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Bacteriological Profile and Antimicrobial Sensitivity Pattern in Sterile Body Fluids from a Tertiary Care Hospital: A Cross Sectional Study

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Abstract: ***Introduction*: Sterile body sites are those in which no bacteria or microbes exist as commensals in a healthy state. Fluids like pleural fluid, peritoneal fluid, synovial, and pericardial fluid are usually sterile. Infections of these sterile sites have greater clinical urgency and these infections could be life-threatening and may result in severe morbidity and mortality. Therefore, early identification of these organisms with antimicrobial susceptibility is decisive for the proper management of these infections. *Materials and Methods*: This cross-sectional study was conducted between January 2022 to December 2022 in the department of Microbiology in tertiary care hospital, Nagpur. A total of 534 sterile fluid samples from patients with suspected body fluid infections were processed using conventional microbiological methods and pathogens isolated & their antibiotic susceptibility testing was done by Kirby-Bauer disc diffusion method. *Result*: Amongst 534 samples, 130 (24.34%) fluids samples showed growth of organisms. Isolates from different fluids were E. coli (30.65%), Klebsiella pneumoniae (27%), Pseudomonas aeruginosa (21.16%), Acinetobacter spp. (15.32%), Staphylococcus aureus (3.64%), Citrobacter spp. (2.9%) and Proteus spp. (0.72%). Gram negative isolates were mostly sensitive to carbapenems and Gram positive isolates were sensitive to linezolid (100%). About 33% of S. aureus isolates in our study were MRSA. *Conclusion*: Timely and appropriate antibiotic treatment; often empiric, can improve the clinical outcome of body fluid infections. Hence, knowledge of bacterial pathogens and their antibiogram pattern, prevalent in a locality, needs to be available and updated on a regular basis.***

Keywords: Body fluids, Antimicrobial Resistance, MRSA

1. Introduction

Sterile body sites are those in which no bacteria or microbes exist as commensals when in a healthy state. [1] Infection of sterile body sites occurs by disease causing pathogens, their multiplication and subsequent production of toxins. Infectious agents may be bacteria, viruses, fungi and parasites.2Among bacterial causative agents of infection of sterile body sites, both gram positive and gram negative organisms have been incriminated. These involve specially those that are present as endogenous and exogenous body flora and commensals.3

Body fluids like pleural fluid, peritoneal fluid, CSF, synovial, drain, and pericardial fluid along with bile are usually sterile and they are frequently received samples in the microbiology laboratory for culture in suspected infections.4, [5] There are certain common pathogenic bacteria like E coli, Klebsiella species, Haemophilus influenza, Staphylococcus aureus, Neisseria Meningitidis, NFGNB (Non fermenting Gram Negative Bacillus), Pseudomonas, Acinetobacter, which invade and infect the sterile body fluids. Infections of these sterile body sites typically have greater clinical urgency and these infections could be life-threatening and may result in severe morbidity and mortality.6, [7]

The morbidity and ability to cause life threatening infections has rendered these cases a medical emergency that demands early diagnosis and suitable treatment. Moreover in many cases, the severity of infection may warrant empirical antibiotic treatment due to which there were fewer chances of retrieving positive cultures. [8]

Therefore, for the better management of patients and framing the antibiotic policy, the knowledge of prevalent strains along with their antimicrobial resistant pattern is essential.

As of now, there are very limited data on bacterial profiles and their antimicrobial susceptibility pattern from body fluids in our geographical area. Hence assessing bacterial profiles and antimicrobial sensitivity pattern from body fluids is very crucial to clinicians.

2. Material and Method

This cross sectional study was conducted between January 2022 to December 2022 in the department of Microbiology Government Medical College, Nagpur. During this period, a total of 534 sterile fluid were received in department of microbiology were included in study. Body fluid samples like Pleural, Peritoneal, Synovial, Pericardial, were collected under proper aseptic precautions and processed within 2 hour of collection.

All the samples were subjected to direct Gram stain, following which the culture was carried out on enriched

media such as blood agar and chocolate agar and differential media such as MacConkey agar. Identification of the isolates was done using standard microbiological techniques.9

The antimicrobial susceptibility test was done on Mueller Hinton Agarby Kirby-Bauer disc-diffusion method, and interpretation was done according to the Clinical And Laboratory Standard Institute guidelines 2022.10

3. Result

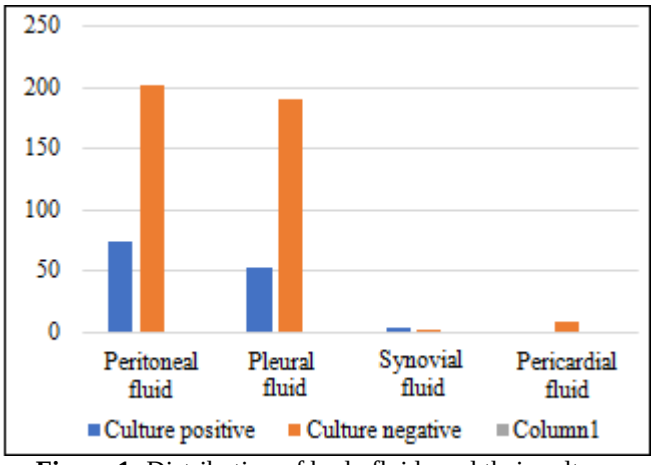

Figure 1: Distribution of body fluids and their culture positivity rate (n=534)

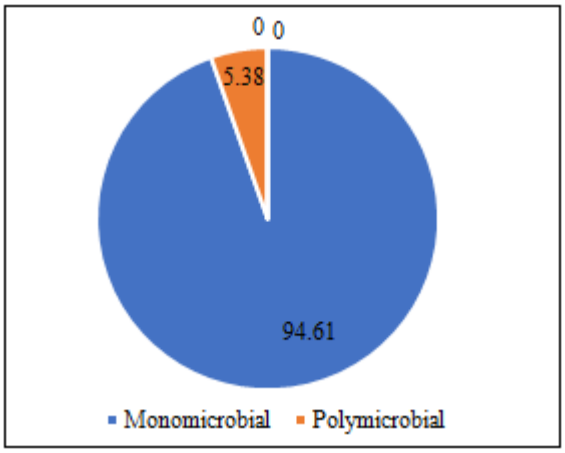

Figure 2: Monomicrobial and Polymicrobial Growth

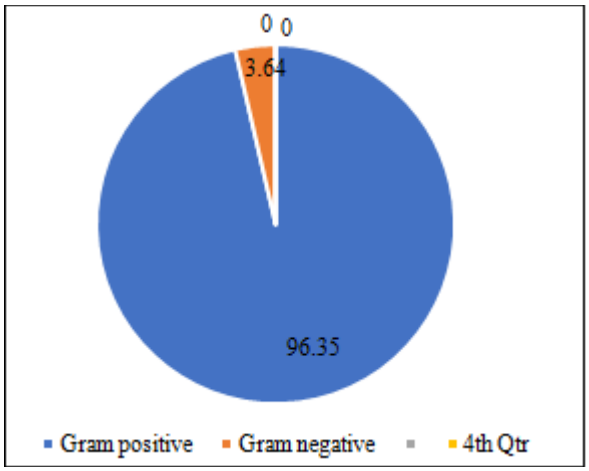

Figure 3: Division of Gram-positive and Gram-negative organisms

Table 1: Frequently isolated organisms from different samples

Organism	Pleural fluid	Peritoneal fluid	Synovial fluid	Total No. isolated, n (%)
Enterobacterial				
E. coli	16	22	02	40 (30.65)
Klebsiella pneumoniae	06	30		36 (27)
Citrobacter spp.	02	02		04 (2.9)
Proteus spp.	01	01		02 (0.72)
Non fermenter				
Pseudomonas aeruginosa	18	11		29 (21.16)
Acinetobacter spp	09	10	02	21 (15.32)
Gram positive cocci				
Staphylococcus aureus	01	04		05 (3.64)
Total	53	80	4	137

Table 2: Antimicrobial Sensitivity Pattern of Enterobacteriacea

Antibiotics	Resistance Pattern			
	E. coli (n=40)	*K. pneumoniae* (n=36)	*C. koseri* (n=4)	*P. mirabilis* (n=2)
Ampicillin	36 (90)	36 (100)	04 (100)	2 (100)
Cefazolin	34 (86)	32 (88)	3 (75)	0
Gentamicin	15 (38)	16 (45)	2 (50)	0
Cefuroxime	34 (86)	31 (86)	3 (75)	0
Cefotaxime	34 (86)	30 (83)	3 (75)	0
Amoxycillin-clavulanate	34 (86)	29 (82)	3 (75)	0
Piperacillin-tazobactam	19 (48)	18 (50)	1 (25)	0
Cefepime	23 (58)	22 (60)	2 (50)	0
Meropenem	13 (32)	14 (38)	(00)	0
Amikacin	14 (35)	14 (40)	1 (25)	0
Ciprofloxacin	32 (80)	28 (78)	2 (50)	1 (50)
Cotrimoxazole	24 (60)	20 (55)	2 (50)	1 (50)

Table 3: Antimicrobial Sensitivity Pattern of Non fermenters

Antibiotics	Resistance Pattern	
	P. aeruginosa (n=29) (%)	*Acinetobacter spp.* (n=21) (%)
Gentamicin	15 (50)	14 (65)
Tobramycin	15 (53)	13 (63)
Levofloxacin	12 (43)	15 (70)
Amikacin	12 (43)	13 (64)
Cefepime	15 (53)	15 (70)
Piperacillin-tazobactam	12 (40)	13 (63)
Ceftazidime	(57)	17 (80)
Aztreonam	10 (35)	-
Meropenem	9 (30)	9 (45)
Netilmicin	12 (40)	-
Amp-sulbactam	-	13 (60)
Minocycline	-	13 (60)

Table 4: Antimicrobial Sensitivity Pattern of Gram positive cocci

Antimicrobial	*S. aureus* n=5 (%)
Penicillin	4 (33)
Cefoxitin	3 (33)
Gentamycin	3 (33)
Doxycycline	3 (33)
Erythromycin	2 (66)
Clindamycin	3 (66)
Linezolid	5 (100)
Ciprofloxacin	2 (33)
Cotrimoxazole	3 (60)

4. Discussion

Infections of the sterile body sites typically have greater clinical urgency and these infections could be life-threatening. These conditions need to be addressed promptly, to reduce both mortality and morbidity.3 Therefore, it is important to know the correct identification of the organisms as early as possible and the susceptibility pattern of these organisms to start the patient on targeted antimicrobial therapy immediately.

A total of 534 samples were studied out of which, 276 were Peritonial fluid, 243 were Pleural fluid, 6 were Synovial fluid and 9 were Pericardial fluid.

Out of 534 samples processed, 130 (24.34%) samples were culture positive. This is in comparison to other studies conducted by Sujatha et al.1[1] and Sorlin et al [12] who reported 31% and 24% respectively culture positivity in sterile body fluids.

In this study, Gram negative organisms were isolated in 96.35% samples and Gram positive organisms were isolated in 3.64% samples. Our findings are in accordance with similar studies conducted by Sharma et al[13] who reported predominance of gram negative organism (81.97%)

Among Gram negative organisms, the predominant organisms were *E. coli* (30.65%) followed by *Klebsiella pneumoniae* (27%) and *Pseudomonas aeruginosa (*21.16%). Isolation of *Acinetobacter spp.* was in 15.32%, *Citrobacter spp.* (2.9%), and *Proteus spp.* (0.72%).

Among Gram positive organisms we could isolate only *Staphylococcus aureus*in 2.18% body fluids. In similar studies done by Dr. Sania Sultana et al[14] and Madigubba et al[15] reported isolation of *Staphylococcus aureus* in 27.27% and 4.5% of body fluid respectively.

Pleural fluid yielded bacterial growth in 21.39% samples which is similar to the finding of Madigubba et al15 who reported 26.7% growth. In our study *Pseudomonas aeruginosa (*33.96%) and *E. coli (*30.18%) were the commonest organisms isolated from pleural effusion samples. This was similar to a study done by Madigubba, et al.1[5] who reported 23.6% *Pseudomonas aeruginosa*. While other studies done by Sujatha et al.1[1] and Evan et al.1[6] found *E. coli* and *Klebsiella spp*. to be the common organism.

Peritoneal fluid yielded growth of bacteria in 26.81% samples which is similar to findings done by Dr. Sania Sultana et al[14] (36.36%). *Klebsiella pneumoniae* (38.75%) was most common organism isolated followed by E. coli (28.75%) and *Pseudomonas aeruginosa* (13.75%). Study done by Sharma et al.1[3] found *E. coli* (35%) the most common isolate followed by *Acinetobacter spp*. (26.8%).

Synovial fluid bacterial culture positivity was 66.66% in the present study, while in other studies conducted by Madigubba, et al.1[5] culture positivity was 19.4%.

Antimicrobial susceptibility pattern among the Gram-negative organisms showed that *E. coli* was least resistant to Meropenem (32%) followed by Piperacillin-tazobactam (36%). However in a study conducted by Madigubba et al[15] E. coli was most sensitive to Amikacin 83% followed by Meropenem 80.9%. *E. coli* isolates showed highest resistance to Cephalosporins. This is in accordance with the study conducted by Barai L et al.1[7] and Tullu et al.1[8]

Klebsiella pneumoniae showed least resistance to Meropenem (38%) and high resistance to beta lactam antibiotics correlating with study done by Harshika et al.1[6] In our study, 70% of Pseudomonas isolates were sensitive to Meropenem, which is similar to the study conducted by Singh, et al.1[7] who reported 66.66% resistance to Meropenem. In our study Acinetobacter was most resistant to ceftazidime (80%).

The study also showed that *S. aureus* was found to be 100% sensitive to linezolid. About 33 % of S. aureus isolates in our study were MRSA, which is much similar to the studies performed by Sharma et al.1[3] who reported 38.5% of MRSA.

5. Conclusion

Knowledge of bacteriological profile and antibiogram of body fluids is necessary, as this will help in effective and accurate treatment of the life threatening infections, in formulating the hospital antibiotic policy and thus prevents indiscriminate use of unnecessary antibiotics and antimicrobial resistance associated with such infections.

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