

Microbiological Profile and Antibiotic sensitivity pattern of pyogenic infections in a Tertiary care hospital

**Dr. Kiran Kumar Bollepaka¹, Dr. Sakru Mudavath^{2*}, Dr. Yarra Sudhakar³
Kudurupka Veerender⁴**

¹ Associate Professor, Department of General Surgery, Government Medical College, Suryapet, Telangana, India

^{2,3,4} Assistant Professor, Department of General Surgery, Government Medical College, Suryapet, Telangana, India

Corresponding author : Dr. Sakru Mudavath

Email id : drsakru2000@gmail.com

ABSTRACT :

INTRODUCTION :

Bacterial infections that cause production of pus are called pyogenic infections. Pyogenic infections are associated with high morbidity, so antimicrobial regimens are recommended to reduce long term complications.

AIM :

The study was aimed to detect pyogenic bacteria in clinical pus samples and determine their antibiotic pattern

METHODS :

The study was conducted in Department of Microbiology, Kakatiya Medical College, Warangal from July 2021 to December 2021. A total of 525 pus samples were collected. Pus samples were collected with disposable sterile cotton swab and pus aspirates in syringes under aseptic precautions, and were transported to microbiology laboratory immediately. The pus samples were inoculated on Blood agar and Mac conkey aga. The plates were incubated at 37⁰ c for 18-24 hours. Identification of organisms were done by using biochemical reactions. Antibiotic sensitivity test was done by Kirby Bauer disc diffusion method according to CLSI guidelines.

RESULTS :

Among 525 samples, 275 (52.38%) samples were positive for growth. Gram negative organisms were isolated more than gram positive organisms. Pseudomonas aeruginosa was isolated predominantly among 275 positive samples, 67(24.3%) out of them was only Pseudomonas aeruginosa, followed by staphylococcus aureus 19.6%, Klebsiella pneumonia 17%, Escherichia coli 11.2%. In our study Gram negative organisms were more sensitive to Meropenem, Piperacillin/Tazobactam and Imipenem; Gram positive bacteria were more sensitive to Vancomycin and Linezolid.

CONCLUSION :

As there is emergence of multi drug resistant bacterial strains ,the knowledge of antibiotic susceptibility pattern of most prevalent pyogenic bacterial isolate is necessary for clinician to aid in accurate therapeutic regimen.

KEYWORDS :

PYOGENIC INFECTIONS, GRAM POSITIVE BACTERIA, GRAM NEGATIVE BACTERIA, ANTIBIOTIC SUSCEPTIBILITY PATTERN

INTRODUCTION

Pyogenic infections are not only the leading cause of morbidity and mortality but also responsible for prolonged hospital stay and disability worldwide¹. In India the crude mortality rate due to infectious disease is 417 per one lakh persons and pyogenic infections account for major contribution.² Pyogenic infections are mainly caused by invasion and multiplication of pathogenic microorganisms. They are characterized by local inflammation of skin, soft tissue and bodily parts. These pathogens causes formation of abscess and pus by releasing certain cellular or toxic metabolites. Pus is an exudate, typically white yellow, yellow, or yellow-brown,formed at the site of inflammation during bacterial or fungal infection. Pus consists of a thin, protein-rich fluid and made upof dead leukocytes ,blood cells and dead tissue.³ The overall incidence of wound sepsis in India is 10% to 33%.⁴ The most common pyogenic infections are surgical site infections, impetigo, otitis media, cystitis, osteomyelitis, septicarthritis, spondylodiscitis.

The infecting pathogens differ not only from country to country but also vary from one hospital to another within the same country.⁵ Pyogenic infections are caused by bacteria, fungi, protozoa,viruses and some cases mixed bacterial infections may be seen.⁶ The most common causative agents of pyogenic infections are Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli, Klebsiella spp. Proteus spp and Pseudomonas spp and Acinetobacter spp.¹³ Fungi like candida spp and moulds also cause pyogenic infections.

In developing countries emergence of MDR bacteria is increasing now a days, so it is a challenge to treat pyogenic infections. In recent years Methicillin resistant Staphylococcus aureus and MDR Gram negative isolates are observed to be increasingly associated with pyogenic infections.

MATERIAL AND METHODS

This is a retrospective study conducted in Department of Microbiology, Kakatiya Medical College, Warangal. All the pus samples collected from various departments are sent to microbiology laboratory for culture and sensitivity. This study was conducted for a period of 6 months from July 2021 to December 2021. Samples were collected aseptically by using sterile disposable cotton swabs and sterile disposable syringes for pus aspiration and transported to microbiology lab immediately. The collected pus samples were inoculated on to Blood agar and Macconkey agar. The culture plates were incubated at 37⁰c for 18-24 hrs. Identification of isolate

from positive culture was done using standard microbiological techniques. Antibiotic susceptibility test was done by using Kirby Bauer disc diffusion method on Mueller Hinton agar as per CLSI guidelines. Standard antibiotics like Amikacin (30mcg), Gentamicin (10mcg), ceftriaxone (30mcg), cefepime (30mcg), Imipenem (10mcg), Meropenem (10mcg), Ciprofloxacin (5mcg), Piperacillin/Tazobactam (100/10mcg). For Gram positive bacteria, Cefoxitin(30mcg), Cotrimoxazole (1.25mcg/23.75mcg), Vancomycin(30mcg), Linezolid(30mcg), Tetracycline(30mcg), Ceftriaxone (30mcg), Erythromycin(15mcg), Doxycycline (30mcg).

RESULTS

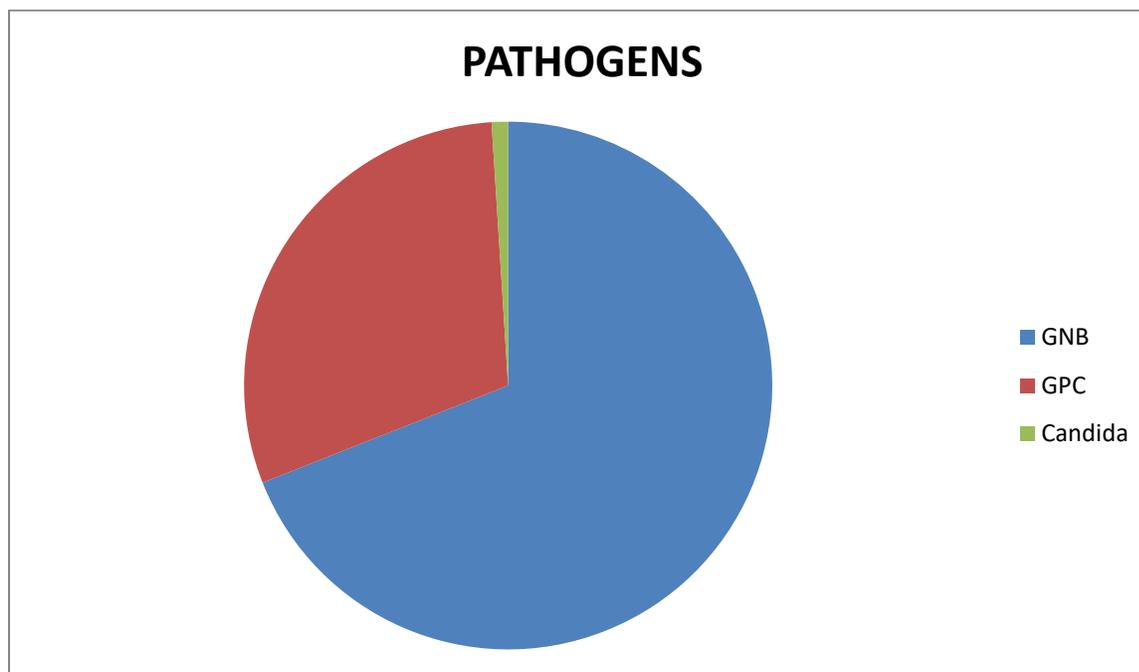
A total of 525 pus samples were collected from various departments both out patient and in-patient of Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal. Maximum number of pus samples were sent from Surgery department 250 (43.47%) samples followed by medicine department 155 (26.95%) samples, orthopaedic department 79 (13.73%) samples, obstetrics and gynaecology department 50 (8.69%) samples, ophthalmology department 6(1.04%) samples, dermatology department 5(0.86%), ENT department 4 (0.69%) samples, dental department and TB & Chest department 2(0.34%) samples each. The most common age group affected by pyogenic infections in this study was 21-30 years as shown in Table 1 and males were more prone than females as shown in Table 2.

Table 1: Distribution of samples according to age group

Age Group	Number of Samples	Percentage
0-10 years	17	3.2%
11-20 years	52	9.9%
21-30 years	169	32.1%
31-40 years	82	16%
41-50 years	86	16.3%
51-60 years	81	15.4%
61-70 Years	30	5.7%
71-80 years	4	0.7%
81-90 years	4	0.7%

Table 2 : Distribution of samples according to Gender

Gender	No.of samples
Male	315
Female	210
Total	525

Fig 1 : Frequency of Isolates in Pus samples

Among 275 positive samples, Gram negative bacteria were most frequent isolates comprising of 189 (69%), gram positive bacteria were 83 (30%) samples and 3 (1%) candida sps.

Table 3 : Prevalence of isolates from pus samples

Organism isolated	Number of isolates	Percentage (%)
Pseudomonas	67	24.3
Staphylococcus aureus	54	19.6
Klebsiella	46	17
E.coli	31	11.2
Coagulase negative Staphylococcus	19	7
Acinetobacter	20	7.2
Citrobacter	13	4.7
Proteus mirabilis	7	2.5
Proteus vulgaris	5	2
Enterococcus	7	2.5
Streptococcus pyogenes	3	1
Candida sps	3	1

In this study out of 275 samples isolated, *Pseudomonas aeruginosa* 67 (24.3%), followed by *Staphylococcus aureus* 54 (19.6%), *Klebsiella* 46(17%), *Escherichia coli* 31 (11.2%), Coagulase negative staphylococci 19(7%), *Acinetobacter* sps 20(7.2%), *Citrobacter* 13 (4.7%), *Proteus mirabilis* 7 (2.5%), *Enterococcus* 7 (2.5%), *Proteus vulgaris* 5 (2%), *Streptococcus pyogenes* 3(1%) and *Candida* sps 3 (1%).

Table 4 : Antibiotic sensitivity pattern of Gram negative bacteria (%S)

Organisms	E.coli n=31	Klebsiella n=46	Proteus mirabilis n=7	Proteus vulgaris n=5	Pseudom onas n=67	Acinetob acter N=20	Citrobacter N=13
Antibiotic							
Ampicillin/Sulbactam	35	28	20	0	0	5	25
Ceftriaxone	45	58	62	30	45	52	50
Peperacillin/ Tazobactam	85.5	80	83.33	87.5	82	84	88
Imipenem	95	88	92	87	89	90	87
Meropenm	98	95	95	95	90	90	90
Gentamicin	80	85	89	75	75	60	70
Cefotaxime	45	85	70	85	89	70	65
Ciprofloxacin	30	20	41.1	45	55	35	50
Cefepime	45	50	50	73.3	52	75	78
Amikacin	68	75	68	75	55	62	72

In this study Gram negative bacteria are highly resistant to Ampicillin / Sulbactam and mostly sensitive to Meropenem, Piperacillin /Tazobactam and Imipenem.

Table 5 : Antibiotic sensitivity pattern of Gram Positive organisms (%S)

Organisms	Staphylococcus aureus n= 54	Coagulase negative Staphylococcus n= 19	Streptococcus pyogenes n=3	Enterococcus n=7
Antibiotic				
Amikacin	65	85	45	55
Cefoxitin	55	75	-	-
Ciprofloxacin	70	60	55	55
Clindamycin	85	85	75	85
Vancomycin	90	96.5	95	71.4

Linezolid	95	90	100	80
Tetracycline	80	90	80	65
Erythromycin	70	60	55	60
Doxycycline	75	75	70	85

In this study, Gram positive bacteria are more sensitive to Vancomycin and Linezolid.

DISCUSSION

Pyogenic infections are characterized by local and systemic inflammation usually with pus formation. It may be either monomicrobial or polymicrobial. The most common causative agents are Gram negative bacteria such as *Pseudomonas*, *Escherichia coli*, *Klebsiella* spp., *Proteus* spp., and Gram positive cocci such as *Staphylococcus aureus* and *Enterococci*.

This study was aimed to detect pyogenic bacteria in clinical pus samples and determine their antibiotic susceptibility pattern. In this study both gram positive and gram negative bacteria were isolated from samples. Gram negative bacteria (69%) were isolated predominantly. It was agreed with studies done by Swati Duggalet al⁷, Sharma et al⁸, and Wadekar et al⁹. Among 525 pus samples received from various departments, 250 (43.47%) samples were from surgery department followed by 155 (26.95%) samples from Orthopaedic department. Majority of pus samples were from surgery department due to more cases presenting with pus and wound discharge which is similar to other studies^{10,11,12,13,14}. The most common age group infected with pyogenic infections are 21-30 years which is similar to other studies^{12,14} this is because young males are more prone to injuries and wounds due to involvement in outdoor activities¹⁵.

In this study the most common gram negative bacteria isolated were *Pseudomonas aeruginosa*, followed by , *Klebsiella pneumonia*, *Escherichia coli*, *Acinetobacter*, *Citrobacter*, *Proteus mirabilis*, *Proteus vulgaris*. These organisms are present in hospital environment which are resistant to common antiseptics and multi drug resistant strains. *Enterococcus*, *Streptococcus pyogenes*, *Candida* sps. Among gram positive bacteria *Staphylococcus aureus* followed by *CONS*, *Enterococci* and *streptococcus pyogenes* which is similar to study conducted by Kumari PH et al¹⁶ and Wadekar et al⁹. The most common isolated pathogens are *Staphylococci* and coliform bacteria because these bacteria can colonise in chronic wounds and cause delayed wound healing¹⁵.

In this study Gram negative bacteria were more sensitive to Meropenem, Piperacillin/Tazobactam and Imipenem which is similar to study of Rameshkannan S et al¹⁷ and Wadekar et al⁹. Gram positive bacteria are more sensitive to Vancomycin and Linezolid which is similar to study of Verma P¹⁸, Shittu et al¹⁹ and Wadekar et al⁹. This high incidence of drug resistance is due to indiscriminate use of antibiotics due to inadequate periods of time.

Due to irrational use of antibiotics, improper diagnosis of patients and incorrect prescription of antibiotics, bacteria acquiring resistance clinically, naturally or in acquired mode. Prevention of antibiotic resistance is done by eradicating these negligible errors. Antibiotic resistance leads to

increase in mortality rate in high risk diseased patients. Knowledge of antibiotic susceptibility pattern of pyogenic bacteria is helpful for clinicians to aid in treatment to patients.²⁰⁻²³

CONCLUSION

As there is emergence of multidrug resistant bacterial strains, the knowledge of antibiotic susceptibility pattern of most prevalent pyogenic bacterial isolate is necessary for clinician to aid in accurate therapeutic regimen. To reduce morbidity and mortality regular surveillance helps in better therapeutic regimens

CONFLICT OF INTEREST : NONE

REFERENCES

1. Singh S, Khare M, Patidar RK, Bagde S, Sahare K, Dwivedi D et al. Antibacterial activity against pyogenic pathogens. *Int J Pharm*
2. Laxminarayana R, Chaudhary RR. Antibiotic resistance in India: Drivers and opportunities for action. *PLoS Med*.2016 Mar 2;13(3):e1001974.
3. D Bindu, Chitralkha Sai Kumar M, Kiran R, Praveena V Illamani. Bacterial Profile and Antibiotic Resistance Pattern of Aerobic Gram Positive Bacteria Isolated From Pus Sample *Res J Pharm, Biol Chem Sci*2014556436
4. Hima Mantravadi, Mallikarjuna Chinthaparthi V, Shravani. Aerobic isolates in pus and their antibiotic sensitivity pattern: A study conducted in a teaching hospital in Andhra Pradesh. *Int J Med Sci Public Health* 20154810769
5. Daganachew Muluye Yitayih Wondimeneh Getachew Tesfaye Nega Kasaw Adane Belete Biadgo Bacterial isolates and their antibiotic susceptibility patterns among patients with pus and/or wound discharge at Gondar university hospital *BMC Res Notes* 201471619
6. Nandhkishor Bankar Bacteriological Profile of pus/wound swab and antimicrobial susceptibility of *Staphylococcus aureus* isolated from pus & wound swab of Indoor Patients of Tertiary Care Hospital *Int J Innov Res Med Sci*20184558737
7. Swati Duggal P K Khatri, R S Parihar Rajat Arora. Antibigram of various Bacterial Isolates from Pus Samples in a Tertiary Care Centre in Rajasthan. *Int J Sci Res*201545158084
8. Mary Sharma, Kulandhaivel Murugesan, Hridhya Vijayan, Isolation Identification and Antibiotic Sensitivity Pattern of Pyogenes from Pyogenic Pathogens *biomed Pharmacol* 2018114638.
9. Mita D Wadeka, Satish J V, Jayashree, Pooja C. Bacteriological profile of pus samples and their susceptibility pattern. *Indian Journal of Microbiolog Research* 2020;7(1):43-47.
10. Duggal S, Khatri PK, Parihar RS, Arora R. Antibigram of various bacterial isolates from pus samples in a tertiary care centre in Rajasthan. *International journal of Science and Research*, 2015 May; 4(5): 1580-4.
11. Rugira Trojan, Lovely Razdan, and Nasib Singh, "Antibiotic Susceptibility Patterns of Bacterial Isolates from Pus Samples in a Tertiary Care Hospital of Punjab, India,"

- International Journal of Microbiology, Vol.2016,Article ID 9302692,4pages, 2016.
Doi:10.1155/2016/9302692
12. Biradar A, Farooqui F , Prakash R, Khagri SY, I tagi I.Aerobic bacteriological profile with antibiogram of pus isolates.Indian J Microbiol Res 2016;3(3):245-249
 13. Muluyeet al : Bacterial isolates and their antibiotic susceptibility patterns among patients with pus and/or wound discharge at Gondar university hospital. BMC Research Notes 2014 7:619.
 14. Roopa. C et al, Deepali. V et al. Pus Culture Isolates and their Antibiotic Sensitivity Pattern in a Tertiary Care Hospital in Hyderabad Karnataka Region. International Journal of Medical Microbiology and Tropical Diseases, Vol 2017;3(4):140-145
 15. Bowler PG, Duerden BI, Armstrong DG, Microbiology and Associated Approaches to Wound Management. Clinical Microbiology Reviews, 2001;14(2):244-269.doi;10.1128/CMR.14.2.244-269.2001.
 16. P H Kumari Purimitla Usha Rani Payala Vijayalakshmi. Evaluation of microbiological profile and antibiogram of aerobic bacteria isolated from pus samples. J Med Allied Sci2018812635.
 17. S Rameshkannan G Nileshraj S Rameshprbu A Mangaiarkkarasi Meher Ali R. Pattern of pathogens and their sensitivity isolated from pus culture reports in a tertiary care hospital Puducherry. Indian J Basic APPLMed Res201412438
 18. PVerma Antibiotic Sensitivity Treatment for Gram Positive Bacteria Isolated from pus sample Bull Environ Phamacol Life Sci201211036
 19. A O Shittu D O Kolawole Ear Oyedepo A study of wound infections in two health institutions in lie-life Nigeria Afr J Biomed Res2002597102
 20. Chamounk K, Farah M, Araj G, Daoud Z, Moghnieh R, Salameh P, et al. Surviellance of antimicrobial resistance in Lebanese hospitals: retrospective nationwide compiled data. International J Infec Dis 2016; 46:64-70.
 21. Bell BG, Schellevis F, Stobberingh E, Goossens H, Pringle M. A Systematic review and meta-analysis of the effects of antibiotic consumptionon antibiotic resistance. BMC Infec Dis 2014;14: 13.
 22. Hollenbeck BL, Rice LB, Intrinsic and acquired resistance mechanisms in Enterococcus, Virulence 2012;3(5):421-569
 23. Nolte O. Antimicrobial resistance in the 21st century : a multifaceted challenge. Protein Peptide Letters 2014;21(4):330-5