Original Article

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Microbiology Section

Bacteriological Profile and Antimicrobial Susceptibility Pattern of the Isolates from Body Fluid Samples from Tertiary Care Health Centre, Ujjain, Madhya Pradesh, India

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ABSTRACT

Introduction: Bacterial Infection of various body fluids can leads to serious invasive infection, high morbidity and mortality. It is a clinical urgency; so early detection and identification of pathogen is essential for appropriate management of patient.

Aim: To determine the bacterial profile and their susceptibility to antimicrobial agents of isolates from various body fluids.

Materials and Methods: This retrospective cross-sectional study was conducted from January, 2021 to December 2021 in the Microbiology Department, CRG Hospital, RD Gardi Medical College, Ujjain, Madhya Pradesh, India. Body fluids were collected and transported aseptically from the patients visited in this hospital. All received samples were processed as per standard microbiology methods. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method and interpreted as per Clinical and Laboratory Standards Institute (CLSI) guidelines.

Results: A total of 298 body fluids samples were received for culture and sensitivity, of these, 63 (21.1%) fluid samples showed growth. Out of them, maximum pathogens were isolated from Broncho Alveolar Lavage (BAL) fluid 28 (44.4%), followed by peritoneal fluid 17 (27%), pleural fluid 12 (19%), CSF 1 (1.6%), pericardial fluid 1 (1.6%) and synovial 4 (6.3%). Most of the isolates were Gram-Negative Bacteria (GNB) 58 (92%), predominantly *Pseudomonas aeruginosa* 20(32%) followed by *Klebsiella* species 18 (29%), *E.coli* 14 (22%), All gram negative isolates were sensitive to Tigecycline and Colistin, However, susceptibility to the carbapenem group (Imipenem, Miropenem and Ertapenem) were (80-100%). Among gram positive bacteria, *Staphylococcus aureus* were 5 (8%) isolated. Of these, Methicillin Resistant *Staphylococcus aureus* (MRSA) was 4 (6.3%) and Methicillin Sensitive *Staphylococcus Aureus* (MSSA) was 1 (1.6%). All isolate of *Staphylococcus aureus* were susceptible to Vancomycin, Linezolide, Teicoplanin and Levofloxacin.

Conclusion: Knowledge of bacteriological and antimicrobial profile of body fluids is necessary, so that the life threatening infections can be effectively treated. In this study, BAL fluid is the commonest received sample. GNB were main isolates among them *Pseudomonas aeruginosa* is frequently isolated pathogen. All isolated pathogens were susceptible for higher group of antimicrobial agents (tigecycline, colistin) and showed reduced sensitivity towards other antibiotics. So, regular monitoring of the pattern of Antimicrobial Resistance (AMR) of bacteriological isolates in the patients is critical to develop antibiotic policy to combat these infections and reduce morbidity and mortality.

Keywords: Antimicrobial resistance, Bronchoalveolar lavage, Gram-negative bacteria, Gram-positive bacteria

INTRODUCTION

Sterile body sites are those in which no microbes exist as commensals when in a healthy state [1]. Microorganisms can invade sterile body sites via haematogenous, lymphatic route or any means. Causative agents can be a pathogenic or opportunistic organism from the normal flora of body [2,3]. In response to infection, fluids may accumulate in any body cavity associated with invasive diseases, such as bacteraemia, sepsis, bacterial meningitis, bacterial peritonitis, and other complications [4]. Infection of sterile Body fluids like BAL, ascitic (peritoneal fluid), pleural, pericardial, synovial fluids, cerebrospinal, and hydrocele are associated with grave morbidity and life threatening events [5]. Lesser isolation rate of organisms from these samples is because of less number of pathogens as well as prior administration of empirical antibiotics [6]. Hence, Isolation of single colony of microorganism is significant from body fluids [7,8]. Frequently isolated pathogenic organisms are *Escherichia coli (E.coli), Pseudomonas aeruginosa (P.aeruginosa), Klebsiella pneumoniae, Staphylococcus aureus (S.aureus)* and Non Fermenter Gram Negative Bacteria (NFGNB) [3].

Emergence of AMR leads to extended hospital stay, higher medical costs, increases economical burden on the community, increased morbidity and mortality. The condition is depressing in the poor and developing countries because of limited healthcare facilities, lack of resources, poverty, low education, poor hygiene and sanitation, irrational and abrupt use of antibiotics [9]. Early detection and rapid identification of microorganisms are crucial for the appropriate management in this situation [6].

There are very limited data available on bacteriological profile and their antimicrobial susceptibility pattern from various body fluids samples from the central part of India [10,11]. However, this is a common topic and many studies conducted from the other parts of India [6,12-14]. So, the present study was undertaken to evaluate aerobic bacteriological profile along with their antibiogram that will be very useful to the clinicians for presumptive diagnosis and early start of the treatment.

MATERIALS AND METHODS

The retrospective cross-sectional study was conducted from January 2021 to December 2021 in the Department of Microbiology, CRG Hospital, RD Gardi Medical College, Ujjain, Madhya Pradesh,India, on 63 culture positive body fluids.

Procedure

A total of 298 sterile body fluids like pleural fluid, BAL fluid, peritoneal fluid, Cerebrospinal Fluid (CSF), synovial fluid etc., were collected aseptically from patients in a sterile container and transferred to

the microbiology laboratory for further processing. With standard safety precautions, the samples were subjected for microscopic examination (gram staining) and culture. Samples were processed by inoculation on blood agar, MacConkey's agar and chocolate agar (Hi-media, Mumbai) and incubated aerobically at 37 for 24 hours to obtain isolated colonies. Isolates were identified by using standard technique [7,8,15]. Isolates were identified on the basis of colony morphology, gram staining, catalase test, coagulase test, indole, methyl reduction, urease, citrate, triple sugar iron test, mannitol motility test etc., [7,8]. Susceptibility of bacterial isolates to antimicrobial agents was carried out on Mueller Hinton Agar media using modified Kirby-Bauer disk diffusion method as per Clinical and Laboratory Standards Institute (CLSI) guideline [15]. Relevant clinical history was collected from each patient for clinical correlation.

Reference strains of *S.aureus* (ATCC 25923), *E.coli* (ATCC 25922), and *P.aeruginosa* (ATCC 27853) were used as quality control for susceptibility testing as per CLSI guideline [15].

RESULTS

During the study period, a total of 298 body fluids were processed. Of these, 63 (21.1%) fluids showed growth. Among 63 culture positive samples, Majority were males 50 (79%) whereas females were 13(21%). Age of the study group ranged from two years to 80 years with majority was above 50 years 31(49%) [Table/Fig-1]. The topmost sample was showed growth, that was BAL fluid 28(44%), followed by peritoneal fluid 17(27%), pleural fluid 12(19%), CSF 1(1.6%), pericardial fluid 1(1.6%) and other body fluids 4(6.3%) (synovial) [Table/Fig-2].

Of the total 63 isolates, GNB were prevalent 58 (92%). Predominant GNB isolated was *P.aeruginosa* 20 (32%) followed by *Klebsiella* species 18 (29%), *E.coli* 14 (22%), Other NFGNB (Acinetobacter, Burkholderia) were 4 (6.3%) and less commonly isolated was *Enterobacter species* 2 (3.2%). *S.aureus* 5 (8%) was frequently isolated among gram positive bacteria. MRSA were 4 (6.3%) and MSSA were 1 (1.6%) isolated [Table/Fig-2]. All the *S.aureus* strains were sensitive to vancomycin, Linezolide, Teicoplanin and Levofloxacin [Table/Fig-3]. Gram negative organisms were utterly susceptible to tigecycline and colistin, sensitivity towards

Demographic profile	Number of patients	Percentages (%)
Attended Hospital as		
Out patients	0	00
In patients	63	100
Age (years)		
1-15	1	1.6
>15-30	10	16
>30-50	21	33
>50	31	49
Gender		
Male	50	79.4
Female	13	20.6

[Table/Fig-1]: Demographic profile among patient's sterile body fluids showed positive culture during study period (n=63).

Isolates	BAL fluid n=28 (%)	Pleural fluid n=12 (%)	Peri-toneal fluid n=17 (%)	CSF n=1 (%)	Peri-cardial fluid n=1 (%)	Other body fluid n=4 (%)	Total
Pseudomonas aeruginosa	15 (54)	5 (42)	00	00	00	00	20 (32%)
Klebsiella species	5 (18)	3 (25)	7 (41%)	1 (100)	00	2 (50)	18 (29%)
Escherichia coli	4 (14.2)	1 (8.3)	9 (53%)	00	00	00	14 (22%)
Other Non Fermenter Gram negative bacteria (NFGNB)	2 (7.1)	2 (17)	00	00	00	00	4 (6.3%)
Enterobacter species	00	00	1 (6)	00	00	1 (25)	2 (3.2%)
MRSA	2 (7.1)	1 (8.3)	00	00	00	1 (25)	4 (6.3%)
MSSA	00	00	00	00	1 (100)	00	1 (1.6%)
Total	28 (44.4%)	12 (19%)	17 (27%)	1 (1.6%)	1 (1.6%)	4 (6.3%)	63 (100%)

[Table/Fig-2]: Distribution of Bacterial isolates from body fluids (Total N=63)I.

Antimicrobial agents	MRSA n (%) (Total N=4)	MSSA n (%) (Total N=1)
Chloramphenicol	1 (25)	1 (100)
Ciprofloxacin	3 (75)	1 (100)
Levofloxacin	4 (100)	1 (100)
Erythromycin	2 (50)	1 (100)
Clindamycin	2 (50)	1 (100)
Gentamycin	3 (75)	1 (100)
Amikacin	3 (75)	1 (100)
Linezolid	4 (100)	1 (100)
Teicoplanin	4 (100)	1 (100)
Vancomycin	4 (100)	1 (100)
Tetracyclin	2 (50)	1 (100)
Cotrimoxazole	3 (75)	1 (100)
High level gentamycin	-	-
High level streptomycin	-	-
Inducible erthromycin resistant	00	00

[Table/Fig-3]: Antimicrobial susceptibility pattern of gram positive bacteria.

Antimicrobial agents	*Klebsiella* species (n=18) %	*Pseudomonas aeruginosa* (n=20) %	*E.coli* (n=14) %	*Enterobacter species* (n=2) %	Other NFGNB (n=4) %
Amoxclave	11 (59)	9 (45)	9 (64)	1 (50)	2 (50)
Piperacillin-Tazobactam	5 (29)	20 (75)	11 (79)	00	2 (50)
Ceftazidime	10 (53)	8 (40)	9 (64)	00	1 (25)
Cefuroxime	5 (29)	3 (15)	7 (50)	1 (50)	1 (25)
Ceftriaxone	5 (29)	-	4 (29)	1 (50)	1 (25)
Cefoperazone-salbectam	14 (76)	6 (30)	13 (92)	1 (50)	2 (50)
Cefepime	5 (29)	6 (30)	6 (43)	1 (50)	1 (25)
Imipenem	15 (82)	12 (60)	12 (86)	2 (100)	3 (75)
Meropenem	16 (88)	16 (80)	12 (88)	2 (100)	4 (100)
Ertapenem	16 (88)	-	12 (88)	2 (100)	4 (100)
Doripenem	17 (94)	17 (85)	14 (100)	2 (100)	4 (100)
Ciprofloxacin	2 (12)	11 (55)	6 (43)	00	00
Levofloxacin	7 (41)	12 (60)	8 (57)	00	1 (25)
Amikacin	13 (71)	15 (75)	10 (71)	2 (100)	2 (50)
Gentamycin	10 (53)	9 (45)	8 (57)	1 (50)	2 (50)
Tigecyclin	18 (100)	-	14 (100)	2 (100)	4 (100)
Colistin	18 (100)	20 (100)	14 (100)	2 (100)	4 (100)
Aztreonam	8 (47)	9 (45)	11 (78)	1 (50)	1 (25)
Minocyclin	-	-	-	-	2 (50)
Ticarcillin clavulinate		14 (70)	-	-	2 (50)
Cotrimoxazole	5 (29)	8 (40)	7 (50)	00	1 (25)
Polymyxin b	-	20 (100)	-	-	3 (75)

[Table/Fig-4]: Antimicrobial susceptibility pattern of Gram Negative Bacteria (GNB).

carbapenem group was 80-100%. They showed high resistance to amoxyclav, quinolones, aminoglycosides and third generation cephalosporin (ceftazidime, ceftriaxone and cefotaxime) [Table/Fig-4].

DISCUSSION

In the present study, samples were received from all the age groups, their age ranged from two year to 80 year, Majority of them were from above 50 years of the age with 79% males and 21% females. That is in concordance with study conducted at North India (63.6% were males, while 36.4% were females) [12]. In the present study, culture positivity rate was 21.1% as it is likewise the study conducted by Harshika YK et al., with rate of 22% [13].

In the present study, out of 63 culture positive samples, The most common received sample was BAL fluid 28 (44%), followed by peritoneal fluid, then pleural fluid , then CSF, pericardial fluid and other body fluids. This is in contrast with studies from South India, where peritoneal fluid and pleural fluid were reported as commonest received sample [6,13]. Isolation of microorganisms from various clinical samples was described in previous study in [Table/Fig-5] [6,13,14,16-18].

In this study *P.aeruginosa* 20 (32%) was the commonest pathogen isolated followed by *Klebsiella species* 18 (29%), *E.coli* 14(22%), Other NFGNB were 4 (6.3%) and *Enterobacter species* 2 (3.2%) was least isolated among GNB. As compared to other studies, isolation rate of gram positive bacteria were less, 5 (8%) were *S.aureus*, out of them MRSA were 4 (6.3%) and MSSA were 1(1.1%). Bacteriological profile from various samples reported by past studies showed in [Table/Fig-6] [6,13,14,16-18].

In present study, GNB 58 (92%) were repeatedly isolated than gram positive bacteria. This finding was similar to South Indian study with the isolation rate of gram negative organisms were 83% and gram positives were 16.3% [14]. Similar gram negative predominance seen in previous studies [3,18]. In contrast, gram-positive bacteria was reported as most frequent isolate by Vishalakshi B et al., and Perween N et al., [6,12]. In the present study, predominant organism isolated was *P.aeruginosa* 20 (32%) followed by *Klebsiella species* 18(29%), *E.coli* 14(22%), That is correlated with previous studies by Shume T et al., and Magazine R et al., [3,19]. *P.aeruginosa* 15 (54%) was most commonly isolated from BAL fluid, that is comparable with studies conducted by Magazine R et al., 35(35%) and Akhtar S et al., 46(54.76%) [19,20]. Isolation rate of *P.aeruginosa* was 5(26%) from the pleural fluid and was the commonest pathogen isolated from the same sample. This is similar with study from South India 23.6% [14]. This result is in discrimination with other studies, where *E.coli* is the frequently isolated from pleural fluid [13,18]. In this study, from the peritoneal fluid frequently isolated GNB was *E.coli* followed by *Klebsiella species*. This is concordance

Authors Name	Place of study	Year of Publication	Total samples	Total positive growth	Pleural fluid	Peritoneal fluid	CSF	Pericardial	Other body fluid
Vishalakshi B et al., [6]	Ballari, Karnataka, India	2016	115	17 (15%)	1 (5.9%)	2 (11.8%)	00	-	14 (82.3%)
Sharma R and Anuradha ND [16]	New Delhi, India	2017	405	122 (30%)	22 (18%)	82 (67%)	-	2 (1.6)	16 (13.1%)
Harshika YK et al., [13]	Hubli, Karnataka India	2018	635	142 (22.3%)	59 (42%)	56 (39.4%)	23 (16.2%)	4 (2.8 %)	-
Vijaya durga S and Anuradha B, [17]	Telangana, India	2019	1708	351 (21%)	107 (30%)	162 (46%)	10 (3%)	2 (0.5%)	70 (20.1%)
Madigubba H et al., [14]	Puducherri, Karnataka, India	2020	4358	1305 (30%)	224 (17.2%)	391 (30%)	313 (24%)	-	377 (29.3%)
Sultana S et al., [18]	Hyderabad, Telangana, India	2021	380	11 (2.9%)	2 (18.2%)	4 (36.4%)	1 (9%)	00	4 (36.4%)
Present Study	Ujjain, Madhya Pradesh, India	-	298	63 (21.1%)	12 (19%)	17 (27%)	1 (1.6%)	1 (1.6%)	4 (6.3%)

[Table/Fig-5]: Describing culture positive clinical samples included studies [6,13,14,16-18].
Note: Author had included the samples showed positive growth in all studies

Organisms isolated	Authors name and place of study	Pathogen isolated from various clinical samples				
		Pleural fluid	Peritoneal fluid	CSF	Pericardial	Other body fluid#
Vishalakshi B et al., [6] Ballari, Karnataka						
S.aureus		1 (5.9%)	2 (12%)	-	-	4 (24%)
E.coli		-	-	-	-	2 (12%)
K. pneumoniae		-	-	-	-	1 (5.9%)
P. aeruginosa		-	-	-	-	3 (18%)
Other Isolates*		-	-	-	-	4 (24%)
Sharma R and Anuradha ND New Delhi, India [16]						
S.aureus		1 (0.8%)	1 (0.8%)	-	-	11 (9%)
E.coli		6 (5%)	29 (24%)	-	-	-
K. pneumoniae		2 (1.6%)	18 (15%)	-	2 (1.6%)	3 (2.5%)
P. aeruginosa		2 (1.6%)	4 (3.3%)	-	-	-
Other Isolates*		11 (9%)	30 (25%)	-	-	2 (1.6%)
Harshika YK et al., Hubli, Karnataka, India [13]						
S.aureus		10 (7%)	3 (2%)	2 (1.4%)	-	-
E.coli		16 (11.3%)	9 (6.3%)	6 (4.2%)	1 (0.7%)	-
K. pneumoniae		6 (4.2%)	9 (6.3%)	6 (4.2%)	1 (0.7%)	-
P. aeruginosa		9 (6.3%)	9 (6.3%)	2 (1.4%)	-	-
Other Isolates*		22 (15%)	23 (16%)	5 (3.5%)	2 (1.4%)	-

Vijaya durga S and Anuradha B, Telangana, India[17]						
S.aureus		19 (5.4%)	25 (7.1%)	2 (0.6%)	-	16 (5%)
E.coli		21 (6%)	65 (19%)	1 (0.3%)	1 (0.3%)	10 (3%)
K. pneumoniae		33 (9.4%)	38 (11%)	4 (1.1%)	-	3 (0.9%)
P. aeruginosa		16 (4.6%)	6 (1.7%)	-	-	12 (3.4%)
Other Isolates*		18 (5.1%)	18 (5.1%)	3 (0.9%)	1 (0.3%)	29 (8.3%)
Madigubba H et al., Puducherri, Karnataka, India[14]						
S.aureus		19 (1.5%)	15 (1.1%)	16 (1.2%)	-	8 (0.7%)
E.coli		26 (2%)	157 (12%)	44 (3.4%)	-	162 (13%)
K. pneumoniae		35 (2.7%)	58 (4.4%)	27 (2%)	-	72 (6%)
P. aeruginosa		53 (4%)	30 (2.3%)	57 (4.4%)	-	31 (2.3%)
Other Isolates*		91 (7%)	131 (10%)	169 (13%)	-	103 (8%)
Sultana S et al., Hyderabad, Telangana, India[18]						
S.aureus		00	00	1 (9%)	00	2 (18.2%)
E.coli		1 (9%)	3 (27%)	00	00	1 (9%)
K. pneumoniae		1 (9%)	00	00	00	00
P. aeruginosa		00	1 (9%)	00	00	1 (9%)
Other Isolates*		00	00	00	00	00
Present study Ujjain, Madhya Pradesh, India						
S.aureus		1 (1.6%)	00	00	1 (1.6%)	3 (5%)
E.coli		1 (1.6%)	9 (14.2%)	00	00	4 (6.3%)
K. pneumoniae		3 (5%)	7 (11.1%)	1 (1.6%)	00	7 (11.1%)
P. aeruginosa		5 (8%)	00	00	00	15 (24%)
Other Isolates*		2 (3.1%)	1 (1.6%)	00	00	3 (5%)

[Table/Fig-6]: Bacteriological profile in various samples included studies [6,13,14,16-18].
*Others isolates include *Streptococcus, Pneumococcus, Enterococcus, Coagulase negative Staphylococcus, Acinetobacter spp., Elizabeth kingia, Stenotrophomonas maltophilia, Serratia marcescens, Proteus spp, Pantoea spp*, unidentified NF-GNB, *Citrobacter spp, Burkholderia pseudomallei, Burkholderia cepacia*
#Other body fluids include BAL fluid, Bile fluid, drain fluid

with studies from South India [14,17]. In India, from different geographical areas *E.coli* was reported as predominant isolated organism from peritoneal fluid [18,20]. As *E.coli* is a normal flora of intestinal tract as well as facultative anaerobe so easily grow in routinely used media in laboratory.

In present study, susceptibility pattern of isolates were good. GNB were highly sensitive towards carbapenem groups, susceptibility for amikacin and gentamycin is reduced. Third generation cephalosporin (ceftazidime and ceftriaxone) was showed less effective. Gram positive organisms were entirely sensitive towards vancomycin, levofloxacin, linezolide, teicoplanin and decreased sensitivity seen for aminoglycoside group (amikacin and gentamycin). Antimicrobial pattern of previous studies described in the [Table/Fig-7,8] [6,13,14,16-18]. In this study, all isolates of *P.aeruginosa* were sensitive to Tigecycline and Colistin, susceptibility to carbapenem antibiotics were Meropenem 80% and Imipenem 60%, Piperacillin-Tazobactem 75% and Ticarcillin-clavulinate 70%. Susceptibility reduced towards aminoglycoside compounds; still better for Amikacin than Gentamycin (Amikacin 75% and Gentamycin 45%). Resistance was higher among cephalosporins (Ceftazidime 40%, Cefepime 30%) and Cotrimoxazole 40%. Similar pattern of susceptibility was seen in previous studies [13,14,18,17]. This was different from Vijaya Durga S and Anuradha B, studies, they reported higher sensitivity to Piperacillin tazobactam 95% and >80% to carbapenems [17].

In the present study, all *Klebsiella pneumoniae* isolates were sensitive only for reserved antibiotics, such as Tigecycline and Colistin, whereas susceptibility to carbapenem group was; for Meropenem and Ertapenem 88% both. That is comparable with study done by Sharma R and Anuradha ND [16], whereas contemplate with Madigubba H et al., study [14]. Susceptibility reduced towards routinely used antibiotics such as for third generation cephalosporin (Ceftazidime 53% and Ceftriaxone 29%), Amoxyclave 59%, Piperacillin-Tazobactam 29% and Cotrimoxazole 29%. Among Aminoglycoside group susceptibility to Amikacin 71% and Gentamycin 53%, which was compatible with Madigubba H et al., study [14].

Name of organism	Studies and place	CX	AK	GEN	VA	CD	E	CIP	COT
S.aureus	Vishalakshi B et al., [6] Ballari, Karnataka	71.43	83	100	100	40	58	58	83
	Sharma R and Anuradha ND [16] New Delhi, India	61.5	-	-	100	-	56	79	65
	Harshika YK et al., [13] Hubli, Karnataka India	-	100	100	100	75	67	92	75
	S Vijaya durga and Anuradha B, [17] Telangana, India	82	100	100	100	70	68	81	77
	Madigubba H et al., [14] Puducherri, Karnataka, India	72.8	-	-	100	-	-	-	55.9
	Sultana S et al., [18] Hyderabad, Telangana, India	-	-	0	-	65	-	65	30
	Present study, Ujjain MP, India	20	80	80	100	60	60	80	80

[Table/Fig-7]: Antimicrobial susceptibility pattern of gram positive Isolates (%) included studies [6,13,14,16-18].
CX: Cefoxitin; AK: Amikacin; GEN: Gentamycin; VA: Vancomycin; CD: Clindamycin; E: Erythromycin; CIP: Ciprofloxacin; COT: Cotrimoxazole

Name of organism	Studies and place	CTR	CTX	AMC	PTZ	AK	GEN	IMP	MRP	CIP	COT	AT
E.coli	Vishalakshi B et al., [6] Ballari, Karnataka	-	00	-	-	100	100	50	-	100	100	--
	Sharma R and Anuradha ND [16] New Delhi, India	-	-	--	72	63	67	79	-	61	49	69
	Harshika YK et al., [13] Hubli, Karnataka India	-	18	44	-	62	58	100	-	62	44	-
	Vijaya durga S and Anuradha B, [17] Telangana, India	60	35	-	92	85	75	100	-	65	50	-
	Madigubba H et al., [14] Puducherri, Karnataka, India	16.1	16.1	-	57.3	83	25.1	-	80.9	18.2	-	-
	Sultana S et al., [18] Hyderabad, Telangana, India	-	40	-	-	-	-	100	-	40	-	-
	Present study, Ujjain Madhya Pradesh, India	30	-	68	80	71	57	86	88	42	50	76
K. pneumoniae	Vishalakshi B et al., [6] Ballari, Karnataka	-	100	-	-	100	100	100	-	100	100	-
	Sharma R and Anuradha ND [16] New Delhi, India	-	-	-	81	68	63	89	-	71	54	71
	Harshika YK et al., [13] Hubli, Karnataka India	-	34	44	-	84	78	100	-	56	34	-
	Vijaya durga S and Anuradha B, [17] Telangana, India	45	42	-	75	85	75	100	-	65	42	-
	Madigubba H et al., [14] Puducherri, Karnataka, India	26.5	25.5	-	46.8	59.8	21.8	-	58.3	34.5	-	-
	Sultana S et al., [18] Hyderabad, Telangana, India	-	00	-	-	-	-	100	-	100	-	-
	Present study, Ujjain, Madhya Pradesh, India	29	-	59	29	71	53	82	88	12	29	47
P.aeruginosa	Vishalakshi B et al., [6] Ballari, Karnataka	-	65	-	-	100	65	65	-	65	-	-
	Sharma R and Anuradha ND [16] New Delhi, India	-	-	-	95	100	85	100	-	76	-	63
	Harshika YK et al., [13] Hubli, Karnataka India	-	-	-	92	76	50	96		50		50
	Vijaya durga S and Anuradha B, [17] Telangana, India	60	55	-	90	75	68	98	-	65	-	-
	Madigubba H et al., [14] Puducherri, Karnataka, India	-	-	-	64.3	59.6	19.8	-	63.1	62.2	-	-
	Sultana S et al., [18] Hyderabad, Telangana, India	-	-	-	-	-	-	100	-	50	-	-
	Present study, Ujjain, Madhya Pradesh, India	-	-	47	75	75	47	60	80	55	40	45

[Table/Fig-8]: Antimicrobial susceptibility pattern of gram negative isolates (%) included studies [6,13,14,16-18].
CTR: Ceftriaxone; CTX: Cefotaxime; AMC: Amoxyclav; PTZ: Piperacillin /Tazobactam; AK: Amikacin; GEN: Gentamycin; IMP: Imipenem; MRP: Meropenem; CIP: Ciprofloxacin; COT: Cotrimoxazole; AT: Aztreonam

In the present study, MRSA isolation were 4(6.3%), all the isolates were sensitive to Vancomycin, Linezolide, Teicoplanin and Levofloxacin. Susceptibility pattern of the antibiotics were similar but isolation rate of MRSA was 27% in Mediguppa's study, which was higher than finding in the present study [14].

Limitation(s)

This was a single institute based study, to make more convenient for clinicians and fabricating of effective antimicrobial policy additional data is needed. It is important to perform research work by collaboration of more than one institute.

CONCLUSION(S)

Significant number of both gram negative and gram positive microorganism isolated among various body fluids. *P.aeruginosa* was the commonest pathogen isolated in the present study. AMR is higher among various isolates. Over use and misuse of antimicrobials, lack of awareness of antimicrobial use, non following of infection prevention practices are the common reasons of emergence of AMR. Hence, surveillance of bacteriological profile and antibiotic susceptibility pattern of isolates from body fluids is an essential part for the selection of the most appropriate empiric antibiotic regimen which helps the clinicians to treat effectively and thus prevent morbidity and mortality associated with these infections.

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