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RESEARCH ARTICLE

A RETROSPECTIVE STUDY ON THE OCCURRENCE OF ENTEROBACTERIACEAE AS ETIOLOGICAL AGENTS OF PYOGENIC INFECTIONS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Members of the family Enterobacteriaceae are important causative agents of pyogenic infections in both hospitalized patients and community-acquired infections. Objectives: The objective of the study was to determine the occurrence of Enterobacteriaceae causing pyogenic infections, assess their mono- or poly-microbial etiology, and evaluate the antimicrobial susceptibility patterns of the isolates. **Methods:** Clinical samples received for aerobic bacterial culture were subjected to Gram staining and cultured on appropriate media. Isolates were identified using standard microbiological techniques and antimicrobial susceptibility testing was performed according to CLSI guidelines. **Results:** Among 122 Enterobacteriaceae-positive culture samples, 94 (77%) were mono-microbial and 28 (23%) were poly-microbial. Sensitivity pattern showing tigecycline (56%), netilmicin (48%) and cotrimoxazole (47%) sensitive which was followed by cefoperazone + sulbactam (42%), gentamicin (34%), meropenem (57%), ceftriaxone (20%), ciprofloxacin (19%), cefepime (19%), ampicillin+sulbactam (16%), piperacillin+ tazobactam (16%), nalidixic acid (13%), aztreonam (13%), amikacin (11%), cefexime (11%), ceftazidime (9%), cefuroxime (6%), amoxicillin + clavulanate (3%). **Conclusion:** The occurrence of pyogenic infections caused by Enterobacteriaceae varies across geographical regions and hospital settings, highlighting the need for periodic surveillance to guide appropriate antimicrobial therapy.

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INTRODUCTION

Pyogenic infections are an important cause of wound sepsis and are commonly associated with trauma, burns, and surgical procedures[1]. These infections are characterized by the production of pus resulting from local inflammation caused by the invasion and multiplication of pathogenic microorganisms[2]. Pyogenic infections of wounds are among the leading causes of morbidity and mortality worldwide which may further proceed to sepsis if proper treatment is not initiated[3]. Suppurative wound infections have been reported to vary between 3% and 11% in developed countries and are estimated to be as high as 40% in developing countries. Pyogenic infections are significant infectious diseases encountered in hospitals worldwide. These are associated with prolonged hospitalization, increased morbidity and are a huge economic burden to the country[4]. Pyogenic bacteria may be either from gram negative organisms especially belonging to order Enterobacterales as well as gram positive, aerobes or facultative anaerobes[5]. A large number of Methicillin resistant Staphylococcus aureus (MRSA) along with multidrug resistant gram-negative isolates are increasing as important cause of pyogenic infections in recent years[6]. The routine use of antibiotics has resulted in wide spread antibiotic resistance especially within the gram-negative organisms[7]. Antibiotic resistance is seen as potential danger around the world and infection caused by such bacteria increases morbidity and mortality, resulting in significant economic loss due to the usage of more expensive antibiotics to treat these infections[8].

MATERIAL AND METHODS

The current study was conducted in the Department of Microbiology, Goa Medical College, Bambolim, Goa for a period of 6 months from October 2024 to March 2025. The clinical specimens included wound swabs, pus, slough, aural swabs, tissue samples, and body fluids obtained from patients with pyogenic infections. A total of 455 clinical samples were received for aerobic culture from outpatient and admitted patients with pyogenic infections. All samples were subjected to primary gram staining for Pus cells and bacteria; following which, they were cultured on Blood agar, MacConkey agar and Glucose broth. All inoculated media were incubated at 37^0C for 24 hours. Growth on culture media was identified by standard microbiological techniques. This included colony morphology, hemolysis on Blood agar, gram staining, motility and biochemical reaction. Some strains were confirmed by Automated Identification System using VITEK2 Biomerieux. Antimicrobial susceptibility testing was done for all isolates by Kirby Bauer disc diffusion techniques as per according to CLSI M100, 34th edition (2024)[12]. Samples yielding mixed flora with 3 or more organisms were excluded from the study.

RESULTS

A total of 455 clinical samples were processed during the study period. Enterobacterales were isolated from 122 (26.8%) samples. From each sample type the total number of samples received and the number of culture positive samples amongst them were as follows:

Table 1. Distribution of Enterobacteriaceae-positive samples according to specimen type

Sample type	Number of Samples	Positive samples
Wound swab	170(37.3%)	46(37.7%)
Pus	132(29%)	32(26.2%)
Slough	72(15.8%)	21(17.2%)
Fluid	36(7.9%)	9(7.4%)
Vaginal swab	27(5.9%)	7(5.8%)
Tissue	13(2.9%)	5(4.1%)
Aural Swab	5(1.1%)	2(1.6%)
Total	455	122(26.8%)

The mono-microbial (77%) and poly-microbial (23%) distribution of culture positive samples with organisms belonging to *Enterobacteriaceae family* were as follows:

Table 2. Distribution of Enterobacteriaceae-positive samples according to organism type

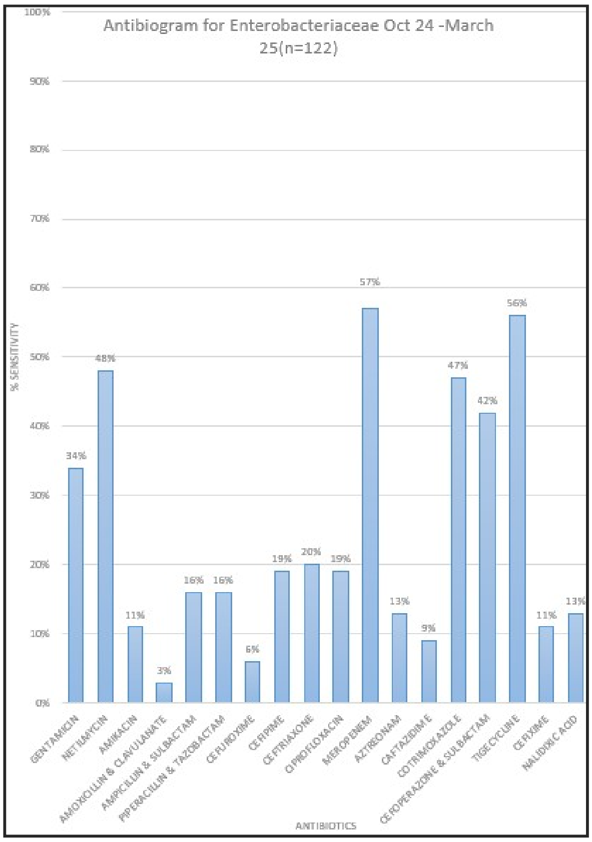
Organisms	Mono-microbial	Poly-microbial	Total culture positive samples
Klebsiella species	49(52.1%)	9(32.1%)	58(47.5%)
Escherichia coli	17(18.1%)	7(25%)	24(19.6%)
Enterobacter species	10(10.6%)	5(18%)	15(12.3%)
Proteus mirabilis	5(5.3%)	2(7.1%)	7(5.7%)
Proteus vulgaris	4(4.3%)	2(7.1%)	6(5%)
Citrobacter diversus	6(6.4%)	1(3.6%)	7(5.7%)
Citrobacter freundii	3(3.2%)	2(7.1%)	5(4.1%)
Total	94(77%)	28(23%)	122

Samples with poly-microbial growth of *Enterobacteriaceae* with other secondary microorganisms was as mentioned below:

Table 3. Distribution of Enterobacteriaceae-positive samples as per poly-microbial etiology

Primary Organisms	**Secondary Organisms**
Escherichia coli	*Pseudomonas species (3)* *Klebsiella species (1)* *Enterobacter species (1)* *Citrobacter species (1)* *Enterococcus species (1)*
Klebsiella species	*Pseudomonas species (4)* *Citrobacter species (3)* *Proteus species(1)* *MSSA(1)* *MRSA(1)* *CoNS(1)*
Enterobacter species	*Pseudomonas species (4)* *CoNS(1)*
Proteus mirabilis	*Enterococcus species (1)*
Citrobacter species	*Pseudomonas species (4)*

The antibiotic susceptibility pattern of the above isolates was as shown in the graph below.



DISCUSSION

Pyogenic infections are significant type of infection frequently encountered in hospital globally[1]. Wound infections can increase the length of hospital stay and accounts for the mortality rate up to 70-80%[3]. The etiological agents include both Gram-positive and Gram-negative pathogens, with Gram-negative organisms predominating[4]. Moreover, continuous upsurge of AMR is a therapeutic challenge[6]. Therefore, updated knowledge of etiology and Antibiogram is highly valuable to reduce morbidities[6]. The predominant organisms isolated were Klebsiella species (47.5%), followed by Escherichia coli (19.6%). This is comparable to a study showing *Klebsiella species* (31 %) including *Klebsiella pneumoniae* and *Klebsiella oxytoca* followed by *Escherichia coli* (25.7%) conducted in Gurugram, Haryana 2023 study by Devi, et al[1]. Similarly in study conducted in Nagpur MH 2023 Bajare et al[2] reported *Klebsiella species* (27%) followed by *Escherichia coli* (20.2%). Other Enterobacteriaceae isolated included *Enterobacter* species (12.3%), *Proteus mirabilis* (5.7%), *Citrobacter diversus* (5.7%), *Proteus vulgaris* (5%), *Citrobacter freundii* (4.1%). About 23 % culture positive samples were poly-bacterial having associated infections with other *Enterobacteriaceae family organisms* or with *Pseudomonas aeruginosa*, coagulase negative *staphylococcus* species (CoNS) and *Enterococcus* species. This pattern is similar to study conducted in Shahajahanpur, UP 2023 Diwakar et al[8]. The pattern of organisms is also similar to study conducted in Mewat, Haryana 2016 Sangwan et al[9]. In our study, *Enterobacteriaceae* showed highest sensitivity to tigecycline (56%), netilmycin (48%) and cotrimoxazole (47%). This was followed by by cefoperazone- sulbactam (42%), gentamicin (34%), meropenem (57%), ceftriaxone (20%), ciprofloxacin (19%), cefepime (19%), ampicillin-sulbactam (16%), piperacillin+ tazobactam (16%), nalidixic acid (13%), aztreonam (13%), amikacin (11%), cefexime (11%), ceftazidime (9%), cefuroxime (6%), amoxicillin-clavulanate (3%) indicating a high burden of antimicrobial resistance when compared with previous study in Chamrajanagar , Karnataka 2020 by Wadekar et al[7] showing piperacillin + tazobactam (88.7%) and meropenem (85.4%) sensitivity. A study conducted in Shahajahanpur, UP 2023 Diwakar et al[8] shows maximum sensitivity to imipenem comparable to our study showing maximum sensitivity to meropenem (57%).

CONCLUSION

This study highlights that the distribution of Enterobacteriaceae causing pyogenic infections varies across geographical regions and healthcare settings. Regular surveillance of bacterial etiology and antimicrobial susceptibility patterns is essential for effective empirical therapy and antimicrobial stewardship. These infections are mainly caused by *Klebsiella* species, *Escherichia coli*, *Enterobacter* species, *Proteus mirabilis*, *Citrobacter diversus*, *Proteus vulgaris* and *Citrobacter freundii*. Very few of them are having associated infections with *Pseudomonas aeruginosa*, coagulase negative *staphylococcus* species (CoNS) and *Enterococcus* species. As antimicrobial susceptibility pattern varies with time and geographical area, more studies with molecular level analysis should be conducted at intervals.

REFERENCES

Devi KD, Khandait M, Sharma M, Sardar M, Singh A, Saha R, et al. Prevalence of multidrug-resistant Gram-negative bacteria causing pyogenic infections at a tertiary care hospital in Haryana. MGM J Med Sci 2023;10:517-23.

Bajare B, Dhangar A, Tankhiwale S, Shrikhande S, et al. Bacteriological profile of pyogenic infections and their antimicrobial susceptibility in a tertiary care hospital in central India. Med Lab J. 2024,18(2):16-8

Wajid, M., Naaz, S., & Hashmiya, S. S. (2022). Evaluation of bacteriological profile of pyogenic infections and their susceptibiltiy profiles at a tertiary care hospital. International Journal of Health Sciences, 6(S3), 5237-5246

Chakraborty, A., Chanda, D.D., Choudhury, N., Manjula, N.G. and Shilpa, B.M. (2021) A Retrospective Study on the Pyogenic Pathogens and Their Antibiotic Susceptibility Patterns along with the ESL Production. Advances in Microbiology, 11, 317-326.

Yadav LK, Ansari S, Yadav SR, Yadav RL. Bacteriological profile of pyogenic infections at a Tertiary Care Centre of Nepal. Microbes Infect Dis 2022; 3(2): 332-338

Basista Prasad Rijal, Deepa Satyal, and Narayan Prasad Parajuli 2017High Burden of Antimicrobial Resistance among Bacteria Causing Pyogenic Wound Infections at a Tertiary Care Hospital in Kathmandu, Nepal Hindawi Journal of Pathogens Volume 2017, Article ID 9458218

Wadekar MD, Sathish JV, Jayashree, Pooja C. Bacteriological profile of pus samples and their antibiotic susceptibility pattern. Indian J Microbiol Res 2020;7(1):43-47

Manish Kumar Diwakar, Abhishek Mehtab, Rana Pratap. (2023). Bacteriological Profile and Antibiotic Resistance Pattern of Pathogens Causing Pyogenic Infections at a Tertiary Care Hospital in Central India. SVU-International Journal of Medical Sciences. Vol.6, Issue 2, pp: 215-226

Jyoti Sangwan, Pooja Singla, Pratibha Mane, Sumit Lathwal and A. K. Malik. 2016. Prevalence and Antimicrobial Susceptibility Patterns of Aerobic Bacterial Isolates from Pyogenic Wound Infections at a Tertiary Care Institute in Haryana, India. Int.J.Curr.Microbiol.App. Sci. 5(2):78-85

Minichil Worku, Solomon Belay, Tigist Molla[1], Melak Aynalem[2] and Muluneh Assefa[3] 2024 Prevalence and antimicrobial susceptibility pattern of Klebsiella pneumoniae isolated from various clinical specimens at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia Worku et al. BMC Infectious Diseases (2024) 24:917

Wesevich A, Sutton G, Ruffin F, Park LP, Fouts DE, Fowler VG, Jr, Thaden JT. 2020. Newly named Klebsiella aerogenes (formerly Enterobacter aerogenes) is associated with poor clinical outcomes relative to other Enterobacter species in patients with bloodstream infection J Clin Microbiol. 58:e00582-20

Clinical Laboratory Standards Institute 34th edition CLSI M100™ Performance Standards for Antimicrobial Susceptibility Testing 2024

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