Original Research Article

A study on spectrum of bacterial isolates from wound infections by aerobic culture and their antibiotic pattern at SKMCH, Muzaffarpur

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Abstract

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%. This study was designed to evaluate the profile of aerobic pyogenic bacteria in our area along with their susceptibility to antimicrobial agents. **Methodology:** The current study was undertaken by the Department of Microbiology, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar, India. Pus samples were collected from in- and outpatients of various departments over a period of 2 years from March 2019 to February 2021. 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. Prior approval was obtained from the Institutional Ethics Committee.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. Findings were tabulated and analyzed using SPSS ver. 21.0. **Results:** A total of 564 samples were tested of which 255 samples showed significant growth that constitute 45.2% of the total samples received during the study duration . Of these, 40.5% were gram positive cocci and 59.5% were gram negative bacteria. Of the gram-positive cocci, Staphylococcus *aureus* was the most prevalent organism, followed by Streptococcus *pyogenes*. S. *aureus* was highly resistant to penicillin, ampicillin, and erythromycin, and sensitive to vancomycin and linezolid. Of the 59.5% gram-negative bacilli isolated, Escherichia *coli* was the most common organism followed by Klebsiella, Pseudomonas, and others. **Conclusion:** 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.

Keywords: Bacterial isolates, wound infections, aerobic culture, antibiotic pattern

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 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].

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Methodology

The current study was undertaken by the Department of Microbiology, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar, India. Pus samples were collected from in- and outpatients of various departments over a period of 2 years from March 2019 to February 2021. 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. Prior approval was obtained from the Institutional Ethics Committee.

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 mg), erythromycin (15 mg), oxacillin (1 mg), vancomycin (30 mg), clindamycin (2 mg), linezolid (30 mg), for gram-positive bacteria and ceftriaxone (30 mg), cefotaxime (30 mg), 9 (30 mg), cefuroxime (30 mg), imipenem (10 mg), meropenem (10 mg), ertapenem (10 mg), doripenem (10 mg), tobramycin (10 mg), ciprofloxacin (5 mg), levofloxacin (5 mg), co-trimoxazole (1.25/23.75 mg), gentamicin (10

mg), amikacin (30 mg), and piperacillin/tazobactam (100/10 mg) (HiMedia, Mumbai, India) for gram-negative bacteria were tested. Findings were tabulated and analyzed using SPSS ver. 21.0. Result has been depicted in form percentages and pictorial representation has been used to highlight major findings of the current study.

Results

A total of 564 samples were tested of which 255 samples showed significant growth that constitute 45.2% of the total samples received during the study duration **[Figure 1]**. Of these, 40.5% were gram positive cocci and 59.5% were gramnegative bacteria.

Of the gram-positive cocci, Staphylococcus aureus was the most prevalent organism, followed by Streptococcus pyogenes. S. aureus was highly resistant to penicillin, ampicillin, and erythromycin, and sensitive to vancomycin and linezolid [Table 1].

Of the 59.5% gram-negative bacilli 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 2].**

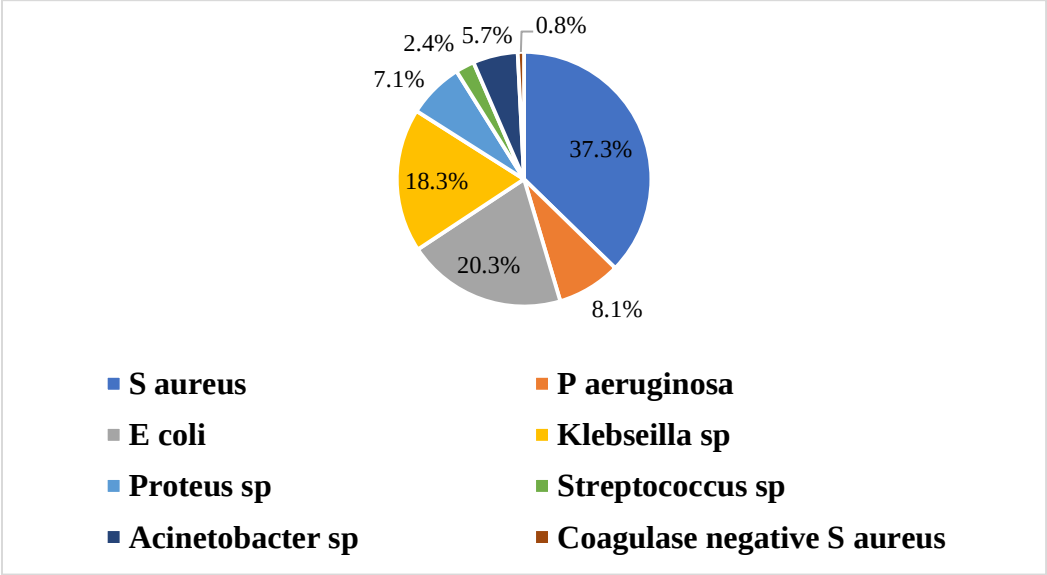

Fig 1: Pie distribution of isolates

Table 1: Distribution of gram positive cocci according to their antibiotic sensitivity

Antibiotic	% of organism showing antibiotic sensitivity		
	Staphylococcus	Streptococcus	CONS
Penicillin	12.5	100	33
Ampicillin	37.8	100	33
Erythromycin	53.6	75	50
Oxacillin	63.5	100	61.5
Clindamycin	85.7	100	100
Ofloxacin	50.5	100	11.2
Amikacin	78.7	100	100
Ceftriaxone	88.6	100	81.2
Linezolid	90.7	90	100
Vancomycin	100	100	100
Teicoplanin	61.8	90	90
Amoxyclav	20.8	100	100

Table 2: Distribution of gram negative bacilli according to their antibiotic sensitivity

Antibiotic	% of organism showing antibiotic sensitivity			
	E.*coli*	Klebseilla	Proteus	Pseudomonas
Imipenam	98.2	100	100	88.4
Meropenam	66.2	66.2	100	82.6
Ertapenam	85.6	50	100	82.6
Doripenam	80.2	16.8	87.8	88.7
Tobramycin	53.6	43.5	92.3	75
Amikacin	100	70.3	95.3	85.8
Gentamycin	66.2	45.7	50	64.8
Levofloxacin	25	71.2	90.3	52.8
Ciprofloxacin	21.5	19.8	62.8	75

Cefuroxime	10.8	5.4	39.3	33.6
Ceftriaxone	21.5	11.9	37.9	68.4
Cefotaxime	30.2	14.8	33.7	72.8
Ceftazidime	31.3	21.3	41.7	54.8
Pipercillin + Tazobactum	85.2	100	100	98.6
Cotrimoxazole	0.8	8.7	25	25

Discussion

Suppurative infection of the skin, ear, and eye are common occurrences in hospitalized patients and outpatients. Wound 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 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 around 40% of the total isolates, rest 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 the researcher. 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 b-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. 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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