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Bacterial and fungal isolates from endotracheal tube secretions culture and their antibiogram in patients with ventilator associated pneumonia

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ABSTRACT

The study was undertaken to determine causative bacteria / Fungi and antimicrobial sensitivity pattern of the isolates in patients with VAP. The study was conducted at the Department of Medicine. The duration of the study was two years. A total of 100 VAP cases were studied, sample collected was endotracheal aspirate. More the age, more the patient is prone to VAP but the role sex in occurance of VAP was not statistically significant in our study. VAP was considered when after 48 hours of intubation patient develops Pneumonia, Leukocytosis/ Leukopenia, Fever. Gram negative bacteria were the most common organism causing VAP. Acinetobacter Baumannii was the most notorious bacteria causing VAP contributes to 53% followed by Klebsiella species 16%, Pseudomonas species 15% were the most frequent bacteria causing VAP later followed by coagulase positive Staphylococcus 6%, Escherichia coli 4%, Candida 4% and Enterobacter Cloacae Complex 2%. The antibiotic sensitivity pattern of gram negative bacteria isolated in our study including Pseudomonas species showed that most of them are sensitive to Colistin, Tigecycline, Meropenem and Amikacin followed by other drugs. In case of Gram Positive (Coagulase positive Staphylococcus) is sensitive to vancomycin and very rarely to Linezolid.

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INTRODUCTION

Ventricular associated pneumonia is the most common nosocomial infection among the critically ill patients admitted in the ICUs and is associated with increased mortality rate, hospital length of stay and costs for patients who acquire. Moreover there is an increased rate of Ventricular associated pneumonia casused by multidrug resistant strains which further increases mortality and morbidity. One of the fundamental piece of current prescription is the thought of essentially wiped out patients in the ICU. In any case ICUs are connected with issue of nosocomial defilements. Nosocomial infections are those which manifest in patients , 48 hrs after admission to hospital and when they were not in incubation at the time of hospitalisation.

Ventricular associated pneumonia may be casued by spectrum of bacterial pathogens which may be polymicrobial and rarely due to anaerobic bacteria, viruses or fungi. The clinical presentation and living creatures causing nosocomial pneumonia are assorted in different set ups.

Frequency of unequivocal bacterial pathogens causing VAP may vary by clinical center, calm masses and changes after some time, underlining the pre-

requisite for advantageous close by perception data. Rapid diagnosis and initiation of appropriate antibiotic treatment is of immense importance, as many studies have co-related this delay with rise of mortality.

The existence structures liable for VAP contrast according to case, establishment, prior enemy of microbial presentation, neighborhood restriction plans, length of mechanical ventilation and unequivocal demonstrative method(s) used. Several published series reveal aerobic gram negative bacteria as the most common isolate found. The predominant among them are Pseudomonas aeruginosa and Acinetobacter species, followed by Proteus species, Escherichia coli, Klebsiella species, and Haemophilus influenza (Chastre and Fagon, 2002).

Some investigators have reported gram-positive bacteria becoming increasingly common, with Staphylococcus aureus being the predominant grampositive isolate.35 the rate of polymicrobial infection in VAP has been emphasized repeatedly. A polymicrobial infection rate of 40% to 60% has been documented (Fagon *et al.*, 1989; Torres *et al.*, 1989).

Underlying disease may predispose patients to infection with specific organisms. Patients with consistent obstructive aspiratory disorder (COPD) are at extended peril for Haemophilus influenzae, Moraxella catarrhalis or Streptococcus pneumoniae pollutions, however injury and neurologic patients are at extended danger for Staphylococcus aureus infection (Antonelli *et al.*, 1994; Rello *et al.*, 1994). The pathogenesis of VAP is related to host and treatment related colonization factors. Longing of oropharyngeal pathogens and the spillage of releases containing organisms around the endotracheal tube are boss components for headway of VAP (Lakshmi *et al.*, 2006).

MATERIALS AND METHODS

Source of Data

All patients on mechanical ventilator admitted in Medicine ICU Krishna Institute of Medical Sciences, Karad in the period of NOV 2013 to JUNE 2015.

Study design

All patients on mechanical ventilator admitted to the intensive care unit during the prescribed study period were considered for case identification and study was prospective study.

Methods of collection of data

Sample Size

100 Patients.

Sampling procedure

Patients in medical intensive care unit on mechanical ventilator who developed pneumonia fulfilling inclusion criteria.

Inclusion criteria

The subjects which are included in this study are those who are on mechanical ventilator for more than 48 hours with radiological evidence of Pneumonia & one of the following.

a) Fever >38.30 C.or 36CC

b) Leucocytosis >12000/cmm, or Leucopenia <4000/cmm

c) Purulent respiratory secretion with gram stain demonstration & Polymorph cells

d) Quantitative endotracheal aspirate cultures with growth >106 cfu/ ml.

Exclusion Criteria

Patients who is already having respiratory infections, those who developed respiratory infections in less than 48 hours of mechnical ventilation, those who are dischaged from MICU in less than 48 hours or died within 48 hours are excluded.

Methods of Study

All adult Patients who develop VAP in critical care units as per definition in inclusion criteria's are investigated clinically, radiologically and bactriologically to determine presence of pneumonia, isolate causative microorganism.

Outcome variable is development of VAP which depends on following factors like age, sex, clinical signs and symptoms, comorbid illness, organism isolated, use of medical devices like RT tube, duration of ventilation etc.

Investigations conducted

Relevant investigations were done in patients clinically suspected to have VAP. They included.

Specific investigations,

a) TLC,DLC

b) Chest x-ray

c) Endotracheal aspirate for C/S in deserving candidates.

Routine investigations included,

Hemoglobin

ESR

Urine examination

FBS, PPBS

Table 1: Reference Bacterial isolates in different study

Author	Place and study	Year	Organism isolated
Raghwendra *et al.* (2002)	Indra Gandhi Institute, Patna	2002	Pseudomonas species,Staphylococcus auerus, Klebsiella species, CONS
Lakshmi *et al.* (2006)	Nizams Institute, Hyderabad	2006	Acinetobacter species,Pseudomonas species, Klebsiella species
Bairy and Dey (2007)	Manipal	2006	Acinetobacter species, Pseudomonas species, Klebsiella species
Medina *et al.* (2007)	Uruguay	2007	Acinetobacter species, Staphylococcus auerus, Pseudomonas species
Singh *et al.* (2011)	India	2011	Pseudomonas species, MRSA, Acinetobacter Baumannii, Klebsiella species
Kalanuria *et al.* (2014)	India	2014	Pseudomonas species, MRSA, Acinetobacter Baumannii complex, Enterobacter

RESULTS AND DISCUSSION

Distribution of samples by sex

In this study total 100 patients are included out of which 75 are males and 25 are females.

Distribution of samples by age groups

Maximum number of samples are obtained in the age group of >61 and least from the age group of <41.

Distribution of male and females by age groups

Total 70% males are in the age group <=40, 77.4% in 41-60 age group and 76.9% in >61 age group while 30% females in the age group <=40, 22.6% in 41-60 age group and 23.1%in >61 age group. The mean age for males 55.36 and 51.32 for females.

Distribution of male and females by onset of disease

67.86% males and 32.14% females have had early onset VAP and 84.09% males and 15.91% females have had late onset VAP.

Distribution of male and females by disease

Those who required intubation and have had no respiratory pathology before intubation are the patients with Stroke maximum in number, 32 being males and 12 females and total 44%, then Organophosphorous poisoning, 15 being males and 6 females and total 21%, Chronic Obstructive Pulmonary Disease contributes 12 males and 4 females and total 16% while Chronic Kidney disease contributes 10 males and 1 females and total 11%. In Acute Coronary Syndrome 6 being males and 1 being female and total 7%. In Neuroparalytic snake bite, only 1 male and no females makes it only 1% of total number of cases.

Distribution of male and females by gram staining

24 males and 7 females showed Gram negative bacilli and pus cells contributes 31%, 38 males and 15 females showed Gram negative cocci, pus cells contributes 53%, 5 males and 1 female showed gram negative rods and pus cells and 4 males and 2 females showed Gram positive cooci with pus cells each contributes 6%, only 4 males showed oval budding cells. Gram Negative rods with pus cells were present in maximum number of patients with VAP. Oval budding cells were the least contributes only 4%.

Distribution of male and females by type organism present

IN 38 males and 15 females Acinetobacter Baumannii contributes 53% being maximum followed by Klebsiella Spp. Contributes 16% out of which 12 being males and 4 being females. In 12 males and 3 females Pseudomonas aeuriginosa contributes 15%. Coagulase positive staphylococcus contributes total 6%, 4 benig males and only 1 female while E.coli contributes 5%, in which 3 are males and 2 are females. Candia spp. (fungal infections) contributes 4% all being male. Enterobacte-

riace cloacae complex total 2% and both are males, being the least common.

Comparison of age groups with disease

In the age group of <40 OPP being maximum counts 15 patients followed by stroke and CKD 6 each, ACS 2, COPD 1 total being 30%. In the age group of 41 to 60 years stroke being more common contributes 18 patients followed by 5 CKD, 3 OPP, 2 ACS, 2 COPD and 1 snake bite total being 31. In the age group of more than 61 years, stroke 20,13 COPD, 3 OPP and 3 ACS contributes 39% of total patients.

Comparison of age groups with onset of disease

In the age group of <40 years, Early VAP patients are 14 and Late VAP patients are 16, total contribution being 30%. In the age group of 41-60 Early VAP patients are 17 and Late VAP patients are 14 contributes to total 31%. In the age group of >61 Early VAP patients are 25 and Late VAP are 14 total contributes to 39%.

Comparison of age groups with gram staining

Total Gram Negative Bacteria are 90 which is a huge number suggestive of in 90% of the patients in this study has got VAP due to Gram Negative bacteria and only 6% VAP is due to Gram Positive bacteria and rest 4% VAP is due to Fungus, Candida spp and all the patients except for Candida spp. Have pus cells in the Gram staining.

Comparison of onset of disease with type organism present

Acinetobacter baumannii being maximum in Early VAP 60.38% and 39.2% in Late VAP, followed by Klebsiella spp. 56.25% in Early, Pseudomonas aeruginosa 46.67% in Early VAP and 53.3% in Late VAP. Coagulase positive staphylococcus contributes 66.67% in Early VAP and 33.3 % in Late VAP. Candida spp. Contributes 50% each in both Early and Late VAP and the same with E.coli. Enterocater Cloacae complex contributes 100 percent in Late VAP.

Association between types of organisms with types of drugs given

In this study,

1. Acinetobacter Baumannii Complex being the commonest organism in VAP, out of 53 cultures, 50 (94.33%) are sensitive to Colistin and only 3 (5.66%)are resistant to Colistin. 39 (73.58%) cultures are sensitive to Tigecycline and 13 (26.42%) are resistant to the same .Only 1 (1.88%) culure is sensitive to Meropenem , 50 (97.12%) cultures are resistant. Only 4 (7.55%) culutres are sensitive while 49 (92.45%) cultures are negative to Amikacin. 11 (20.68%) cultures are sensitive to Minocycline while 42 (78.96%) are resistant. For cefeperazone + sulbactum, 3 (6%) cultures are sensitive while 50 (94%) are resistant. For Cotrimaxazole 9 cultures were sensitive and 1 culture was resistant but this drug couldn't be studied due to some technical problems. Acinetobacter Baumannii Complex is resistant to rest all the drugs.

2. Klebsiella spp. Being the second most commonest, 11 (68.75%) cultures are sensitive and 5 (31.25%) cultures are resistant to Colistin, Tigecyline and Amikacin, shows equal activity against Klebsiella spp. 8 (50%) cultures are sensitive and 8 (50%) cultures are resistant to Meropenem. 2 (12.50%) cultures are sensitive to Ciprofloxacin and Only 1 (6.25%) culture is sensitive to each Amoxicillin, Cotrimaxazole, Piperacillin Tazobactum and gentamycin.

3. In Pseudomonas aueruginosa, being third commonest, Colistin sensitive are 12 (80%) and resistant are (20%) cultures. 9 (60%) cultures were sensitive and 5 (40%)were resistant to Tigecycline. 7 (46.66%) cultures are sensitive and 8 (53.33%) are resistant to Amikacin. 4 (26.66%) cultures are sensitive to Meropenem and 11 (73.33%) are resistant. Piperacillin + Tazobactum sensitive cultures are 5 (33.33%) and resistant cultures are 10 (66.66%). Minocycline sensitive cultures are 2 (13.33%) and resistant are 13 (86.66%). Cefepime sensitive cultrure in only 1 (6.66%) and resistant are 14 (93.33%).

4. Coagulase positive Staphylococcus shows 5 (83.33%) culures sensitive to Vancomycin and only 1 (16.66%) is resistant to the same. 4 (66.66%) cultures are sensitive and 2 (33.33%) are resistant to Tigecyclin. 2 (33.33%) cultures are sensitive and 4 (66.66%) are resistant to each of Linezolid, Meropenem, Ciprofloxacin and Colistin. Only 1 (16.66%) culture is sensitive to each Cotrimaxazole, Piperacillin + Tazobactum and Gentamicin.

5. E.coli shows 3 (75%) cultures sensitive to Meropenem and only 1 (25%) resistant while 2 (50%) cultures are sensitive to Colistin and 2 (50%) are resistant. Only 1 (25%) is sensitive to each of Cefepime, Cefeperazone + Sulbactum, Tigecycline and Cotrimaxazole and 3 (75%) cultures are resistant to the same.

6. Enterobacter Cloacae Complex shows both the cultures sensitive to Meropenem, suggestive of 100% sensitivity to Meropenem, while

1 (50%)culture sensitive and 1 (50%) culture resistant to each of Tigecycline, Colistin, Cefeperazone + Sulbactum, Amikacin.

7. Candida spp. – All patients responded to Fluconazole therapy.

The present study is a prospective study over a period of one year and six months which included 100 diagnosed VAP patients after applying predefined criteria. Objectives were to know causative bacteria and fungi and their antimicrobial sensitivity pattern. All of the above were analysed in our study.

It is basic to have the data on life structures at risk to be accessible and besides the local resistance plan in singular facility ICU (Varghese *et al.*, 2020). Any individual study may not necessarily reflect the same situation in other similar centers as incriminating organisms vary among hospitals (Joseph *et al.*, 2010).

Injudicious use of even prophylactic use of antibiotics are not recommended in case of VAP because exposure to antibiotics is a significant risk factor for colonization and infection with nosocomial multidrug resistant pathogens. The sound use of antibodies poisons may diminish getting colonization and coming about VAP with multidrug safe pathogens (Joseph *et al.*, 2010).As involving pathogens vary among clinical facilities it is basic to know the pace of VAP and the related neighborhood microbial vegetation in each setting so as to oversee progressively convincing and target utilization of antimicrobial authorities (Rakshit *et al.*, 2005).

Age and Sex

In the present study the age group of more than >61 years is prone to VAP, than the age group of <41 years and 41-60 years which co-relate with Bairy and Dey (2007); Trouillet *et al.* (1998) study which shows patients mature enough > 30 years are progressively disposed to get VAP. At any rate sexual direction has no gigantic activity in the improvement of VAP in our examination which co-relates with study done by Bairy and Dey (2007).

Onset of Disease

In our study onset of disease has no relation with causative microorganism or age or sex

Causative bacteria

In the present study bacteria isolated from the ETA of VAP cases were Acinetobacter species, Klebsiella species, Pseudomonas species, Escherichia coli, Staphylococcus auerus and Enterobacteia Cloace complex and candida spp. Which corelates with th study done by Singh *et al.* (2011).

Antibiotic susceptibility pattern

Antibiotic sensitivity pattern of most common organism are compared between different studies,

Acinetobacter species were sensitive to cefoperazone-sulbactam (100%), imipenem (80%). Klebsiella species were sensitive to cefoperazone-sulbactam (100%), imipenem (100%). Pseudomonas species were sensitive to imipenem (25%). Staphylococcus aureus were sensitive to vancomycin (100%) (Lakshmi *et al.*, 2006).

Acinetobacter species were sensitive to cefoperazone-sulbactam (78.2%), imipenem (60.8%), amikacin (17.3%). Klebsiella species were sensitive to cefoperazone-sulbactam (100%), imipenem (100%), amikacin (66.6%). Pseudomonas species were fragile to imipenem (half) amikacin (16.6%). Escherichia coli were fragile to amikacin (100%), imipenem (100%), cefoperazone-sulbactam (100%) (Bairy and Dey, 2007). Table 1 shows that the reference bacterial isolates at different studies

Acinetobacter species were sensitive to cefoperazone-sulbactam (51%), imipenem (24%), ciprofloxacin (14%). Klebsiella species were sensitive to amikacin (55%), cotrimoxazole (50%), gentamycin (28%), ciprofloxacin (27%). Pseudomonas species were sensitive to imipenem (70%), cefoperazone-sulbactam (60%), amikacin (40%), ciprofloxacin (40%), gentamycin (14%). Escherichia coli were sensitive to imipenem (100%), cefoperazone-sulbactam (100%), amikacin (50%), co-trimoxazole (50%), ciprofloxacin (25%). Staphylococcus aureus were sensitive to erythromycin (67%), ciprofloxacin (33%), gentamycin (33%) (Mukhopadhyay *et al.*, 2010).

Psuedomonas areuginosa was sensitive to Colistin (100%), Meropenem (77.77%), Gatifloxacin (55%),Ceperazone sulbactum and cefepime (44%). Acinetobacter Baumanii was sensitive to Colistin (100%), Meropenem (50%), Gatifloxacin (50%). MRSA was sensitive to Linezolid and Vancomycin (100%), Gatifloaxacin (62%), Levofloxacin (25%). Klebsiella Pneumonae was sensitive to Colistin (100%), Gatifloxacin (71%), Meropenem (71%), Levoflxacin (28%) (Singh *et al.*, 2011).

In present study,

1. In this study, Acinetobacter Baumannii Complex being the commenst organsim in VAP, 94.33% sensitive to Colistin. 73.58% sensitive to Tigecycline. 1.88% sensitive to Meropenem,

7.55% sensitive Amikacin. 20.68% sensitive to Minocycline. For cefeperazone+sulbactum, 6% sensitive. For Cotrimaxazole 16.98% sensitive. Studied due to some. Acinetobacter Baumanii Complex is resistant to rest all drugs.

2. Klebsiella spp. Being the second most commnest, 68.75% to Colistin, Tigecyline and Amikacin, shows equal activity against Klebsiella spp.50% sensitive to Meropenem. 12.50% senstitive to Ciprofloxacin and 6.25% culture is sensitive to each Amoxicillin, Cotrimaxazole, Piperacillin Tazobactum and gentamicin.

3. In Pseudomonas aueruginosa , being third commonest, Colistin sensitive 80%. 60% sensitive to Tigecycline. 46.66% sensitive to Amikacin. 26.66% cultures are sensitive to Meropenem. Piperacillin + Tazobactum sensitive 33.33 %. Minocycline sensitive 13.33%. Cefepime sensitive 6.66%.

4. Coagulase positive Staphylococcus shows 83.33% sensitive to Vancomycin. 66.66% sensitive to Tigecyclin. 33.33% sensitive to each of Linezolid, Meropenem, Ciprofloxacin and Colistin. 16.66% sensitive to each Cotrimaxazole, Piperacillin + Tazobactum and Gentamicin.

5. E.coli 75% sensitive to Meropenem .50% sensitive to Colistin .25% sensitive to each of Cefepime, Cefeperazone + Sulbactum, Tigecycline and Cotrimaxazole .

6. Enterobacter Cloacae Complex shows 100% sensitivity to Meropenem, 50% sensitive to each of Tigecycline, Colistin, Cefeperazone + Sulbactum, Amikacin.

7. Candida spp. – All patients responded to Fluconazole therapy.

CONCLUSIONS

Acinetobacter Baumannii Complex, coagulase positive Staphylococcus and Klebsiella Spp. Are found in Early VAP for more than 50%, while Candida Spp and E.Coli are 50% in both Early and Late VAP. Pseudomonas aeruginosa is found in Late VAP more than 50% while Enterobacter Cloacae is exclusively found in Late VAP. The antibiotic sensitivity pattern of gram negative bacteria isolated in our study including Pseudomonas species showed that most of them are sensitive to Colistin, Tigecycline, Meropenem and Amikacin followed by other drugs. In case of Gram Positive (Coagulase positive Staphylococcus) is sensitive to vancomycin and very rarely to Linezolid.

Conflict of Interest

None to disclose.

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