Indian Journal of Emergency Medicine
Volume 4 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/ijem.2395.311X.4218.4

Association of Ventilator Associated Pneumonia with Various Risk Factors in Patients at Ahmedabad, Gujarat

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Received on 20.04.2018,
Accepted on 05.05.2018

Abstract

Background and Aim: Ventilator associated pneumonia (VAP) is a common complication in critically ill patient affecting 9 to 27% of all critically ill patients. We have done the study of ventilator associated pneumonia (VAP) with various risk factors like age, sex, duration of ventilation, airway access, various organisms and their culture and sensitivity to various antibiotics and comorbid conditions associated with ventilator associated pneumonia. *Material and Methods:* The present study was conducted in our Medical ICU of Civil Hospital during period from November 2009 to November 2011. It includes 100 cases of mechanically ventilated patients of age more than 15 years. VAP was defined as the occurrence of a new and persistent radiographic infiltrate in conjunction with positive endotracheal aspirate culture. A cut off of 7 days of mechanical ventilator was used to distinguish patient with early onset VAP from those with late onset VAP. Risk factors like age, sex, duration of mechanical ventilation and comorbid conditions like COPD, stroke, ischemic heart disease were studied. *Results:* Most common comorbid state associated with mechanical ventilatory support was COPD and 72.72% patients with COPD developed VAP. incidence of VAP was highest with reintubation (70%) followed by tracheostomy (30%) and non-invasive ventilation (20%). most common organism for VAP was Pseudomonas with 37.5% incidence, followed by Staphylococcus Aureus (16.66%), Klebslia (16.66%), *Conclusion:* Ventilator associated pneumonia is an important cause of mortality in ICU patients. Most important risk factors for development of VAP include age >60 years, presence of co-morbid illnesses, re intubations, duration of ICU stay.

Keywords: COPD; Ischemic Heart Disease; Stroke; Ventilator Associated Pneumonia.

Introduction

Patients generally in intensive care unit are 5 to 10 times more likely to acquire nosocomial infection than ward patients. Ventilator associated pneumonia (VAP) is a common complication in critically ill patient affecting 9 to 27% of all critically ill patients [31]. Impairment of defence mechanisms in ICU patients and easy access of pathogenic microorganism to the lower respiratory tract are responsible for development of VAP. The risk of VAP is 7-20 fold greater in patients treated with endotracheal intubation than in non intubation patients [23] and risk increases in patients with invasive mechanical ventilation. Increased risk of VAP in ICU patients is primarily due to cross infection from ICU patients, use of invasive medical devices such as endotracheal tube, mechanical ventilator, peripheral and central venous lines, urinary tract catheter, tracheostomy tubes as well as predisposing factors like old age, malnutrition, immunocompromised state, impaired

protective reflexes and associated co-morbid illness [9]. VAP is mainly caused by the most resistant and pathogenic bacteria which are not usually seen in community acquired pneumonia (CAP).

We have done the study of ventilator associated pneumonia (VAP) with various risk factors like age, sex, duration of ventilation, airway access, various organisms and their culture and sensitivity to various antibiotics and comorbid conditions associated with ventilator associated pneumonia.

Material and Methods

The present study was conducted in our Medical ICU of Civil Hospital during period from November 2009 to November 2011. It includes 100 cases of mechanically ventilated patients of age more than 15 years.

Inclusion Criteria were: 15-75 years of age and Mechanical ventilated patients of more than 2 days.

Exclusion Criteria were: Patient's chest x-ray showing consolidation at time of onset of mechanical ventilation.

VAP was defined as the occurrence of a new and persistent radiographic infiltrate in conjunction with positive endotracheal aspirate culture. A cut off of 7 days of mechanical ventilator was used to distinguish patient with early onset VAP from those with late onset VAP.

Outcome

Good: Resolution of pneumonia.

Poor: Death occurred from VAP or associated comorbid condition.

Risk factors like age, sex, duration of mechanical ventilation and comorbid conditions like COPD, stroke, ischemic heart disease were studied. Chest x-ray was done at time of admission and every 48 hours after that.

Results and Discussion

The present study was conducted in Medical ICU of Civil hospital from November 2009 to November 2011.

In present study, we studied 100 patients who were on more than 2 days of mechanical ventilatory support. Out of that, 48 patients (48%) developed ventilator associated pneumonia. It was comparable to Alaka et al. [1] (47%) and Fagon et al. [15] (40%) study (Table 1).

In present study, age group of patients who developed VAP varied from 15 to 75 years. Youngest age was 22 years and oldest age was 73 years. The mean age was 55 years. VAP was seen in age group of 15-24 yrs (33%), 25-34 yrs (25%), 35-44 yrs (20%), 45-54 yrs (27%), 55-64 yrs (54%), 65-75 yrs (75%) respectively. Maximum incidence of VAP (75%) was seen between the age group of 65-75 years which was well correlated with study of William Buczko (70%) [39]. High incidence of VAP was seen in age group of more than 60 years due to age associated low immunity and associated co-morbid illnesses Table 2).

In present study, 34(50%) males out of 68 males and 14 (43%) females out of 32 females developed VAP. It was correlated with Emad Ibrahim et al (50% & 49% in males & female respectively)[11] and Fagon et al[15] (56% & 43% in males & female respectively) studies. Although in present study gender association in causation of VAP is insignificant, higher incidence of VAP was seen in male because of risk factors like smoking (Table 3).

Table 1: Incidence of VAP

Total no of patients	Patients developing VAP	Present study	Alaka et al[1]	Fagon et al[15]
100	48	48%	47%	40%

Table 2: Incidence of VAP in different age group

Age (YEARS)	Total no. of patients (n=100)	No. of patients developed VAP(n=48)	Present study (%)	William Buczko Study (%)[39]
15-24	06	02	33.33%	30%
25-34	08	02	25%	19%
35-44	10	02	20%	27%
45-54	22	06	27%	22%
55-64	22	12	54.54%	50%
65-75	32	24	75%	70%

Table 3: Incidence of VAP in different sex group

Gender	Total no. of patients	patients developed	Present study	Emad Ibrahim et al[11]	Fagon et al[15]
Male	68	34	50%	50.80%	56%
Female	32	14	43.75%	49.2%	43%

In the present study, common comorbid conditions in patients who required mechanical ventilatory support were COPD, CV stroke, ischemic heart disease with left ventricular dysfunction, Guillain Barré Syndrome, organophosphorous poisoning, meningitis and hepatic encephalopathy. Most common comorbid state associated with mechanical ventilatory support was COPD and 66.66% patients with COPD developed VAP. This was comparable to study of Alaka et al. [1] (65%) & Eleni et al. [10] (68%) which also showed higher incidence of VAP with COPD. It was followed by GBS(60%), OP Poisoning (50%), CV Stroke with altered sensorium (42.8%), Meningitis (33%), Hepatic Encephalopathy (33%), Ischemic Heart disease with LVD (20%) which are also comparable to above mentioned studies (Table 4).

In the present study, incidence of VAP was highest with reintubation (70%) followed by tracheostomy (30%) and non-invasive ventilation (20%). This was correlated with Alaka et al. [1] and A. Torre, J Gatewall et al. [33] studies. Higher incidence of VAP was seen with re-intubation because invasive procedure of intubation was repeated, which was associated with higher chances of infection with pathogenic organism during their insertion and patient who required re intubation would have been more vulnerable to aspiration in the interval between extubation and re intubation (Table 5).

So non-invasive ventilation should be preferred over invasive ventilation, if there is no strict indication for the latter.

In the present study, incidence of early onset VAP was 58.33% while late onset VAP was 41.66% which is comparable to study of Emad H. Ibrahim et al. [11] (56% & 44% respectively) and Niederman and Ahmed et al. [26] (50% & 50% respectively) Thus, the risk of VAP is highest in the initial week of ICU stay (Table 6).

In the present study, most common organism for VAP was Pseudomonas with 37.5% incidence, followed by Staphylococcus Aureus (20%), Klebslia (16.66%), E.coli (8.3%), Acinetobacter spp. (4.16%) and Enterobacter spp. (12.5%). Thus, pseudomonas was

Table 4: Indication of mechanical ventilation in different comorbid condition and development of VAP in that condition

	Comorbid Condition	Total no of patients (n=100)	No of patients developed VAP(n=48)	Present study	Eleni[10] et al	Alaka et al[1]
1.	COPD	24	16	66.66%	68%	65%
2.	GBS	20	12	60%	60%	59%
3.	OP Poisioning	04	02	50%	52%	46%
4.	CV stroke with unconsciousness	10	06	42.8%	45%	50%
5.	Meningitis	12	04	33.33%	30%	35%
6.	Hepatic encephalopathy	06	02	33.33%	28%	39%
7.	IHD+LVD	10	02	20%	25%	29%
8.	Others	14	04	28%	28%	24%

Table 5: Incidence of VAP in patients with various airway access

Airway access	Total no. of patients (n=100)	No. of patients develop VAP(n=48)	Present study	Alaka[1] et al	A. Torre, J Gatewall et al[33]
Endotracheal tube	36	16	44%	47%	52%
Reintubation	34	24	70%	79%	65%
Tracheostomy	20	06	30%	20%	35%
Non invasive ventilation (BIPAP or CPAP)	10	02	20%		

Table 6: Incidence of VAP in early onset and late onset

	No of patients developed VAP(n=48)	Present Study	Emad H. Ibrahim et al[11]	Niederman and Ahmed et al[26]
Early Onset (<7days)	28	58.33%	56%	50%
Late onset (≥7days)	20	41.66%	44%	50%

found to be most common organism for development of VAP which was well correlated with study of Emed H. Ibrahim et al. [11] (33%) and Ranga G.S et al. [29] (31%) (Table 7).

In the present study incidence of pseudomonas in the late onset of VAP was 50% while Staph aureus was 20% and Klebsiella, E.Coli, Acinetobacter spp. and Enterobacteria was 10% respectively which is comparable to study of Emad Ibrahim et al. [11] in which incidence of Pseudomonas as causative organism was 40% while staph aureus (21%) and klebsiella (6.5%).

The present study shows that mortality of VAP was 58.33%, it was comparable to Fagon et al. [15] (52%) & Emad Ibrahim [11] (45%) studies. This apparent higher mortality rates seen in age more than 65 years (75%) due to higher incidence of co-morbid illness (Table 8).

In present study, patients who were more than 7 days of ventilatory support (late onset) have higher mortality of 70% as compared to less than 7 days (early onset) which was 50% which is comparable to Emad Ibrahim et al. [11] (60% & 48% respectively) study. The higher incidence of mortality was seen in late onset VAP because of higher chance of infections with MDR pathogens (Table 9).

In present study, pseudomonas organisms were associated with higher mortality rate of 70%, which was followed by Staph aureus (60%), E.Coli (50%), Klebsiella (33%) which were well correlated with study of Jordi Rello et al. [21] in which mortality rates were 74%, 57%, 39% and 61% respectively. Pseudomonas is associated with higher mortality rate because of high virulence and multi-drug resistant nature of pathogen (Table 10).

In present study higher rates of mortality was seen with COPD (62.5%). Mortality of VAP in patients with OP poisionoing, Hepatic encephalopathy and IHD with LVD was 100%, CV Stroke with unconsciousness (50%), GBS (50%), Meningitis (50%).

Conclusion

Ventilator associated pneumonia is an important cause of mortality in ICU patients. Most important risk factors for development of VAP include age >60

Table 7: Incidence of common causative organisms in VAP

	Causative Organisms	No of patients developed VAP(n=48)	Present study	Emad Ibrahim et al[11]	Ranga G.S.[29]
1.	Pseudomonas	20	37.5%	33%	31%
2.	Staphylococcus aureus	10	20%	19.4%	18%
3.	Klebsiella	06	16.66%	8.5%	20%
4.	E.coli	04	8.3%	8%	8%
5.	Enterobacter spp.	06	12.5%	11.1%	13%
6.	Acinetobacter spp.	02	4.16%	4.2%	6%

Table 8: Mortality of patient in relation to VAP

Total no. of patients developed VAP	Mortality with VAP	Present Study	Fagon et al[15]	Emad H. Ibrahim et al[11]
48	28	58.33%	52%	45%

Table 9: Mortality in relation to duration of ventilator

Duration of ventilator	No. of patients developed VAP	Mortality in relation to VAP	Present study	Emad Ibrahim et al[11]
Early onset (< 7 days)	28	14	50%	48%
Late onset (=> 7 days)	20	14	70%	60%

Table 10: Mortality of VAP in relation to various organisms

	Organism	Mortality in relation to VAP	Present study	Jordi Rello et al[21]
1.	Pseudomonas (n=20)	14	70%	74%
2.	Staph aureus (n=10)	6	60%	57%
3.	Klebsiella (n=6)	2	33%	39%
4.	E.Coli (n=4)	2	50%	61%

years, presence of co-morbid illnesses, re intubations, duration of ICU stay. Higher mortality in VAP patients is associated with infection with MDR pathogens, prolonged invasive ventilation and underlying co-morbid illnesses. High index of suspicion and use of clinical, microbiological and radiological scoring systems help us in early detection of VAP and early institution of definitive therapy.

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