Research Article

Aerobic isolates in pus and their antibiotic sensitivity pattern: a study conducted in a teaching hospital in Andhra Pradesh

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Abstract

Background: The bacterial profile and the antibiotic pattern of the wound infections may change from time to time and place to place. Emergence of antimicrobial drug resistance has made the treatment of these wound infections very difficult.

Objective: The aim of the study was to identify the prevalent bacterial profile and its antibiogram in our area.

Materials and Methods: Pus samples from various sites were collected aseptically from 828 patients and were subjected to isolation and identification of aerobic bacteria by standard technique and subsequently antibiogram was carried out by Kirby-Bauer method.

Results: Of the 828 clinical samples, 458 showed growth. *Staphylococcus aureus* was the most common organism isolated (37%), followed by *Escherichia coli* (21%), *Klebsiella* (17%), *Pseudomonas* (8%) among others. *S. aureus* was found to be highly resistant to penicillin, ampicillin, and erythromycin, while being sensitive to linezolid and vancomycin. On the other hand, of the gram-negative bacilli isolated, *E. coli* was found to be more common, followed by *Klebsiella*, *Pseudomonas*, *Proteus*, and *Acinetobacter*. They were all found to be highly resistant to cephalosporins and fairly sensitive to aminoglycosides and carbapenems.

Conclusion: This study shows that in spite of the topographical diversity, the infecting bacterial isolates and their antibiogram from this area are found to be similar to those found in any other part of India.

KEY WORDS: Pus, bacterial isolates, antibiogram

Introduction

Pus, a whitish yellow liquid, is an accumulation of body's defense mechanism produced during an inflammatory pyogenic infection due to bacteria. The overall incidence of wound sepsis in India is from 10% to 33%.[1,2] Fairly consistent studies have always been done all over the world to show a predictable bacterial profile and the antibiogram in their respective areas. This makes an important observation for a clinician who intends to start empirical treatment to his patients while laboratory culture reports are awaited.[3]

Penicillin, the first antibiotic to be used on a large scale, was first put to use during the World War II.[6] It was considered the magic bullet as just a single injection could cure a life-threatening infection.[10] Since its discovery and consequently, with the advent of more antibiotics, there was a belief in the medical fraternity that this would lead to the eventual eradication of infectious diseases. On account of erratic use, malpractices or for natural causes, in recent years, drug resistance to many human

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pathogenic bacteria is being commonly reported from all over the world.[4] Although pharmacological industries have produced large number of newer antibiotics in the last three decades, the situation is alarming in developing as well as developed countries mainly because of their indiscriminate use.[5,7]

This study was designed to evaluate the profile of aerobic pyogenic bacteria in our area along with their susceptibility to antimicrobial agents.

Materials and Methods

Pus samples were collected from in- and outpatients of various departments of Malla Reddy Institute of Medical Sciences, Andhra Pradesh, India, over a period of 1½ years from Jan 2013 to July 2014. The specimens were either collected in sterile swabs or the pus was aspirated into sterile syringes and transported to the microbiology laboratory.

These samples were processed on blood agar, chocolate agar, and MacConkey agar media and incubated at 37°C under aerobic conditions. The organisms were identified by biochemical reactions, Gram stain, and motility tests as applicable as per standard operative procedure. The antimicrobial susceptibility tests were done by Kirby–Bauer's disk diffusion method on Mueller–Hinton agar and interpreted as per Clinical Laboratory Standard Institution guidelines.

Standard antibiotics such as penicillin-G (10 units), ampicillin (10 μg), erythromycin (15 μg), oxacillin (1 μg), vancomycin (30 μg), clindamycin (2 μg), linezolid (30 μg), for gram-positive bacteria and ceftriaxone (30 μg), cefotaxime (30 μg), 9 (30 μg), cefuroxime (30 μg), imipenem (10 μg), meropenem (10 μg), ertapenem (10 μg), doripenem (10 μg), tobramycin (10 μg), ciprofloxacin (5 μg), levofloxacin (5 μg), co-trimoxazole (1.25/23.75 μg), gentamicin (10 μg), amikacin (30 μg), and piperacillin/tazobactam (100/10 μg) (HiMedia, Mumbai, India) for gram-negative bacteria were tested.

Results

A total of 828 samples were tested of which 452 samples showed significant growth [Table 1]. Of these, 184 were gram-positive cocci (40.7%) and 268 (59.3%) were gram-negative bacteria.

Of the gram-positive cocci, *Staphylococcus aureus* was the most prevalent organism (37.2%), followed by *Streptococcus pyogenes* (2.2%), and coagulase-negative *S. aureus* (1.3%). *S. aureus* was highly resistant to penicillin, ampicillin, and erythromycin, and sensitive to vancomycin and linezolid [Table 2].

Of the 59.3% gram-negative bacilli (GNB) isolated, *Escherichia coli* was the most common organism followed by *Klebsiella*, *Pseudomonas*, and others. Most of them were resistant to all the generations of cephalosporins such as cefuroxime, cefotaxime, and ceftazidime, but sensitive to carbapenems such as imipenem and meropenem. They were fairly resistant to quinolones such as ciprofloxacin and levofloxacin but showed sensitivity to aminoglycosides such as amikacin and gentamicin [Table 3].

Discussion

Suppurative infection of the skin, ear, and eye are common occurrences in hospitalized patients and outpatients. Wound

Table 1: Number of organisms and their percentages

Organism isolated (total 458)	Number	Percentage
Staphylococcus aureus	168	37.2
Pseudomonas aeruginosa	34	7.5
E. coli	98	21.7
Klebsiella spp	76	16.8
Proteus spp	32	7.1
Streptococcus spp	10	2.2
Acinetobacter spp	28	6.7
Coagulase-negative Staphylococcus aureus	6	1.3

Table 2: Antibiotic sensitivity pattern of gram-positive cocci

Antibiotic	*Staphylococcus* (*N* = 168), %		*Streptococcus* (*N* = 10), %		Cons (*N* = 6), %	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Penicillin	15.5	84.5	100	0	33	66
Ampicillin	36.3	63.7	90	10	33	66
Erythromycin	58.3	41.7	70	30	50	50
Oxacillin	61.3	38.7	100	0	66	33
Clindamycin	87.5	12.5	100	0	100	0
Ofloxacin	54.2	48.8	80	20	16.7	83.3
Amikacin	71.4	28.6	100	0	100	0
Ceftriaxone	86.3	13.7	80	20	83.3	16.7
Linezolid	92.3	7.7	100	0	100	0
Vancomycin	100	0	100	0	100	0
Teicoplanin	66.7	33.3			100	0
Amoxyclav	22.6	77.4	90	10	50	50

Table 3: Antibiotic pattern of the GNB

	E. coli (*N* = 98), %		*Klebsiella* (*N* = 76), %		*Pseudomonas* (*N* = 34), %		*Proteus* (*N* = 32), %		Acinetobacter (*N* = 28), %	
	Sens	Res	Sens	Res	Sens	Res	Sens	Res	Sens	Res
Imipenem	96.9	3.1	97.4	2.6	82.4	17.6	96.9	3.1	96.4	3.6
Meropenem	65.3	32.4	65.8	34.2	76.5	23.5	96.9	3.1	85.7	14.3
Ertapenem	83.7	16.3	52.6	47.9	76.5	23.5	93.7	6.3	92.9	7.1
Doripenem	82.7	17.3	73.7	26.3	79.4	20.6	81.3	18.7	92.9	7.1
Tobramycin	60.2	39.8	36.8	63.2	76.5	23.5	90.6	9.4	78.6	21.4
Amikacin	92.9	7.1	72.4	27.6	82.4	17.4	93.7	6.3	85.7	14.3
Gentamicin	62.2	37.8	47.4	52.6	64.3	35.3	53.1	46.9	64.3	35.7
Levofloxacin	23.5	76.5	68.4	31.6	58.8	41.2	87.5	12.5	71.4	28.6
Ciprofloxacin	21.4	78.6	19.7	80.3	70.6	29.4	59.4	40.6	64.3	35.7
Cefuroxime	12.2	87.8	6.6	93.3	35.3	64.7	43.8	56.2	75%	25%
Ceftriaxone	21.4	78.6	13.2	86.8	64.7	35.3	40.6	59.4	78.6	21.4
Cefotaxime	29.6	70.4	15.8	84.2	70.6	29.4	37.5	62.5	78.6	21.4
Ceftazidime	32.7	67.3	22.4	77.6	61.8	38.2	43.8	56.2	85.7	14.3
Piperacillin + Tazobactam	84.7	15.3	86.8	13.2	88.2	11.8	100	0	100	0
Cotrimoxazole	4.1	95.9	13.2	86.8	23.5	76.5	28.1	71.9	35.7	64.3

Sens, sensitive, Res, resistant; GNB, gram-negative bacilli

infection is regarded as the most common nosocomial infection among surgical patients.[8] It has been associated with increased trauma care, prolonged hospitals stay, and treatment.[9]

This study revealed *S. aureus* to be the most commonly occurring pathogen (37.2%) in pus samples, which is in agreement with the studies by Rao et al.,[3] Tiwari and Kaur, [11] Lee et al., [12] and Mahmood.[17] However, Agnihotri et al.[13] found it to be the second most common pathogen after *Pseudomonas* spp.

E. coli followed by *Klebsiella* was the most common GNB isolated from the pus samples in our study. Though *S. aureus* was the predominant organism, gram-positive cocci accounted for only 40% of the total isolates, 60% being GNB. Such GNB dominance in the aerobic growth in pus culture has been highly seconded by studies reported by Ghosh et al.[14] and Zubair et al.[15] Another study by Basu et al.[16] also reported *Pseudomonas* and *E. coli* spp. to be the most commonly occurring pathogens in wound infections, in that order. Raza et al.[18] found *E. coli* to be the most common pathogen with similar observations by studies conducted in Nigeria.[19]

High antibiotic resistance was seen by *S. aureus* to penicillin (84.5% to penicillin and 63.6% to ampicillin). Macrolides like erythromycin showed approximately 58.3% sensitivity and 41.7% resistance pattern while they were fairly sensitive to lincomycins like clindamycin. Highest sensitivity was shown by high-end drugs such as linezolid and vancomycin. Unfortunately, this only shows that *Staphylococcus* has become highly resistant to the first and second lines of treatment. On the other hand, *Streptococcus*, the other gram-positive bacteria isolated, still shows fair amount of sensitivity to most of the drugs. These findings are similar to those of Rao et al.,[3] who also found *S. aureus* to be resistant to penicillin (84.62%), erythromycin (84.62%), and sensitive to clindamycin (65.38%) and vancomycin (100%). Studies by Javeed et al. [20] revealed 99.6% resistance to ampicillin and 33.1% to oxacillin, 72.7% to erythromycin but 100% sensitivity to vancomycin and more than 98% to linezolid.

Among the β-lactams, high resistance was seen by gram-negative bacteria to even fourth-generation cephalosporins whereas carbapenems are still sensitive though increasing resistance has been observed to meropenem. Amikacin among the aminoglycosides showed good sensitivity whereas resistance to gentamicin and tobramycin is on the rise. Resistance was seen by most of the isolates to quinolones. Combination drugs such as piperacillin+ tazobactam and cefoperazone+sulbactum showed good amount of sensitivity. Similar studies by Javeed et al.,[20] Rao et al.,[3] and Anguzu and Olila[21] corroborated our findings.

The knowledge of the bacteriology of an infection and the laboratory susceptibility testing of microorganism implicated could make drug selection in antimicrobial chemotherapy more rational.

Conclusion

The antibiotic pattern and the bacterial profile of the wound infections may change from time to time and place to place, as observed by different studies. On account of many antibiotics and their misuse, multidrug-resistant bacteria are emerging.

Hence it becomes essential to know the prevalent profile and sensitivity pattern to guide the clinicians to start the empirical treatment.

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