

**BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL RESISTANCE PATTERNS ISOLATES IN PUS SAMPLES AT AGARTALA GOVERNMENT MEDICAL COLLEGE**ARUNDHATI JAMATIA<sup>1</sup>, DEBASISH ROY<sup>1</sup>, RUBIN SHIL<sup>2</sup>, PRANAV KUMAR PRABHAKAR<sup>2\*</sup><sup>1</sup>Department of Microbiology, Agartala Government Medical College, Agartala, Tripura, India, <sup>2</sup>Department of Medical Laboratory Science, Lovely Professional University, Phagwara, Punjab, India. Email: pranav.16113@lpu.co.in

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**ABSTRACT**

**Objective:** Injudicious use of antibiotics in the management of pyogenic infections leads to emergence and spread of antibiotic resistance among pyogenic bacteria. This study aimed toward the determination of the bacterial isolates from pus samples and their antibiotic resistance pattern.

**Methods:** A retrospective analysis of 359 consecutive pus specimens received at Microbiology Department of Gobind Ballabh Pant Hospital under Agartala Government Medical College, Agartala has been done. Bacterial isolates were identified by standard microbial techniques, and antibiotic susceptibility was done by modified Kirby-Bauer methods.

**Results:** Growth was seen in 176 (49.02%) specimens out of 359 samples. A total of 176 specimens yielded single isolate whereas 4 specimens yielded 2 isolates. *Staphylococcus aureus* was the most common organism isolated 53 (30.11%) followed by *Pseudomonas* spp. 37 (21.02%), *Klebsiella* spp. 30 (17.07%), *Escherichia coli* 24 (13.63%) *Proteus* spp. 11 (6.40%), *Acinetobacter* spp. 7 (3.97%), *Citrobacter* spp., and *Enterobacter* spp. 4 (2.27%) each. The highest number of multidrug resistant isolates was *Klebsiella* spp. All *S. aureus* were 100% sensitive to vancomycin, and all Gram-negative bacilli were 100% sensitive to imipenem and amikacin.

**Conclusion:** This study revealed the most common organism in pus samples is *S. aureus* followed by *Pseudomonas* spp. and highly multidrug resistance *Klebsiella* spp. Hence, continued monitoring of susceptibility pattern need to be carried out to detect the true burden of antibiotic resistance in organism and prevent their further emergence by judicious use of drugs.

**Keywords:** Pyogenic bacteria, Antibiotic resistance, Multidrug-resistant *Klebsiella*, Antibiotic policy.

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**INTRODUCTION**

The pyogenic infections are either polymicrobial or monomicrobial with an average of 5-6 organisms is often involved in the infections with mixture of aerobic and anaerobic organisms [1]. The most common organism likely to be encountered from pus are Gram-positive cocci such as *Staphylococcus aureus*, *Staphylococcus epidermidis* followed by Gram-negative bacilli, such as *Klebsiella* spp., *Pseudomonas* spp., *Escherichia coli*, *Proteus* spp., *Citrobacter* spp., *Acinetobacter* spp., and *Enterobacter* spp., respectively [2]. These are the type of infections require wise choice of antimicrobial treatment which should be based on cultured organisms and their susceptibility pattern as dilemma of starting empirical therapy with narrow spectrum agent or broad spectrum agent or one that comes resistant organism to persist [3]. However, the type of causative organism for infections and their sensitivity and resistant pattern vary from place to place. Hence, the appropriate selection of an effective antimicrobial agent for microbial infection requires knowledge of the potential microbial pathogen and understanding of the therapeutic agent [4]. Therefore, this retrospective study was carried out to investigate the bacterial isolates responsible for formation of pus and study their antimicrobial susceptibility pattern at Agartala Government Medical College, Gobindh Ballabh Pant Hospital (GBPH).

**METHODS**

A retrospective analysis of 359 consecutive pus specimens received at microbiology laboratory from various wards of Agartala Government Medical College and GBPH, Agartala over a period of 1 year from February 2013 to February 2014 were done. The aspirate specimens were transported in sterile leak-proof container, and swabs were

obtained on sterile cotton swabs and were processed immediately in the laboratory. All specimens were inoculated onto nutrient agar, blood agar, and MacConkey agar (Hi Media) incubated overnight at 37°C. Bacterial isolates were identified based on colony morphology, gram stain, and conventional biological tests following standard microbial techniques. Antibiotics susceptibility testing was done using Mueller Hinton agar (Hi-Media) by modified Kirby-Bauer methods as recommended by CLSI.

**RESULTS**

A total of 359 samples were received at the laboratory during the study period. The highest number of samples received from the Department of Orthopedics, 203 followed by Surgery 90, ENT 26, Obstetrics and Gynecology 17, and skin 10. Out of 359 samples, 176 samples showed growth of organism comprising 49.02% while 183 samples did not show any growth comprising 50.97%. Table 1 shows ward-wise distribution of samples.

Mixed growth was seen in four samples and 176 samples showed single growth. The most common isolates were *S. aureus* 53/176 comprising 30.11% followed by *Pseudomonas aeruginosa* 37/176 (21.02%), *Klebsiella* spp. 30/176 (17.03%), *E. coli* 24/176 (13.63%), *Proteus* spp. 11/176 (6.25%), 7/176 (3.37%), *Citrobacter* spp., and *Enterobacter* spp. 6/176 (3.34%) each (Table 2).

All the isolates of *S. aureus* were sensitive to vancomycin. 66.66% isolates of *S. aureus* were sensitive to cloxacillin, 56.25% to amoxiclav, 54.71% to Erythromycin, 40.00% to Cefodoxime and 52.63% to Moxifloxacin (Table 3).

All isolates were vancomycin sensitive. The Higher rate of resistance was seen against penicillin (84.32%) and amoxicillin (62.50%). All the isolates of *E. coli* were sensitive to amikacin followed by 70.56% to ceftazidime clavulanic acid, 70% to gentamicin, 66.66% to ofloxacin. Nearly, 75% of the *E. coli* were resistant to ceftazidime followed by

**Table 1: Ward-wise distribution of samples**

Ward	Male	Female	Total
Orthopedic	157	46	203
Surgery	36	54	90
ENT	18	8	26
O/G		17	17
Skin	7	3	10
Medicine	3	1	4
Mental	2		2
Cancer	1	1	2
Cabin	2		2
Anesthesia	1		1
Dental	1		1
Pediatric	1		1
Total	229	130	359

**Table 2: Bacterial growth profile of pus culture**

Organism isolated	Total (%)
<i>S. aureus</i>	53 (30.11)
<i>P. aeruginosa</i>	37 (21.02)
<i>E. coli</i>	24 (13.63)
<i>Klebsiella</i> spp.	30 (17.05)
<i>Proteus</i> spp.	11 (6.25)
<i>Acinetobacter</i> spp.	7 (3.97)
<i>Citrobacter</i> spp.	6 (3.40)
<i>Enterbacter</i> spp.	4 (2.27)
Yeast cell	4 (2.27)
Total	176 (176/100)

*S. aureus*: *Staphylococcus aureus*, *P. aeruginosa*: *Pseudomonas aeruginosa*,  
*E. coli*: *Escherichia coli*

**Table 3: Sensitivity and resistant pattern of *S. aureus***

Type of antibiotic	Percentage of sensitive	Percentage of resistant
Erythromycin	54.71	45.29
Amoxicillin	37.5	62.50
Azithromycin	51.02	48.98
Penicillin	15.68	84.32
Amoxiclav	56.25	43.75
Cloxacillin	66.66	33.34
Cefodoxime	40.00	60.00
Moxifloxacin	52.63	47.37

*S. aureus*: *Staphylococcus aureus*

**Table 4: Antibiotic resistance pattern of Gram-negative bacilli**

Antibiotic	<i>E. coli</i> (%)	<i>Klebsiella</i> spp. (%)	<i>Pseudomonas</i> (%)	<i>Proteus</i> spp. (%)	<i>Citrobacterspp.</i> (%)	<i>Acinetobacter</i> spp. (%)
Ceftriaxone	56.85	62.5	41.18	11.12	40	50
Cefotaxime	58.34	55.56	30	22.23	20	50
Ceftazidime clavulanic acid	29.42	72.73	31.58	20	71.73	ND
Amoxiclavulanic acid	100	100	95	80	100	100
Cotrimoxazole	ND	55.56	88.88	77.78	ND	100
Ofloxacin	ND	ND	66.67	ND	ND	ND
Gentamicin	30	62.5	30	00	ND	71.43
Amikacin	00.00	42.86	00.00	50	00.00	00.00
Penicillin	100	100	100	ND	ND	100
Amoxicillin	100	100	100	ND	ND	100

*E. coli*: *Escherichia coli*

58.34% to cefotaxime and 56.85% to ceftriaxone, and 56.85% were extended-spectrum beta-lactamase (ESBL) producers *E. coli*. A total of 10 isolates of *E. coli* shows resistant to all drugs except imipenem. All the isolates of *Pseudomonas* spp. were 100% sensitive to imipenem and amikacin. Nearly 70% of *Pseudomonas* isolates showed sensitivity to gentamicin and cefotaxime and 68.42% isolates showed sensitivity to ceftazidime clavulanic acid. These isolates showed 100% resistant to ampicillin, penicillin, and cloxacillin. 30% of the *Pseudomonas* isolates are ESBL producers. Higher rate of multidrugs resistant strain was seen among isolates of *Klebsiella* spp. 50% of the isolates were showed all drugs resistant pattern except with imipenem. 80% of isolates were sensitive to moxifloxacin followed by 57.14% to amikacin. 55.56% isolates were ESBL producers. Isolates showed 100% resistant to amoxiclavulanic acid, amoxicillin, and penicillin. 80% of the isolates were resistant to ceftazidime. All the isolates of *Acinetobacter* spp. were sensitive to amikacin and imipenem. 50% isolates were ESBL producers, and all were resistant to amoxi clavulanic acid and cotrimoxazole. Isolates of *Proteus* and *Citrobacter* spp. were 100% sensitive to moxifloxacin and amikacin. 11.12% of *Proteus* spp. and 20.00% of *Citrobacter* were ESBL producers. Table 4 shows resistant pattern of Gram-negative bacilli.

## DISCUSSION

Good similarity is observed in the present study with other studies reported by various authors across the country.

In present study culture, the positive rate is 49.02% which is slightly high compared to overall incidence of wound sepsis in India range from 10% to 33%. The Western studies indicate this range to be between 3% and 10%, with average of 5%. Predominant isolates were *S. aureus* highest followed by *Pseudomonas* spp., *Klebsiella* spp., *E. coli*, *Proteus* spp., and *Acinetobacter* spp. where similar findings observed in the studies by Rajan [5], Marton and Nichols [6] and Sader *et al.* [7].

Among *S. aureus* isolates penicillin, amoxicillin, and cefotaxime resistance were higher as similar to the study conducted by Tiwari and Kaur [8]. In our study, erythromycin resistance was found 45.29% which is comparatively low than that was found by Tiwari and Kaur [8]. There is a higher prevalence of methicillin-resistant *S. aureus* at our hospital. This may be the reason for occurrence of higher resistance toward beta-lactam and the other group of drugs. All *S. aureus* isolates were 100% sensitive to vancomycin.

In the present study, *Pseudomonas aeruginosa*, *Klebsiella* spp., and *E. coli* were the most common Gram-negative bacilli obtained from the pus. A number of study has also come to same conclusion and reported in that same order regarding occurrence of pathogens in wound infections [9-11]. Among Gram-negative bacilli, highest resistance was seen with amoxiclavulanic acid (100%), amoxicillin (100%), and penicillin (100%). Resistance toward the third generation cephalosporin was also high such as cefotaxime, ceftriaxone and ceftazidime, and cefotaxime. This may be because of increasing expression of ESBL

among Gram-negative bacilli. 22.72% of isolates showed resistance to all drugs tested without imipenem. *Klebsiella* isolates contributed maximum number of multidrug resistance. Ceftriaxone and cefotaxime were the drugs with 37.5%, and 44.44% isolates sensitive in this group followed by ceftazidime and gentamicin.

#### CONCLUSION

This study reports the most common organism encountered in pus is *S. aureus* followed by *Pseudomonas aeruginosa*, *Klebsiella* spp., and *E. coli*. Vancomycin, aminoglycosides such as amikacin and gentamicin and imipenem could be used as empirical therapy to cover these organisms. Hence, continued monitoring of susceptibility pattern needs to be carried out to detect the true burden of antibiotic resistance in organism and prevent their further emergence by judicious use of drugs.

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