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Microbiological Profile of Ventilator Associated Infections in Intensive Care Units in a Tertiary Care Hospital

KEYWORDS: Hospital Associated Infections (HAI) Intensive care unit, Mechanical ventilation, Ventilator Associated Infections (VAI)

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ABSTRACT *Ventilator-associated infections(VAI) is a sub-type of Hospital Associated Infections (HAI) which occurs restricted to patients undergoing mechanical ventilation while in a hospital, Ventilator associated infection is a major cause of hospital mortality and morbidity despite recent advances in diagnosis and accuracy of management. The study was conducted over a period of 2 months in Intensive Care Units (Pediatric ICU, Medical ICU) of Tirunelveli Medical College Hospital. A total of 25 patients who were kept on mechanical ventilator were randomly selected. Cases included were patients of both sexes who were kept on mechanical ventilator. Gram staining and bacterial culture and sensitivity was done. Out of 25 patients, 17 patients developed VAI. The risk factors significantly associated with VAI in our study was found to be the duration of ventilator support, advanced age, associated disease and the level of consciousness of the patient. The most common organism isolated in our study was Klebsiella pneumoniae. The incidence of early-onset infections (within 96 h) was found to be 27% while the late-onset type (>96 h) was 73%. Late-onset had poor prognosis in terms of mortality (66%) as compared to the early-onset type (20%). In conclusion, the incidence of Ventilator associated infection was directly proportional to increased duration of mechanical ventilation. Late-onset Ventilator associated infections were associated with poor prognosis and increased mortality as compared to the early-onset variety.*

Introduction:
Ventilator-associated infections (VAI) refers to bacterial respiratory infections developed in patients who have been mechanically ventilated .It ranges from *6 to 52%* and can reach *76%* in some specific settings.[1] The presence of hospital associated infections increases hospital stay by an average of *7-9 days* per patient[2]. The clinical diagnosis based on purulent sputum may follow intubation or oropharyngeal secretion leakage around airway, chest X-ray changes suspected of VAP may also be a feature of pulmonary edema, pulmonary infarction, atelectasis or acute respiratory distress syndrome. In fact, it was proven that colonization of airway is common and presence of pathogens in tracheal secretions in the absence of clinical findings does not suggest VAI.[3][4] This study aims to find the incidence of bacterial infections, outcome and identify risk factors in relation to VAI.

Materials and methods:
This prospective study was carried out in Paediatric ICU, Medical ICU, Tirunelveli Medical College hospital, Tamil-Nadu, India from April 2013 to September 2013.The study protocol was approved by the ethical committee of the institution. The patients gave written informed consent to participate in the study.

Study population:
A total of *25* patients who were kept on mechanical ventilator were randomly selected. Cases included were patients of both sexes who were kept on mechanical ventilator. A questionnaire was prepared with the consent of the patient, age, sex, date of admission to IMCU, date of initiating mechanical ventilation, associated risk factors and the outcome were recorded. Indication of mechanical ventilation was noted.

Laboratory procedures:
Routine investigations was performed and special investigations, like culture of tracheal tube, oral swab and ET(EndoTracheal) aspirate from the patients were collected and transported to the laboratory in a sterile culture tube. Gram staining and bacterial culture and sensitivity was done using Nutrient agar plate, MacConkey agar plate, Blood agar plate, Muller Hinton agar plate.

Results:
The present study comprised of 25 patients of various diagnosis like poisoning, neurological disorders, sepsis etc .Among them 17 patients developed VAI during their ICU stay. Out of the 25 patients in the study group, 14 were males and the rest of them were females (11).The incidence of VAI was high in males 11 males (64.71%) than females 6(35.29%) **.**There was male predominance. The mean age group in our study was 34 years.

In this study five patients (29.42%) developed infection before three days and 12 patients (70.58%) developed infection after three days of ventilation. The duration of mechanical ventilation was an important risk factor for ventilator associated infections in our study**. (Table-1)**

Level of consciousness has a significant impact on the incidence of Ventilator associated infections. It was found in our study that the incidence of Ventilator associated infections in stuporous and comatose (76.47%) patients was higher than that in conscious and drowsy (23.53%) patients.**(Table- 2**)

Patients with history of Diabetes mellitus (5 patients), Tuberculosis (1 patient) had VAI in this study. Immunocompromised health status favored the bacterial growth in these patients.

The order of prevalence of organism in this study was found to be *Klebsiella pneumoniae* (36.84%), *Escherichia coli* (26.31%), Non Fermenting *GramNegativeBacteria* (26.31%), followed by *Methicillin Resistant Coagulase Negative Staphylococcus MR-CONS* (10.52%) ,*Klebsiella pneumoniae* was the most common organism isolated. **(Figure-1)**

Klebsiella spp. is sensitive to Ofloxacin, Imipenem and Amikacin.Almost all the *Klebsiella Spp.* is resistant to Ceftazidime,

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ciprofloxacin followed by Ceftriaxone.Similarly in case of *E.Coli* is sensitive to Amikacin, Ofloxacin and Imipenem. *Staphylococcus aureus* is sensitive to Vancomycin, Erythromycin and Ofloxacin.ESBL production was detected in 5 strains of *Klebsiella Spp*. and 3 strains of *Escherichia coli* and MRCONS was detected in one strain of *Coagulase Negative Staphylococcus*.

Discussion:

The present study comprised with 25 patients of various diagnoses like poisoning, neurological disorders, sepsis etc .Out of the total 25 patients, 14 were males and the rest of them were females. Among them 17 patients developed VAI during their ICU stay. There was a male predominance 11 (64.71%) than females 6 (35.29%).This was because of the risk factors that were present in males in this study. The mean age group in our study was 34 years. The young population group in our set up was due to the number of cases of poisoning that predominated our study.

In the present study, those of whom required prolonged ventilator support (>3 days) had a higher incidence of VAI, which was in similar to some other studies also[5,6].The incidence of early onset infections within 3 days was found to be 29% while the late onset type more than 3 days was 71%.The duration of mechanical ventilation was an important risk factor for ventilator associated infections. In the present study mortality rate was more among late onset VAI (53%)

One patient with history of Tuberculosis and five other patients with the history of Diabetes had Ventilator associated infections. . Immuno compromised health status enhanced the bacterial growth in these patients. These bacteria developed multi drug resistance when compared to other persons without any risk factors.[7] Increased serum glucose has been identified in the research literature by Konard et al. to be associated with the increased risk of infections in ICU.[8] So this study proves that the patient with lower level of immune status, acquired infection with bacteria showing multidrug resistance than the other patients on ventilation.

Level of consciousness had a significant impact on the incidence of Ventilator associated infections.[9] It was found in our study that the incidence of Ventilator associated infections in stuporous and comatose patients was higher (76.47%) than that in conscious and drowsy (23.53%) patients. This may be due to the higher chances of aspiration in comatose patients. [10][11] This is similar to other studies, where the level of consciousness played a role in developing VAI.[12]

Klebsiella pneumoniae was the most common organism isolated. The order of prevalence of organisms isolated in this study was found to be *Klebsiella pneumoniae* (36.84%), *Escherichia coli* (26.31%), Non Fermenting *Gram Negative Bacteria* (26.31%), followed by Methicillin Resistant Coagulase Negative Staphylococcus *MR-CONS* (10.52%) .Our study matches with other studies where *Klebsiella* species was the common causative organism for Ventilator Associated Infections. [13][14]The overall mortality in the VAI patients was found to be 54% which was definitely higher than the other ward patients.

Conclusion

Ventilator-associated infection is one of the most common infection acquired by adults and children in ICU's.VAI is a cause of significant mortality, morbidity, excess use of antimicrobials and increased hospital stay.Thereby, it imparts economic burden to patients.

Klebsiella pneumoniae was the most common organism isolated in association with VAI in this study. The incidence of Ventilator associated infection was directly proportional to increased duration of mechanical ventilation. Late-onset Ventilator associated infections were associated with poor prognosis and increased mortality as compared to the early-onset variety. Thus, it is important to adopt strategies to prevent VAI like adhering to hand hygiene .To prevent aspiration, proper oral hygiene, in line suctioning and head elevation can be done. Measures to minimize the duration of ventilation would help in decreasing the risk of developing Ventilator-associated infection.

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Table – 1 Duration of Ventilation versus VAI

Days on ventilator	Ventilator associated infection	**Percentage**
< 3Days	5	29.42%
>3Days	12	70.58%
TOTAL	17	

Table- 2 Association of level of consciousness of the Patient with VAI

Consciousness	Developed infections	Percentage
Conscious, drowsy	4	23.53%
Stuporous, comatose	13	76.47%
Total	17	

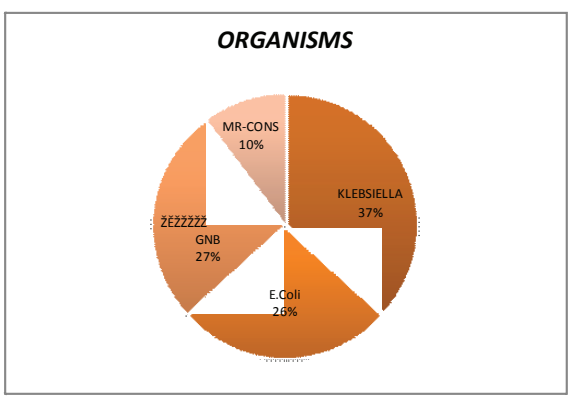

Figure -1- Microbiological profile of VAI

REFERENCE

1. Davis KA. Ventilator-associated pneumonia: a review. J Intensive Care Med 2006; 21:211-26. | 2. Koenig SM, Truwit JD. Ventilator-associated pneumonia: diagnosis, treatment, and prevention. Clin Microbiol Rev 2006; 19:637-57. Back to cited text no. 2 | 3. Niederman MS. Gram-negative colonization of the respiratory tract: pathogenesis and clinical consequences. Semin Respir Infect 1990; 5:173-84. Back to cited text no. 6 | 4. Diaz E, Rodriguez AH, Rello J. Ventilator-associated pneumonia: issues related to the artificial airway. Respir Care 2005; 50:900-6. | 5. Chastre J, Fagon JY. Ventilator-associated pneumonia. Am J Respir Crit Care Med 2002; 165:867-903. | 6 Apostolopoulou E, Bakakos P, Katostaras T, Gregorakos L. Incidence and risk factors for ventilator-associated pneumonia in 4 multidisciplinary intensive care units in Athens, Greece. Respir Care 2003; 48:681-8. | 7. He L, Chen X, Pan J. Incidence, risk and prognostic factors of pneumonia acquired at intensive care units. Zhonghua Jie He He Hu Xi Za Zhi 1998; 21:532–4. | | 8. Konrad F, Wiedeck H, Kilian J, Deller A. Risk factors in nosocomial pneumonia in intensive care patients. A prospective study to identify high-risk patients. Anaesthesist 1991; 40:483–90. | | 9.Torres A, Gatell JM, Aznar E, el-Ebiary M, Puig de la Bellacasa J, Gonzalez J, et al. Re-intubation increases the risk of nosocomial pneumonia in patients needing mechanical ventilation. Am J Respir Crit Care Med 1995; 152:137-41. | 10. Kollef MH, Von Harz B, Prentice D, Shapiro SD, Silver P, St John R, et al. Patient transport from intensive care increases the risk of developing ventilator-associated pneumonia. Chest 1997; 112:765-73. | 11.Leal-Noval SR, Marquez-Vacaro JA, Garcia-Curiel A, Camacho-Larana P, Rincon-Ferrari MD, Ordonez-Fernandez A, et al. Nosocomial pneumonia in patients undergoing heart surgery. Crit Care Med 2000; 28:935-40. | 12.Torres A, Serra-Batlles J, Ros E, Piera C, Puig de la Bellacasa J, Cobos A, et al. Pulmonary aspiration of gastric contents in patients receiving mechanical ventilation: the effect of body position. Ann Intern Med 1992; 116:540-3 | 13. Kollef MH. What is ventilator-associated pneumonia and why is it important? Respir Care 2005; 50:714-21. | 14. Park DR. The microbiology of ventilator-associated pneumonia. Respir Care 2005; 50:742-63. |