EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 6
Issue: 3
285-292
Year: 2019

HOSPITAL ACQUIRED PNEUMONIA IN ICU PATIENTS IN A TERITIARY CARE HOSPITAL IN KERALA

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Article Received on 01/01/2019 **Article Revised on 22/01/2019** **Article Accepted on 12/02/2019**

INTRODUCTION

Hospital acquired pneumonia [HAP] refers to the development of parenchymal lung infection after at least 48hr of hospitalization, and if infection develops after the patient has undergone intubation and received mechanical ventilation for at least 48hr, the condition is termed ventilator associated pneumonia [VAP].[1] Nosocomial Pneumonia(NP) accounts for 13% to 18% of all nosocomial infections. Rates of NP are highest in ICU patients and are increased 6 to 20 fold in mechanically ventilated patient.[2] VAP occurs in 9-27% of all intubated patients.[3]

Most pneumonias occur within the first few days after admission to the ICU because patient's illness severity and related depression of immunity are at their worst levels during this time.[4]

The endogenous sources of microorganisms are nasal carriers, sinusitis, mouth, oropharynx, gastric or tracheal colonization and hematogenous spread. The exogenous sources of microorganisms are biofilm of the tracheal tube, ventilator circuits, nebulizers and humidifiers. Health care workers may also play a role in the setting.[5]

The American Thoracic Society consensus statement categorizes nosocomial pneumonia based on its appearance as
a) early- onset nosocomial pneumonia - within 4 days of hospital admission
b) late- onset nosocomial pneumonia.- after 4 days of hospital admission.[6]

In early- onset VAP, so called "core pathogens" include community pathogens, Gram negative bacilli, methicillin-sensitive S. aureus, S pneumonia and H. influenzae.[7] Late onset pneumonia is usually diagnosed in patients who had recently received antibiotic treatment and is mostly caused by potentially resistant pathogens MRSA, Pseudomonas aeurginosa, Acinetobacter baumani or Stenotrophomonas maltophilia.[8]

The clinical definition of HAP requires that a patient have a new or progressive radiographic parenchymal lung infiltrates, in addition to some sign that the infiltrate is infectious in origin. This usually requires the presence of at least 2 of the following signs: temperature alteration [$<36^0$C or $>38.3^0$C], a white blood count <5000cells/mm^3 or $>10{,}000$cells/mm^3 or purulent-appearing sputum or endotracheal aspirate. (sensitivity of 69% and a specificity of 75%.[10]) The Centers for Disease Control and Prevention [CDC] uses a similar definition, supplemented by other clinical findings, such as altered mental status, increase in respiratory secretions, new onset of cough or dyspnea, and the presence of rales or bronchial breath sounds.[9]

The CDC definition also requires at least 1of the following microbiologic criterion: positive result of blood culture not from another source, positive result of pleural fluid culture, positive results of quantitative culture of specimens from bronchoalveolar lavage[BAL] or a protected brush, >5% intracellular bacteria on a Gram stain of BAL fluid, or histologic evidence of pneumonia. In general, microbiologic conformation is based on quantitative cultures with a bacterial count exceeding a diagnostic threshold of $>1x10^3$ colony forming units (cfu)/mL in a protected brush specimen, $>1x10^4$cfu/mL or $1x10^5$cfu/mL in a BAL fluid specimen, and $>1x10^6$cfu/mL in a endotracheal aspirate specimen.[1]

MATERIALS AND METHODS

Study design

The study was done in Amala Institute of Medical Sciences from 1/9/2016 to 31/10/2016 in the medical – surgical ICU and medical wards, to find out the prevalence of hospital acquired pneumonia, its risk factors, clinical features and causative organisms.

110 patients who had been admitted in the medical-surgical ICU or medical wards was taken comprising 56 females and 54 males.

Inclusion Criteria: All patients who were admitted in the medical-surgical ICU and who are not coming under exclusion criteria were taken.

Exclusion Criteria
1) fever at the time of hospital admission,
2) HIV positive patients,
3) those on long term steroids & immunosuppressant drugs,
4) who had been treated for respiratory infection during past 4 weeks
5) below 15 years of age.

The patients were followed up from the time of admission till they were discharged from the hospital. Data were mainly collected from the case sheets and laboratory investigation reports. Data collected included the age, gender, date of admission in the ICU, date of discharge from the hospital, type of surgery, ventilation, tracheostomy, central lines, presence of systemic illnesses, appearance of fever, purulent secretions, presence of breathlessness, $Sp0_2$, general condition of the patient, vital status, chest findings, loss of consciousness and any organ failure. Lab reports collected included Hb level, total count, differential count, ESR, blood urea, blood sugar, serum creatinine, sputum culture, sputum Gram stain and chest x ray. The study was conducted up to 31/7/2014 and the details of patients discharged or expired before 31/7/2014 were taken. HAP positive cases were identified from their clinical features and culture reports.

OBSERVATIONS AND RESULTS

Prevalence of hospital acquired pneumonia

The study consisted of 110 patients admitted in the medical and surgical ICU, comprising 56 females (50.9%) and 54 males.(49.09%). The incidence of HAP in the study population was found to be 10.9%, (12 out of 110). Out of 12 patients, 9 were on mechanically ventilation, and 5 of them (55.55%) developed early onset VAP and 4 (44.44%) late onset VAP. Male predominance was observed in HAP positive patients with 9 (75%) out of 12 developing HAP.

Predisposing factors of hospital acquired pneumonia

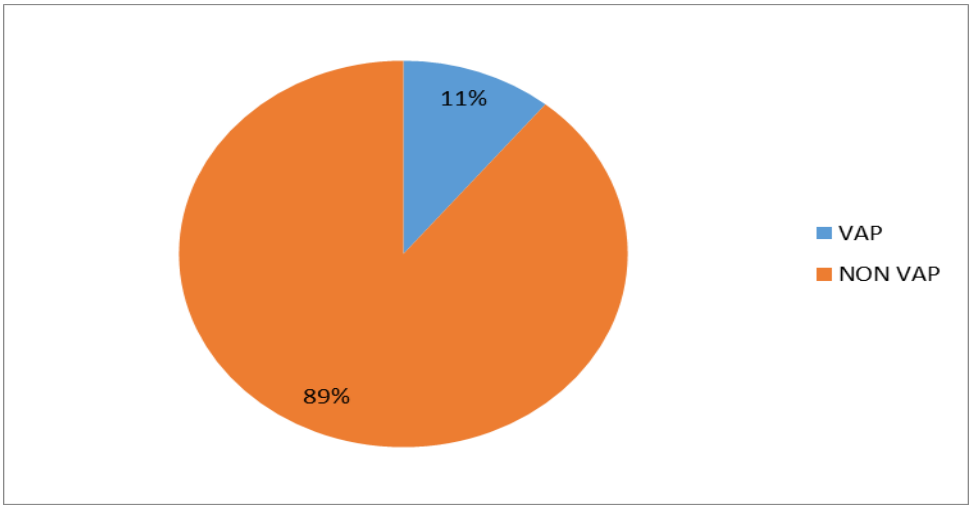
The maximum number of positive cases was observed between the age group 55 and 64(4 of 12) followed by 65 and 74(3 of 12). 2cases each were found in the age groups less than 43 and more than 75 and only 1 case between 45 and 54. The comorbid conditions observed mainly included mechanical ventilation, tracheostomy, presence of central lines, decreased level of consciousness and diabetes. It was found that among the 12 positive cases 9 (75%) were mechanically ventilated, 9 (75%) were having decreased level of consciousness, 8 (66.66%) with diabetes, 4 (33.33%) underwent tracheostomy and 2 (16.66%) were with central lines. 9 out of the 12 were from the medical ICU(75%) and 3 from the surgical ICU(25%). Clinical spectrum of positive cases include 3 cardiac cases, 3 CNS cases, 2 post operative cases, 2 poisoning cases, 1 renal failure and 1 trauma case. Out of 14 mechanically ventilated patients 9 (64.28%) developed HAP, while it was 4 among the 5 tracheostomy patients (80%). The frequency of developing HAP in diabetic patients was found to be 24.24% (8 out of 33) and 20% (2 out of 10) in patients with central lines.

Clinical features of hospital acquired pneumonia

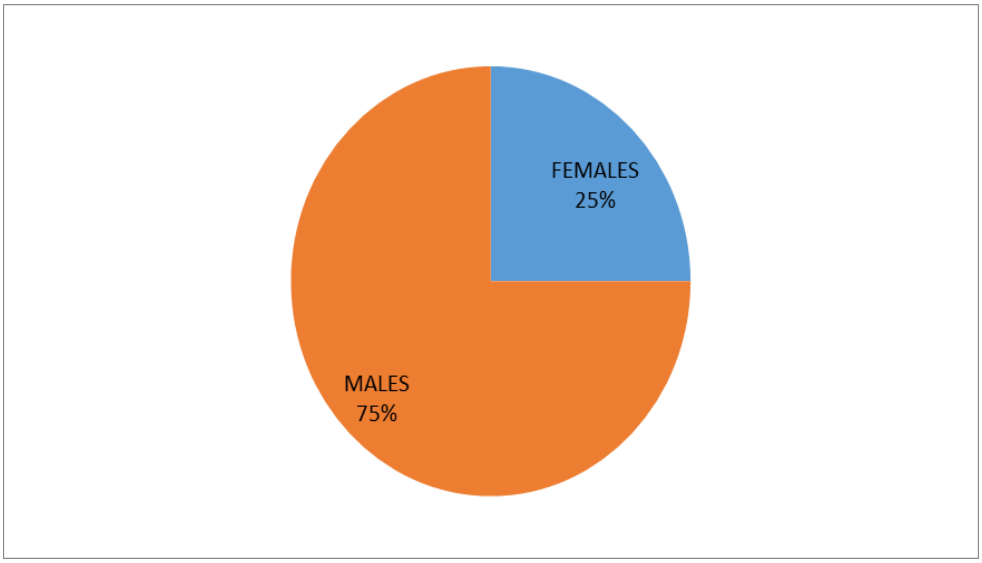
It was found that all the 12 positive cases had fever above 38.3^0C, leucocytosis above 11000/mm^3 and chest radiograph with new pulmonary infiltrates. To begin with 9 out of 12 patients developed purulent secretions which later subsided with medication [figure 8]. Out of 12, 7 (58.3%) developed breathlessness[figure 10]. Saturation fall was noticed in 9 out of 12(75%) patients[figure 11]. On assessing the vital status it was observed that 9 out of12 (75%) were hypertensive, respiratory rate was more than 18/mt and tachycardia observed in 9 out of 12 (75%) patients. Crepitations and wheeze were observed in 8 patients (66.66%) [figure 9] and bronchial breathing along with crepitations and wheeze was found in 2 cases.

Organisms isolated from our hospital set up

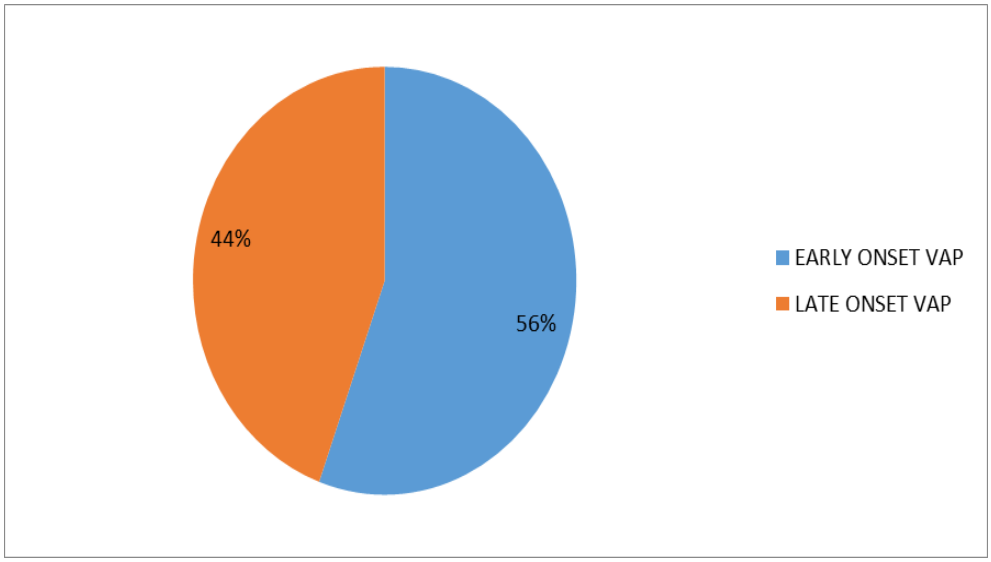
Most common organisms isolated from the 12 positive cases was the Gram negative bacilli, with 5 out of 12 cases(41.66%). Next was Klebsiella pneumoniae, 3 out of 12(25%) cases followed by Pseudomonas aeruginosa and polymicrobial with 2 cases each (16.66%) [figure 12]. Early onset HAP was mainly caused by Gram negative bacilli and Klebsiella pneumonia. Late onset HAP was mainly caused by Pseudomonas and polymicrobial infection. Mortality rate was 25% (3 out of 12 cases).



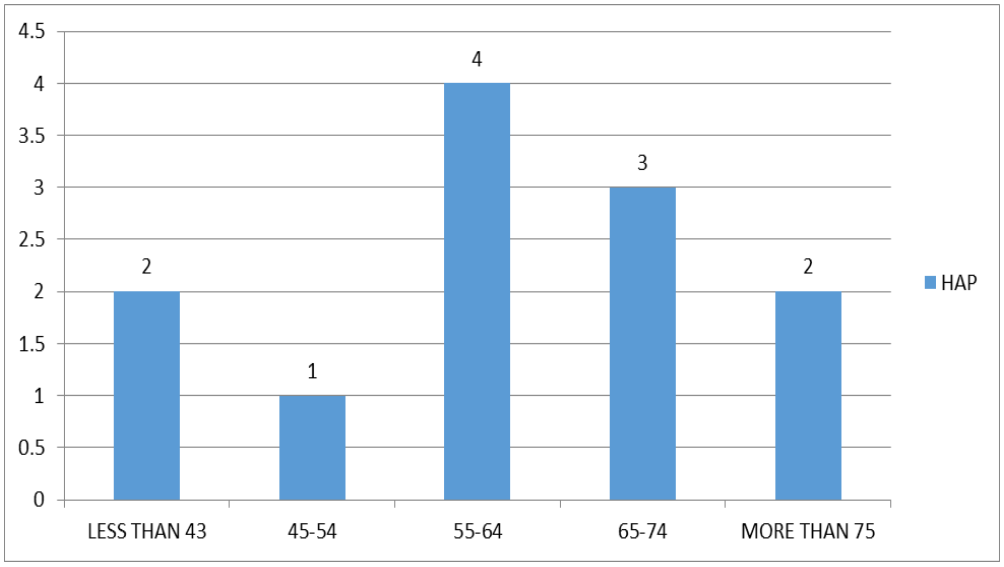
Prevalence of Hospital Acquired Pneumonia: figure 1.



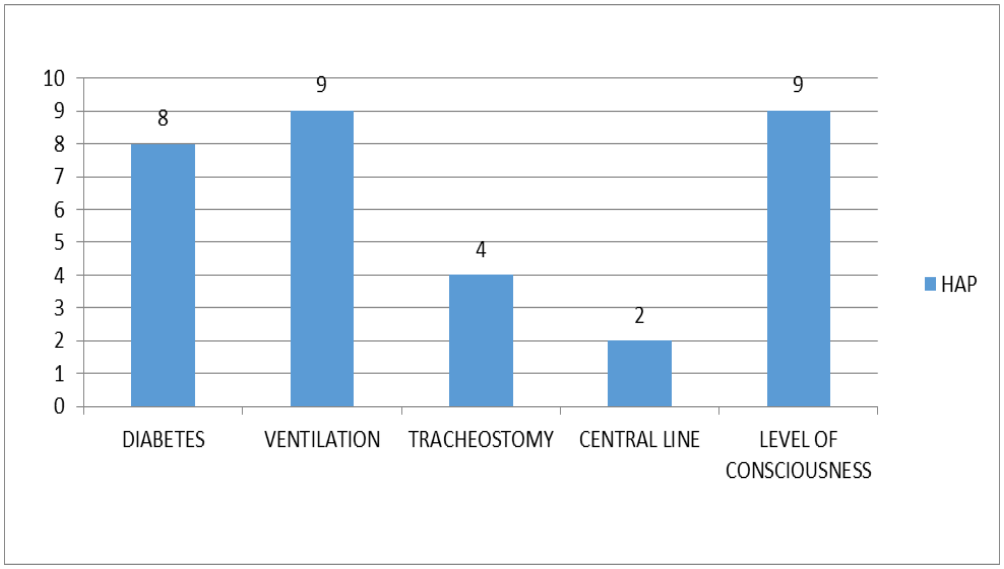
Relationship Between Sex and Hospital Acquired Pneumonia: figure 2.



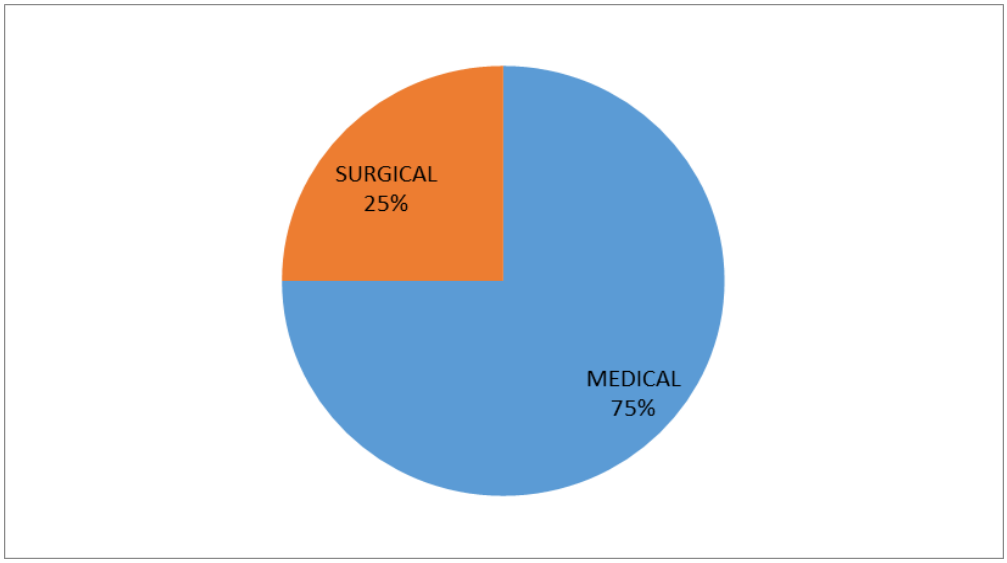
Onset of Ventilator Associated Pneumonia: figure 3.



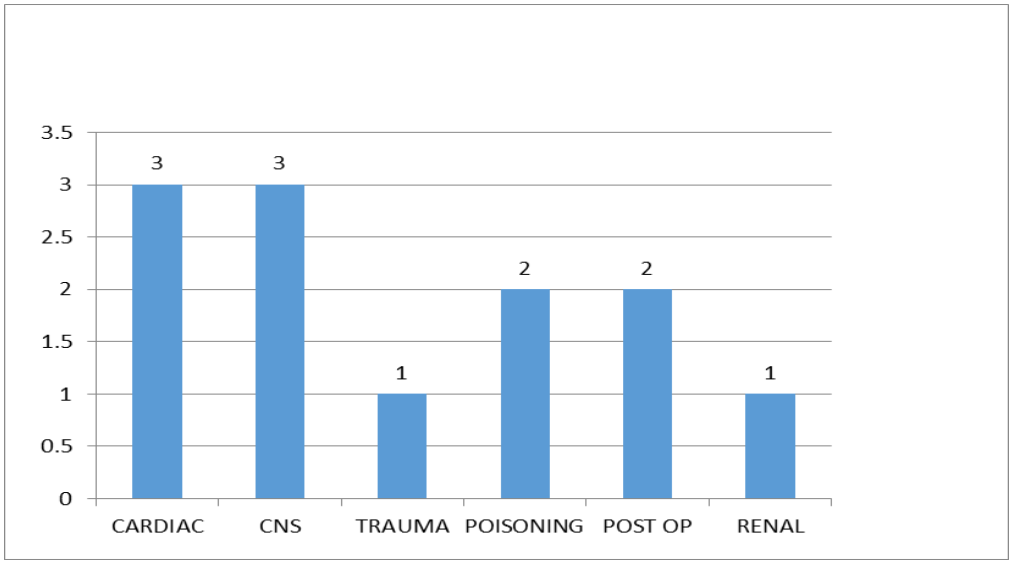
Relationship Between Age and Hospital Acquired Pneumonia: figure 4.



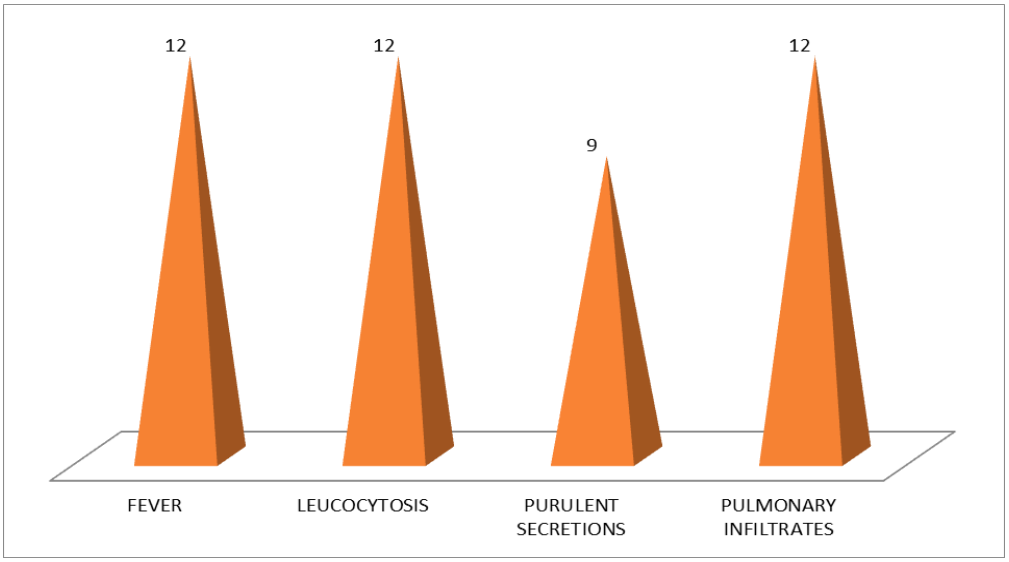
Comorbid Conditions In Hospital Acquired Pneumonia: Figure 5.



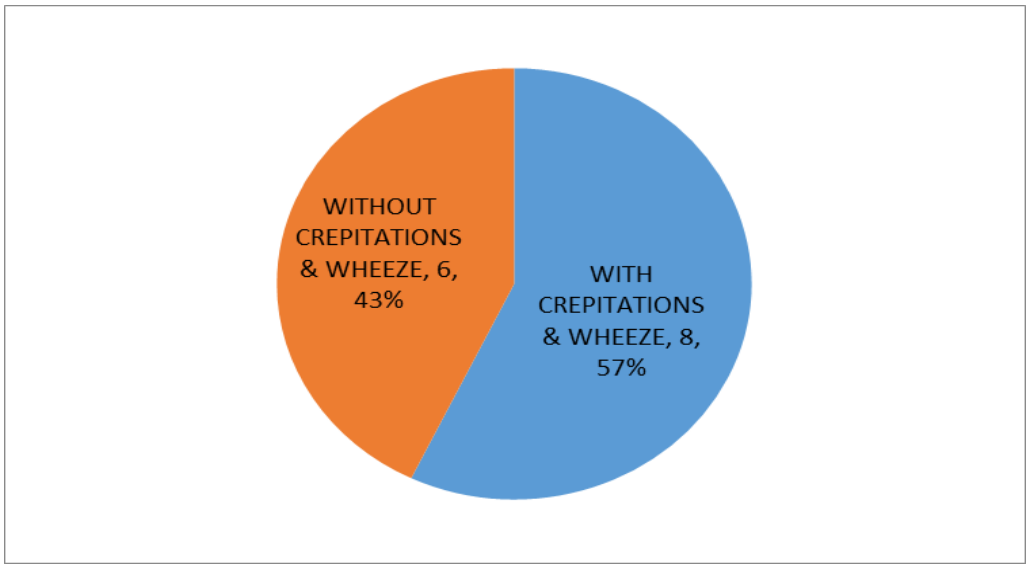
Relationship Between Site and Hospital Acquired Pneumonia: figure 6.



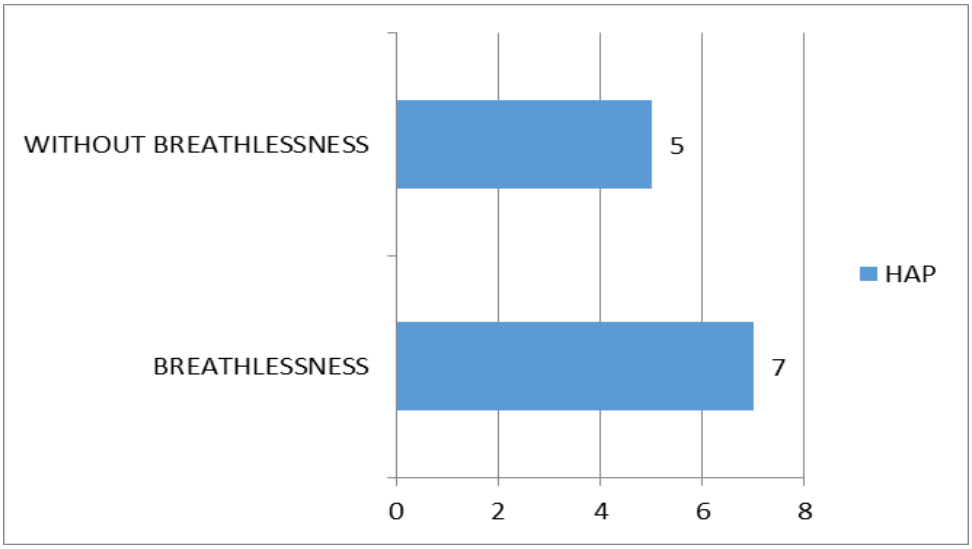
Relationship Between Causes and Hospital Acquired Pneumonia: figure 7.



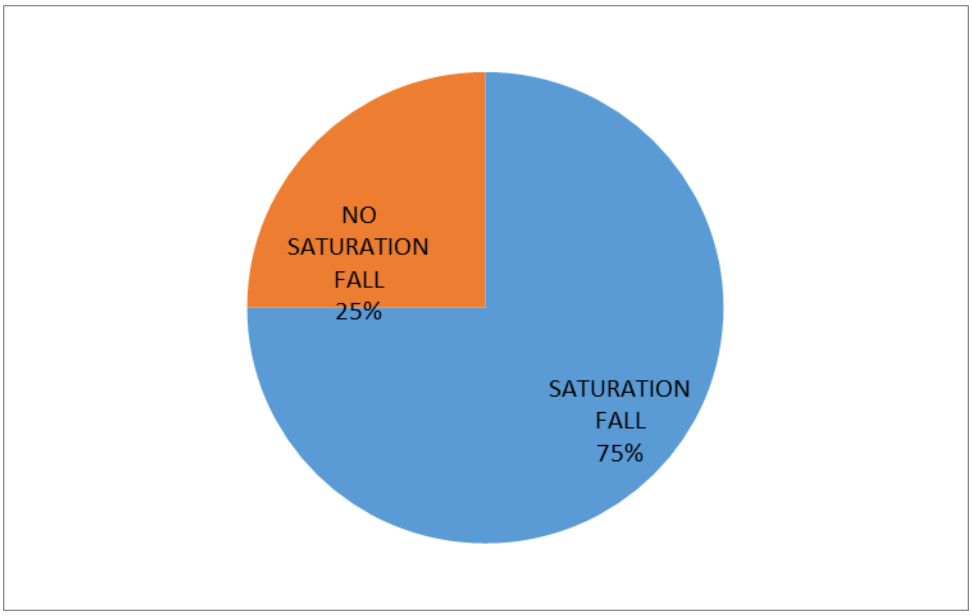
Common Signs of Hospital Acquired Pneumonia: figure 8.



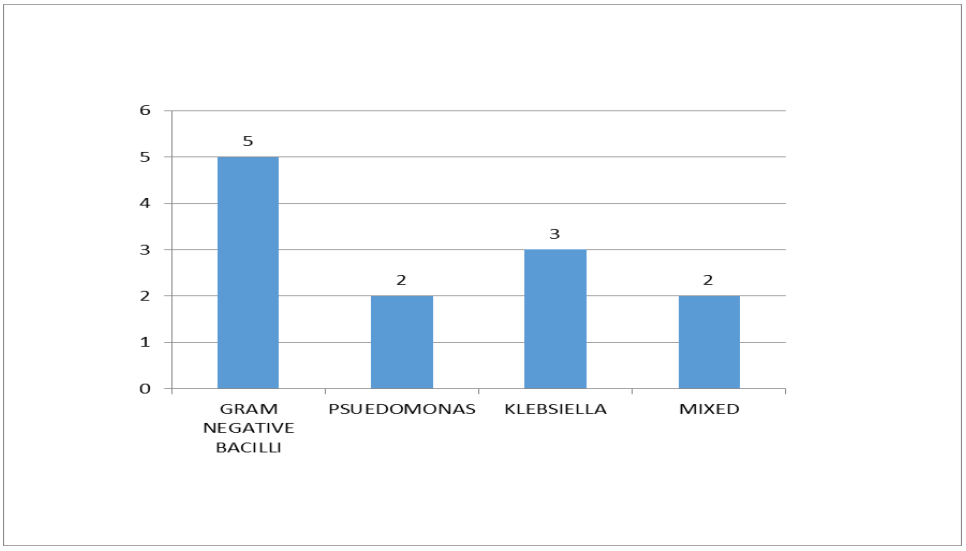
Clinical Chest Finding In Hospital Acquired Pneumonia: figure 9.



Relationship Between Breathlessness and Hospital Acuired Pneumonia: figure 10.



Saturation Fall In Hospital Acquired Pneumonia: figure 11.



Type of Organisms: figure 12.

DISCUSSION

In the study it was found that the incidence of hospital acquired pneumonia was 10.9%. The appearance of the disease was found to vary with the time period, with 55.55% developing early disease and 44.44% developing late disease. Male predominance was also observed among the HAP positive patients. These data are correlating with the study conducted by Rello J etal[11,12] which shows that the incidence is 9.3% with 63.2% developing early disease compared to the late ones. They also observed a male predominance among the pneumonia patients.

Age was one of the significant risk factors, with maximum incidence in the age 55 to 74 [58.33%], similar to the study of Fontaleza.[12] Kollef in his prospective study had found out an association between age and development of disease with high incidence in patients with age greater than 60. The major risk factors for developing pneumonia was tracheostomy(80%) and mechanical ventilation (64.28%). Other risk factors include decreased level of consciousness, presence of central lines and diabetes. Two studies described the early colonization of trachea in intubated and mechanically ventilated patients which varies from 80% to 89%.

All the 12 positive cases were found to develop fever above 38.3^0C, white blood cell count >11000/mm^3 and new pulmonary infiltrates in the chest.75% of positive cases developed purulent secretions, 58.3% developed breathlessness and saturation fall was found in 75% of patients. As per the study of Michael S Niederman[9], the clinical definition of HAP requires the presence of at least 2 of the following signs: temperature alteration [<36^0C or >38.3^0C], a white blood count <5000cells/mm^3or >10,000cells/mm^3or purulent-appearing sputum or endotracheal aspirate.

The most common organism isolated in our hospital set up was Gram negative bacilli (41.66%) followed by Klebsiella pneumonia(25%) Pseudomonas aeruginosa and polymicrobial infections (16.66%) of patients. Johanson et al[14] showed that the frequency of respiratory tract colonization with Gram negative bacilli was 76% in patients. Budak A[15] studied that Gram negative-non fermenting bacilli were the most frequent aetiologic agents of hospital acquired pneumonia among patients from Anesthesiology and Intensive Care Unit in the Rydygiers hospital in Cracow.

The strength of our study include proper follow of the patients from the day of admission into the ICU till the date of discharge from the hospital. This approach has helped us to find out the new clinical features appearing in patients at the right time. We have excluded patients below the age of 15 years which would have produced controversy in the results. Unlike other studies we also excluded the HIV patients, patients on immunosuppressant drugs and long term steroids which helped us to find out the appearance of hospital acquired pneumonia in those individuals who are having good immune status. Even though the positive cases were limited in number we got results similar to that of many important studies conducted in this field justifying that this study could act as a sample representing the big population getting admitted to the hospital set up.

Short duration of the study was a major limitation which resulted in attaining only 12 positive cases among the study population. A study duration of atleast 6 months is required to attain a significant result. As a result we have obtained only an observational result regarding the study. We were not able to find out the P value as it was found to be negligible due to the limited number of positive cases. Quantitative tests being not conducted in the hospital was another major limitation. BAL is not practiced in the hospital, the result of which would have helped us to arrive at more specific results. The absence of a baseline data regarding the common pathogens in our hospital set up also appeared as a limiting factor in the study.

CONCLUSION

We conclude that the prevalence of hospital acquired pneumonia found in our study was 10.3%. Late appearance of infection is found in more individuals compared to the early. Gender, age, mechanical ventilation, tracheostomy, presence of central lines, decreased level of consciousness and diabetes are found to have influence in the appearance of hospital acquired pneumonia in individuals admitted into the hospital. All the HAP patients have developed fever, leucocytosis and new pulmonary infiltrates. 3/4^{th} of the patients developed purulent secretions and saturation fall. The common organism isolated in our study set up was Gram negative bacilli followed by Klebsiella, Pseudomonas and polymicrobial infection. The study will be an eye opener for our hospital authority to take necessary measures to prevent the hospital acquired infections and to detect the infection as early as possible for proper management. It also points to the necessity of more specific and advanced techniques for early detection and management.

SUMMARY

The prevalence of hospital acquired pneumonia was found to be 10.3%. The major predisposing factors include male gender, age between 55 and 74, mechanical ventilation, decreased level of consciousness and tracheostomy. Main features developed uniformly in all individuals were fever, leucocytosis and new pulmonary infiltrates in the radiograph. Most of the patients were also found to develop purulent secretions, breathlessness and saturation fall. The common organism isolated in our hospital set up was Gram negative bacilli followed by Klebsiella, Pseudomonas and polymicrobials.

The study should be conducted over a long period of time and the data should be analysed on the basis of

advanced scores. This will help the hospital infection control board to find out the baseline organisms in the hospital set up and thereby prevent its multiplication and spread among the patients. They must also have an eagle eye on the development of resistant strains which can lead to a great threat in the field of health care services.

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