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AN OBSERVATIONAL STUDY BASED ON EXAMINATION OF PULMONARY ASPIRATES AND DRUG SENSITIVITY FOR DECREASING MORTALITY AND MORBIDITY IN VENTILATOR ASSOCIATED PNEUMONIA PATIENTS IN ICU

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ABSTRACT

Ventilator associated pneumonia is the most prevalent and leading cause of death in Intensive care units (ICU). Directing therapy towards the most common organisms to Ventilator associated pneumonia (VAP) will improve case-rates survival and reduce emergence of resistant organism. Observational study was done to assess the causative Micro-organisms responsible for VAP and sensitivity of Micro-organisms to antibiotics in our ICU. 100 patients requiring mechanical ventilation > 48hrs in our ICU having clinical-pulmonary infection score (CPIS) >6 were prospectively studied over 8 months. After 48 hrs Tracheobronchial aspirate was done and repeated on 3rd and 7th day. All positive cultures were tested for drug sensitivity by Disc Diffusion method. Out of 100 patients 62 patients having CPIS >6, 40 were diagnosed of Microbiological origin. Organisms found were *Staphylcoccus aureus* (26%), *Pseudomonas aeruginosa* (24%), Klebsiella (8%), *Streptococcus pneumonia* (6%), E.,Coli (4%), Multi-drug Resistant Staphylcoccus Aureus (MRSA) (4%), Candida (20%). Monomicrobial was 28% and polymicrobial infection in 34% cases. Mortality in inappropriately treated patient was 88% compared to 42% in appropriately treated patient. Appropriate adequate initial treatment based on information provided by examination of pulmonary aspirates and drug sensitivity organisms would be helpful by decreasing mortality, morbidity and better out come in our ICU.

Key words: VAP, *Staphylcoccus aureus, pseudomonas aeruginosa*, Nosocomial infections, Tracheobronchial aspirate, ICU.

INTRODUCTION

Among all the nosocomial infections in ICU pneumonia is the most prevalent infection [1]. Pneumonia is considered to be the leading cause of death mainly in patients with mechanical ventilation in ICU [2,3].

Various studies have been carried out to determine which Micro-organisms are Responsible for VAP [3-8] .

Directing therapy towards the most common organisms with certain antibiotic regimes may improve cure rates and survival and reduce the emergence of Resistant organisms [3-8].

Empirical treatment of VAP is based on predominant microorganisms responsible for VAP at each institution, information performed by examination of pulmonary aspirate and antibacterial activities of Anti-microbial agents [10].

Aims of our Study are:

1) To study the causative micro organisms responsible for VAP in our ICU.
2) To study the sensitivity of Micro-organisms for antibiotics.
3) To study the incidence of VAP in our ICU.
4) To study mortality in cases of VAP and morality in relation to appropriate antibiotic therapy.

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5) Mortality In relation to appropriate antibiotic therapy.

MATERIALS AND METHODS

After approval of Institutional ethical committee and informed consent of the nearest relatives of all patients, we prospectively studied 100 patients admitted at medical ICU , Civil Hospital tertiary care centre at Ahmedabad.

We studied patients requiring mechanical ventilation more than 48 hrs and clinical suspection of having pulmonary infection according to CPIS. CPIS greater than six was used as diagnostic criteria for VAP.

Patients having severe immunosuppression, evidence of pulmonary infection (pneumonia) and suspicion of gross aspiration on admission were excluded from our study.

Demographic, clinical and treatment data were collected from all patients. Age, Sex, Diagnosis, antimicrobial therapy, days of mechanical ventilation, details of clinical examination and Investigations including X-Ray chest, haemogram, serum biochemistry and Arterial blood gas analysis was done whenever required.

After 48hrs of endotracheal intubation or tracheostomy, Tracheo Bronchial Aspirate Swabs (TABS) was obtained and repeated on 3rd day and 7th day of mechanical ventilation. Followup was done until resolution of VAP, extubation, Development of VAP and Death.

Trancheal Aspirate: The practitioners suctions the airway with sterile suction catheter with a Mucus extractor and collects the sputum specimen aseptically.

The sputum sample collected was sent for sputum culture.

Sputum culture:

Normal : Sputum that has passed through Mouth normally contains several types of harmless bacteria including some types of streptococcus and staphylococcus. The culture should not show any harmful bacterial fungi. Normal culture results are negative.

Abnormal : If harmful bacteria or fungi grow the culture is positive. The harmful bacteria in a sputum culture are those that can cause bronchitis or pneumonia e.g. *streptococcus pneumonia*, staphylococcus aureus, Haemophillus influenza, klebsiella pneumonia, chlamydophilia pneumonia or Tuberculosis.

VAP was diagnosed by the growth of harmful organisms > or = 10^5 Colony Forming Units (cfu)/ml.

If test result of culture positive: sensitivity treating was done to determine the best antibiotic to kill bacteria or fungus. The antibiotic susceptibility was assessed by Disc Diffusion method.

RESULTS

In this study we prospectively studied 100 patients out of which 62 patients showed CPIS score >6 and were suspected to be suffering from pneumonia. Out of 62 patients, 40 were diagnosed of microbiological origin. Maximum number of patients was in 4th to 6th decade of life youngest patient was 15 years while the eldest one was 87 years.

The indications of mechanical ventilation were patients of neurological conditions (66%) e.g. (cerebrovascular accidents, snakebite, Guillian-Barre syndrome, Meningitis etc. Next common indications were tropical conditions (24%) e.g. Tetanus, organo-phosphorus poisoning and 11% were due to trauma and surgical patients.

As shown in Table 2 and Fig. 1 common organisms isolated were staphylococcus aureus (8%), *streptococcus pneumonia* (6%), EColi (4%), Methecillin resistant staphylococcus Aeurous (4%) and Candida (20%) Monomicrobial infections were present in 28% and polymicrobial infection in 34% of cases.

Group 1 organisms was present in early period of mechanical ventilation (40%)

Group 2 organisms form the major contribution to late infections (67%)

However colonization of candida did not show any specific trend.

Early onset ventilator associated pneumonia developed in 12% cases while late onset ventilator associated pneumonia in 28% cases (Table -4)

Out of 12% cases of early onset ventilator associated pneumonia staphylococcus Aureus (60%) and *streptococcus pneumonia* (20%) were the common organisms. According to antibiotics sensitivity testing *staphylococcus aureus* was sensitive to ciprofloxacin or ceftriaxone and *streptococcus pneumonia* was sensitive to ciprofloxacin of levofloxacin.

Out of 28% cases of late onset ventilator associated pneumonia pseudomonas (50%), Methicillin resistant *staphylococcus aureus* (9%) and *Klebsiella* (41%) were present.

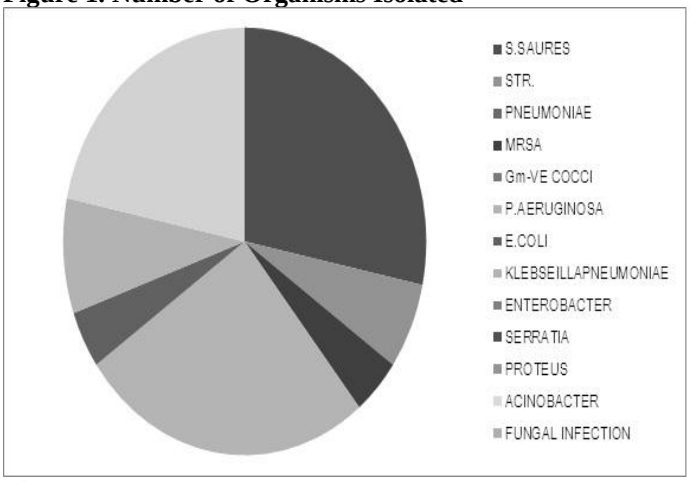
The antibiotics of sensitivity in our study case for *pseudomonas aeruginosa* were piperacillin plus tazobactum, imipenem or Amikacin plus ciprofloxaicn. For methecillin resistant staphylococcus Aeurous were ciprofloxacin plus linezolid or vancomycin and for Klebsiella , E.coll were ciprofloxacin plus imipenem or piperacillin plus tazobectum.

Mortality in group 2 organisms were 67% compared group 1 is 45% and candidial infections were 51%. Mortality in inappropriately treated patients was 88% compared to 42% in appropriately treated patients which was significantly higher.

DISCUSSION

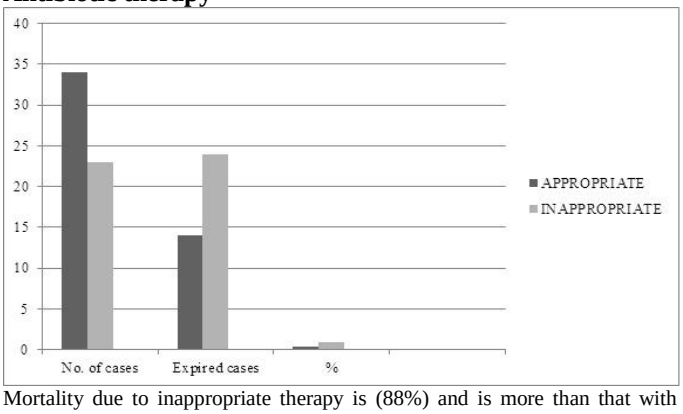
In our study most common organisms found were staphylococcus aureus (25%), *pseudomonas aeruginosa* (24%) and less common organisms are *Klebseilla* (8%) and *streptococcus pneumonia* (6%). While in study done by Ritu Singhal et al, predominant organisms found were Acinetobacter species and pseudomonas species and two isolates of staphylococcus Aureus [3].

Figure 1. Number of Organisms Isolated



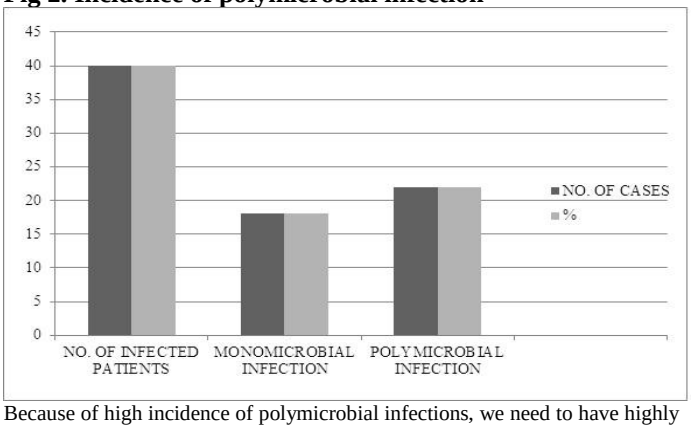
Of these, among the Gram Negative bacteria, Pseudomonas (24%), Klebsiella (8%) were the leading etiological agents. Amongst gram positive cocci, *Staphylococcus aureus* (26%) was the leading etiological agents.

Figure 3. Mortality Related to Appropriateness of Antibiotic therapy



Mortality due to inappropriate therapy is (88%) and is more than that with Appropriate therapy (42%). This may correlate with other studies. Empirical antibiotics should be started early and later on covered with specific antibiotic therapy to decrease morbidity and mortality in ICU.

Fig 2. Incidence of polymicrobial infection



Because of high incidence of polymicrobial infections, we need to have highly developed micro biological set up to know various organisms and their sensitivity to drug. Each institute should have antibiotic policies to overcome inappropriate, inadequate unethical use of antibiotics giving rise to multidrug resistant organism in ICU settings, which increases mortality, morbidity of patient and increase health costs of society as a whole.

Table 1. Incidence of vap in relation to age

Age Group (years)	Group 1 (No)	Group 2 (No)
<20	4	6
21-40	10	6
41-60	14	8
>60	2	12

Group-1 includes str. Pneumoniae, Methicillin sensitive S. Aureus.

Group-2 includes *Pseudomonas, Klebsiella, E.Coli*.

From above results it difficult to come to conclusion that age plays vital role in pathogenesis of infection in our study. However incidence is more common with advancing age.

Table 2. Micro organisms isolated in positve cases (n=62)

Micro-Organisms		No. of organisms isolated	%
Gm+Ve Cocci			
1.	*S.saures*	26	26
2.	*Str. pneumoniae*	6	6
3.	*MRSA*	4	4
Gm-Ve Cocci			
1.	*P.aeruginosa*	24	24
2.	*E.coli*	4	4
3.	*Klebsella pneumoniae*	8	8
4.	*Enterobacter*	0	0
5.	*Serratia*	0	0
6.	*Proteus*	0	0
7.	*Acinobacter*	0	0
Fungal Infection			
1.	*Candida*	20	20

Table 3. Incidence of polymicrobial infection

Polymicrobial Infection	No. of Cases	%
No. of infected patients	40	40
Monomicrobial Infection	18	18
Polymicrobial Infection	22	22

Table 4. Mortality in various group of microorganisms

Incidence of VAP	No. of Cases	%
Total no. of Clinically Infected Patients	62	62
VAP +VE Cases	40	40
Early onset `	12	12
Late onset VAP	28	28

Table 5. Mortality in various groups of micro organisms

Categories	Total no. of Infected Patients	Expired	Mortality %
Group-1	12	5	45%
Group-2	28	18	67%
Candida	20	10	50%

Table 6. Mortality Related to Appropriateness of Antibiotic therapy

Antibiotic therapy	No. of Cases	Expired Cases	%
Appropriate	34	14	42%
Inappropriate	23	24	88%

The incidence of polymicrobial infection 34% compared to 12.3% in study done by Ritu Singhal et al [3]. 83% of isolates of pseudomonas were sensitive to piperacillin plus tazobactum in this study same findings were observed in our study. *Pseudomonas aeruginosa* was sensitive to piperacillin plus Tazobactum or Imipenem. Predominant organisms found in study done by Chastre J et al. are similar to our study [1].

In one old study by Vindra Patil et al. commonest organisms associated withventilator associated pneumonia are similar to our study but the incidence of Micro-organisms causing VAP were different [5] .

In contrast to our study predominant isolates observed in Goel et al, Dey et al were acinetobacter baumanni and *pseudomonas aeruginosa*, in our study Staphylococcus Aureus was the commonest organism [6,7]

In comparison to antibiotic sensitivity done by Gupta et al *pseudomonas aeruginosa* was sensitive to polymyxin B and colistin and carbapenems while in our study pseudomonas Aerunginosa was sensitive to piperacillin plus tazobactum, Imipenem or Amikacin plusciprofloxacin. In their study methicillin resistant staphylococcus was found sensitive to vacomycin or linezolid. Same result for MRSA was observed in our study. Most isolates of Klebsiella pneumonia were found to be sensitive to gatifloxacin and meropenem or Imipenem or polymyxin B and colistin while in our study same.Organisms were sensitive to ciprofloxacin plus imipenem or piperacillin and tazobactum [8].

The main cause of difference in organisms causing ventilator associated pneumonia are primarily due to duration of mechanical ventilation and prior antibiotic exposure of patients. VAP is caused by organisms that normally colonise the oropharynx and gut and by transmission by Healthcare workers from environment and from other patients [9].

Treatment recommendations according to the local pattern of microbiology and drug resistance for the management of VAP and hospital acquired infection decreases the rate of initial inappropriate antibiotic treatment and decreased 14 day mortality. After receiving appropriate therapy significant improvements were observed in all clinical parameters in 6 days. Also in our study mortality in inappropriate treated patients was higher (88%) than that of appropriately treated patients (42%) [10,11].

Because broncheoalveolar lavage (BAL), protected specimen brush (PSP) specimens are dilution of endotracheal aspirate, the bacteria obtained from distant locations of respiratory tract are not signiticantlly different from endotracheal aspirate. Thus culture of endotracheal aspirate can be used in the management of VAP so tracheal aspirate was used in management of VAP in our study [13,14].

CONCLUSION

We concluded from our study that appropriate adequate initial antibiotic therapy should be started as early as possible and should be based on predominant flora responsible for VAP at each institution and information provided by examination of pulmonary aspirates and sensitivity of organisms to Antimicrobial agents. Such policy would be helpful by decreasing Mortality, Morbidity, stay in ICU and better out come in VAP cases.

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