheostomy protects mechanically ventilated patients from VAP.[20]

The mechanical ventilation and ICU stay was prolonged in patients with VAP, and the morbidity was also significantly increased in this group. Other studies of Wilhelmina G et al [21] also reported similar outcomes.

Early-onset VAP in our study was found to be 38.46 % which is similar to the study of Kollef[22] where it was found to be around 40%. Studies have shown that previous antibiotic use decreases early-onset VAP but markedly increases multi drug resistant(MDR) pathogens.[23]

Our study also demonstrated that early onset VAP had a good prognosis as compared with the late-onset type in terms of mortality, which is also statistically significant. The de-escaltation strategy, which means initiation of a broad-spectrum antibiotic and changing to a narrow spectrum after the sensitivity results are made available, will reduce inappropriate antibiotic use and, subsequently, the drug-resistant pathogens.[24] Invasive bronchoscopic sample collection and quantitative sample culture reduces inappropriate antibiotic use.[25]

The mortality rate in our study was found to be 38.46 % in the VAP group compared to 24.32 % in the non-VAP group. The mortality incidence was higher in VAP, and is statistically significant. So it can be implied that VAP does increase the mortality in ICU patients after cardiac surgery.

CONCLUSION

The incidence of ventilator-associated pneumonia was high in our setting. Requirement of mechanical ventilation for more than 15 days increases the risk. Late-onset VAP is associated with poor prognosis as compared to the early-onset variety. VAP leads to increased morbidity and mortality in ICU patients after cardiac surgery. These patients need special attention towards preventive measures such as hand washing, hygiene, proper weaning protocol, early and planned tracheostomy etc to decrease the incidence of VAP and decrease morbidity and mortality.

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