Bacteriological Profile Of Nosocomial Pneumonia Patients In A Superspeciality Hospital

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Abstracts: Background**:** To ascertain the bacteriological profile of patients with nosocomial pneumonia in endotracheal cultures and correlation with blood cultures. Methodology: 559 endotracheal aspirates were collected using mucous traps from 180 patients of suspected nosocomial pneumonia patients over 2 years. The samples were processed and a colony count of 10^4cfu/ml was taken as the cut-off to differentiate between pathogens and colonizers. Identification and sensitivity of bacterial isolates was done with the help of Vitek 2. Blood for culture was processed as per standard techniques. Results & Conclusion: Klebsiella sp.(33%) was the commonest bacteria isolated, followed by Acinetobacter baumanii, Pseudomonas sp., Escherichia coli and Staphylococcus aureus. 25% of Acinetobacter spp. and 40% of Pseudomonas spp were pandrug resistant. Mostly non-fermenters were sensitive to Tigecycline and Colistin. Enterobacteriaceae showed highest resistance for Cephalosporins and Cotrimoxazole but were mostly sensitive to Tigecycline. Staphylococcus aureus was uniformly sensitive to Linezolid and Teicoplanin. Blood cultures were positive in 52 (9.3%) patients of which pulmonary origin bacteremia was present in 33 patients while non-pulmonary origin bacteremia was present in 19 patients. The pulmonary care bundle along with rational use of antibiotics will go a long way to improve treatment outcome, patient morbidity and mortality. [Tiwari U NJIRM 2016; 7(3):60 - 63]

Key Words: Antibiogram, Bacteremia, Endotracheal aspirate, Nosocomial pneumonia.

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Introduction: Nosocomial pneumonia is the second most common hospital acquired infection with an incidence ranging from 7% to 14.6% [1]. Nosocomial pneumonia is defined as pneumonia developing after 48 hours of hospital stay along with clinical features (fever, leucocytosis or purulent endotracheal secretions), radiological features and positive endotracheal aspirate (ETA) culture. Nosocomial pneumonia or ventilator associated pneumonia (VAP) can either be early onset (within 5 days of hospitalisation) or late onset (after 5 days of hospitalisation). Early onset pneumonia is usually caused by antimicrobial sensitive bacteria while late onset pneumonia is generally due to multidrug resistant organisms such as Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter spp. and Methicillin resistant Staphylococcus aureus(MRSA) [2].

Recently, definitions for multi-drug and pan-drug resistance among gram negative bacilli have been given. Multi-drug resistance usually refers to resistance to two or three classes of drugs. Pan-drug resistance refers to resistance to 7 drugs, namely, Cefepime, Ceftazidime, Imipenem, Meropenem, Piperacillin/tazobactam, Ciprofloxacin and Levofloxacin.[3]

Quantitative cultures samples of the protected specimen brush (PSB) or the bronchoalveolar lavage (BAL) using fiberoptic bronchoscopy has a sensitivity and specificity of more than 95%[1]. These samples are collected from the distal airways, thus avoiding contamination from upper airways or oral secretions. The Endotracheal aspirate sample for culture should be collected with the help of a sterile mucous trap using aelatll sterile precautions[4]. Endotracheal aspirate sample collection is a simple, inexpensive and non invasive technique with a sensitivity of 95% and negative predictive value of 94% in diagnosis of nosocomial Pneumonia[1,2].

In this study we have studied the antibiotic susceptibility profile of organisms causing nosocomial pneumonia and also correlated them with the blood cultures in our hospital.

Material and Methods: 180 patients were enrolled in the study of which single samples were taken from 103(57%) patients and multiple samples (2-7) from the rest 77(43%) patients over 2 years i.e. January,2014 to December, 2015. 559 Endotracheal aspirate samples with the help of mucous trap were collected. After proper handwashing and wearing sterile gloves before suctioning, endotracheal secretions were collected with the help of a sterile mucous trap. The samples were immediately transported to the laboratory, where they were plated onto blood agar and Mac Conkey agar. Colony characteristics were observed and 10^4cfu/ml was taken as the cut-off between microorganisms causing VAP and colonizers. Identification and sensitivity was done with the help of Vitek 2.

Blood for aerobic culture were also taken from the patients. The blood culture bottle was incubated and

plated on Blood agar and Mac Conkey agar. Culture bottles were incubated for five days and plated again at five days. If the culture showed no growth, then the culture was reported as sterile.

Results: Total of Five Hundred and fifty nine (559) Endotracheal aspirate samples were collected with the help of mucous traps over a period of 24 months. Majority of samples were from general ICU (56.6%) followed by neurosurgery ICU (40%) and rest from neurology ICU (3.4%) (shown in Table 1).

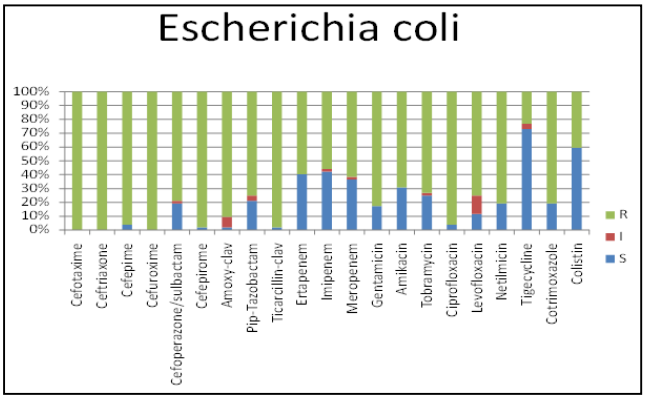
Table 1: Location of samples

TYPE OF ICU	SAMPLES (%)
GENERAL ICU	56.6
NEUROSURGERY ICU	40
NEUROLOGY ICU	3.4

Out of the 559 samples, 83(14%) showed colonisation and 476 (86%) were pathogens. Among the patients from whom multiples samples were taken, around two-third (51) of them showed the presence of same organism. 43% of the samples were polymicrobial in nature. Most commonly encountered microorganisms were Klebsiella sp. (33%), Acinetobacter baumanii (29%), Pseudomonas sp. (27%), Escherichia coli (9.3%) and Staphylococcus aureus (1.7%).

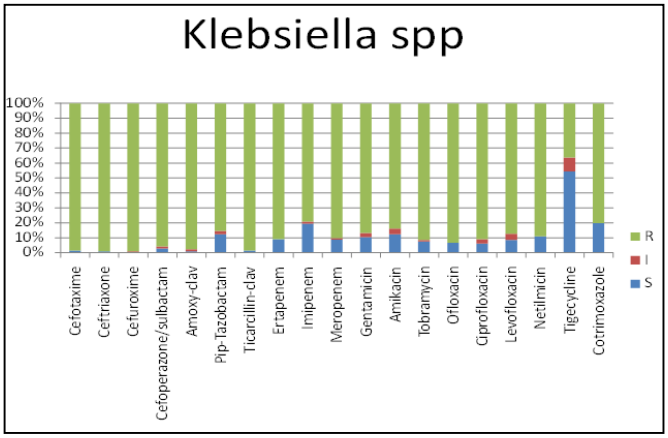
In this superspeciality hospital, pandrug resistant strains of Klebsiella sp(36%), Acinetobacter sp (25%) and Pseudomonas sp (40%) are seen. In E.coli, all isolates are resistant to B-lactams (Cefotaxime, Ceftriaxone and Cefuroxime). Amoxyclav, Piperacillin-tazobactam and Levofloxacin showed 80-90% resistance. 40-42% isolates are sensitive to carbapenems, namely, Imipenem and Ertapenem. 73% of isolates are sensitive to Tigecycline (Figure 1).

Figure 1: Antibiogram of E.coli



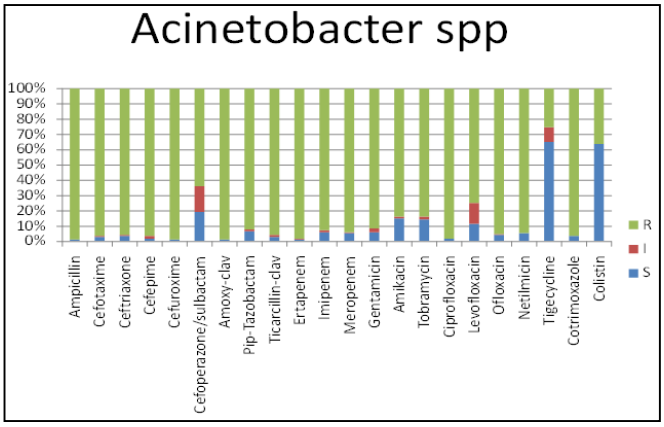
Almost all isolates of Klebsiella pneumonia were resistant to B-lactams (98.5%), flouroquinolones (90%), Aminogycosides (90%) and Meropenem (90%). 70% of isolates were resistant to Imipenem and Cotrimoxazole (Figure 2).

Figure 2: Antibiogram of Klebsiella spp



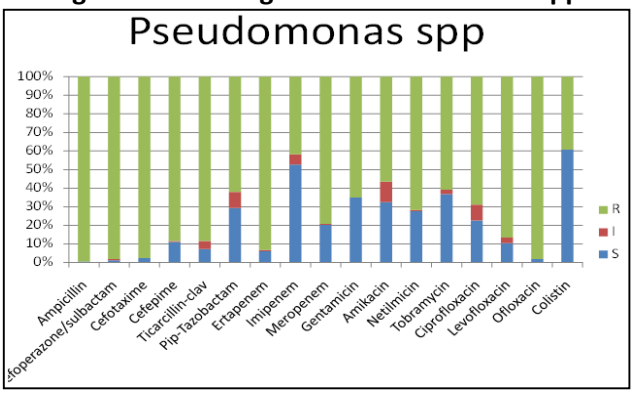
Almost all strains of Acinetobacter baumanii were resistant to B-lactams and B-lactam inhibitor combination (99%), 80% isolates were resistant to Amikacin and 74% resistant to Levofloxacin. The sensitivity of bacterial isolates to Tigecycline was 75% and to Colistin was 64% (Figure 3).

Figure 3: Antibiogram of Acinetobacter spp



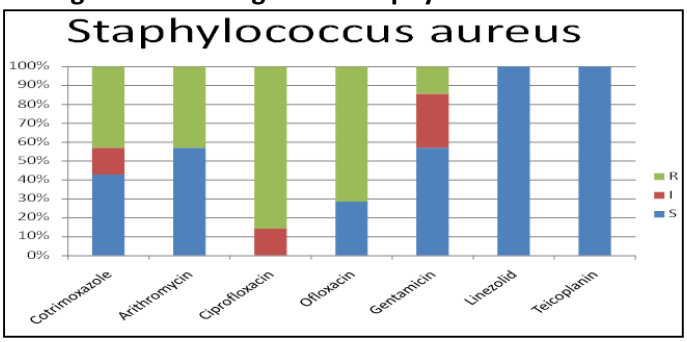
Almost all strains of Pseudomonas spp. were resistant to Ampicillin, Ofloxacin, Cefotaxime and Cefoperazone (98-99%). 60% of strains were sensitive to Imipenem and Colistin. 30% isolates were sensitive to Ciprofloxacin, Netilmicin and Ceftazidime (Figure 4).

Figure 4: Antibiogram of Pseudomonas spp



Amongst the isolates of Staphylococcus aureus, all isolates were uniformly sensitive to Linezolid while 15% resistance was seen against Teicoplanin. Highest resistance was observed against Ciprofloxacin (85%) (Figure 5)

Figure 5: Antibiogram of Staphylococcus aureus



Amongst the patients with positive endotracheal cultures, blood cultures were positive in 52(9.3%) patients. Out of 52 patients, pulmonary origin bacteremia (i.e. in which both endotracheal secretion and blood culture were positive for same organism) was present in 33 patients (63.4%). Bacteremia due to non-pulmonary origin (i.e. in which both blood culture and endotracheal secretions were positive but with different organisms) was present in 19 patients (36.6%) (Table 2)

Table 2: Microorganisms isolated from blood cultures

Microorganism	Blood stream infection	
	Pulmonary origin	Non-pulmonary origin
Klebsiella pneumonia	11	8
E.coli	4	2
Staphylococcus aureus	0	1
Pseudomonas aeruginosa	9	6
Acinetobacter spp.	9	2

Discussion and Conclusion: Ventilator associated pneumonia is the commonest complication in patients who are mechanically ventilated with endotracheal intubation tube. Studies have shown varied colonisation rates. Delclaux et al showed 66% colonisation rates in their study while Albert at al reports 85% colonisation rate[5]. In the present study, colonisation rate was low i.e. 15%. It may be due to the fact that most of the patients are very sick and had been referred from secondary and tertiary centres to this hospital. These patients have already been given many antibiotics and therefore are most likely to harbour multidrug resistant bacteria.

Among the patients from whom multiples samples were taken, around two-third (51) of them showed the presence of same organism. In 26 patients, different organism was isolated after 1-2 months due to change in flora as a result of prolonged hospitalisation.

Fagon et al reported 40% of the cases of VAP to be of polymicrobial etiology in their study. Similar finding was noticed in this study group. Most common organisms isolated from endotracheal aspirates as reported by Kant et al were Acinetobacter sp, Pseudomonas sp. and Staphylococcus aureus[6]. In our study Klebsiella sp., Acinetobacter baumanii and Pseudomonas sp. were most commonly isolated.

Staphylococcus aureus accounted for few samples only. In our study, one-fourth of Acinetobacter sp, one-third of Klebsiella sp. and half of Pseudomonas sp. isolates were found to be pan-drug resistant. Such high drug resistance could be attributed to the fact, that most patients who come to the superspeciality hospital are mostly referred from secondary centres and have already received multiple antibiotics before admission. These organisms have high intrinsic resistance to many antibiotics and ability to develop multiple antibiotic resistances due to various mechanisms such as B-lactamase production, upregulation of efflux pumps, porin channels etc. These microorganisms are also able to survive under wide range of environmental conditions and infect individuals who are hospitalized and are critically ill[7].

Most gram negative bacilli were resistant to B-lactams, flouroquinolones, aminoglycosides and cotrimoxazole. In these patients, Colistin and Tigecycline were the drugs that were mostly found susceptible. Hence, the patients were given one of these in combination with some other drugs such as carbapenems or

flouroquinolones to improve efficacy. All gram positive cocci i.e. Staphyloccus aureus , were sensitive to Linezolid and with the exception of one case , all were found to be sensitive to Teicoplanin.

In patients with nosocomial pneumonia, bacteremia has been reported at a rate ranging from 10% to 31%[3]. In this study, incidence of blood cultures was 11%. In 33 patients, pulmonary origin bacteremia was noted. This implies that most probably bacteremia occurred following the occurrence of VAP. Due to decreased immunity of patient, the infection spread from lungs to the bloodstream. Hence, same microorganism was isolated both from blood and endotracheal secretions. Hence, blood culture done from VAP patients can act as a useful adjunct in diagnosis as well as aid in the early detection of septicaemia secondary to VAP[3].

VAP is a preventable condition but has high mortality if not treated properly.[5] Hence, critical care bundles have been introduced in various healthcare centres. These bundles consist of a group of good practices which prevent VAP and help to decrease the morbidity and mortality of patients in the ICU. These consist of measures such as elevation of bed upto 45%, 1-2% chlorhexidine mouthwashes, subglottic aspiration, proper drainage, proper tracheal tube cuff pressure, proper position of ventilator tube, daily assessment of sedation level and stress ulcer prophylaxis. Proper cleaning of ICU and disinfection of suction bottle and humidifier reduces the formation of biofilm by drug resistant microorganisms.

Antibiotic use should be restricted to patients who show clinical or radiological signs of pneumonia or patients with positive cultures. Emperical therapy should be given according to the antibiotic policy which is based on the epidemiological data. The choice of antibiotics should be reviewed as soon as the culture reports become available. Combination of antibiotics should be preferred over monotherapy as it decreases the dose of individual drugs, thereby limiting its adverse effects. Rational use of antibiotics and cycling reduces the incidence of drug resistance, thereby improving treatment outcome and morbidity.

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