Original Research Article

Prevalence of pathogenic bacteria and their antibiotic resistance pattern in wound infections in a tertiary care hospital in south Trivandrum district, Kerala, India

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Abstract

Background: The ever-increasing multi drug resistant strains of pathogenic bacteria isolated from wound infections, makes it difficult in treating them for clinicians. To evaluate, and hence to elucidate proper treatment, we have undertaken this retrospective study in the southern part of Trivandrum district, Kerala, India. Out of the total 276 cases of wound infections from whom pus samples were collected and subjected to aerobic culture, 200 cases were culture positive (72.5%). Out of which 48 cases yielded more than 1 pathogen, up to 3. As a result total number of isolates was 250. The major pathogenic bacteria isolated were, Staphylococcus aureus (24.8%), Klebsiella spp (18%), Escherichia coli (15.2%), Pseudomonas spp (15.2%), Proteus spp (6.8%), Enterococcus spp (6.4%). Other less isolated species were Acinetobacter, Citrobacter, Enterobacter species, Streptococcus pyogenes, coagulase negative staphylococcus (CONS) and one fungal agent Candida spp. Out of the 62 Staphylococcus aureus strains isolated, 16.1% were methicillin resistant Staphylococcus aureus (MRSA). Among 60 Klebsiella species isolated, 25% were multi drug resistant (MDR) strains. Two strains of Pseudomonas species and 1 of Escherichia coli were also MDR. Among MSSA, 65.4% of the strains were resistant to Penicillin. On the other hand 100% of the strains were susceptible to Cloxacillin, Cefazolin, Cefuroxime, Linezolid and Vancomycin. Among MRSA, 100% resistance was noted against Cloxacillin, Ceforoxime, and Penicillin, with 100% sensitivity to Linezolid and Vancomicin. Of the 16 Enterococcus species isolated, 75% of the strains were resistant to Cotrimoxazole, followed by Ceftriaxone (68.8%) and Clindamycin (62.5%). Hundred % susceptibility was recorded against Chloramphenicol, Linezolid and Vancomycin. All the strains of Klebsiella isolated were intrinsically resistant to Ampicillin with appreciable resistance (64-71%) to cephalosporins, Cotrimoxazole, Amoxyclave and Cefaperazone/sulbactam. Escherichia coli isolates also shown similar pattern of reisistance. The resistance pattern of other strains are depicted under results.
Key words: MDR, MRSA, Klebsiella species, CONS, wound infection, Pseudomonas, Proteus species, Trivandrum district.

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INTRODUCTION

Wound infections are caused by trauma, surgical site infections, burn infections or diabetic ulcers. Surgical site infections are a major concern in hospitals, causing prolonged stay, treatment cost and in few cases enormous morbidity and mortality.[1] Wound infections are typically polymicrobial, harbouring both aerobic and anaerobic bacteria.[2] The most common agents are Staphylococcus aureus, Klebsiella species, Pseudomonas species, Escherichia coli, Proteus and Entrococcus.[3,4] A complex

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interplay between host, microbial and surgical factors ultimately determines the prevention or establishment of a wound infection[5]. Emergence of resistant strains has increased the morbidity and mortality associated with wound infections. MRSA, multi drug resistant enterobacteriaceae strains and MDR Pseudomonas spp accounting for nosocomial infections are the major resistant bacterial species causing substantial morbidity, especially among immunocompromised cases.[6] These strains jeopardise the selection of appropriate treatment.[7] There are few reports of this nature from India.[8] We have already published a work on Pseudomonas species resistance pattern in wound infections from the same centre.[9] With all these aspects in mind, we have undertaken this work, so as to know the resistance pattern of all the probable pathogens from wound infections in and around south of Trivandrum district, Kerala, India.

MATERIALS AND METHODS

The work was carried out in the department of Microbiology, Dr Somervell Memorial CSI Medical College and Hospital, Karakonam, Trivandrum district, Kerala, India, between 9-1-2020 and 25-4-2020, as a retrospective study. Pus swabs in sterile test tubes as duplicates, discharges in sterile disposable containers or aspirates with pre-sterilised disposable syringe and needles, after proper disinfection, were sent to microbiology diagnostic laboratory for further processing. A total of 276 cases of various wound infections were included for this study. All specimens were processed within 1hr of collection and were subjected to gram stain and graded for pus cells as, occasional (≤1/OIF), few (1-5/OIF), moderate (5-10/OIF) and numerous (>10/OIF). Simultaneously, culture was performed in liquid media like, thioglycolate and brain heart infusion broths and also on blood agar and macConkey agar, purchased from HiMedia, Mumbai. The isolates were identified based on gram stain, colony morphology and biochemical characterisation, as per the standard procedures.[10] Out of the total 276 cases studied, 200 (72.5%) gave positive cultures. Total number of isolates were 250, as 48 cases yielded more than 1 isolate up to 3. The pathogens isolated were, Staphylococcus aureus, Streptococcus pyogenes, Enterococcus spp, CONS, Candida spp, Escherichia coli, Klebsiella spp, Pseudomonas spp, Acinetobacter spp, Enterobacter spp and Citrobacter spp (Table 4,5). All the 250 isolates were subjected to antibiotic susceptibility testing by Kirby-Bauer disc diffusion method in Mueller - Hinton agar, except Candida spp, based on CLSI guidelines. ATCC strains one each of the isolates were employed as quality control.[11] The antibiotic discs used were, Amikacin (30 mcg), Amoxycillin-clavulanic acid (30 mcg), Ampicillin (10 mcg), Ceftriaxone (30 mcg), Ceftazidime (30 mcg), Cefoperazone/sulbactam (70/30 mcg), Cefixime (30 mcg), Cephotaxime (30 mcg), Cefuroxime (30 mcg), Cefazolin (30 mcg), Chloramphenicol (30 mcg), Ciprofloxacin (5 mcg), Clindamycin 92 mcg), Cloxacillin (5 mcg), Cotrimoxazole (25 mcg), Erythromycin (15 mcg), Gentamicin (10 mcg), High level gentamicin (120 mcg), Linezolid (10 mcg), Meropenem (10 mcg), Penicillin G (10 units), Piperacillin (30 mcg), Piperacillin/tazobactam (100/10 mcg), Rifampicin (5 mcg), Tobramycin (10 mcg) and Vancomycin (30 mcg), procured from HiMedia, Mumbai. The zone of inhibition was measured in milli-metres to ascertain, whether a particular isolate was resistant or sensitive to an antibiotic, by interpreting from the chart provided by the disc manufacturer (HiMedia, Mumbai).

OBSERVATIONS AND RESULTS

Out of the 200 culture positive cases of various wound infections, 21 (10.5%) were culture positive among new born (<1 year old), 85 (42.5%) in male and 94 (47%) cases in female (Table-1). Age group of >60 years showed the highest prevalence of culture positive cases, 55 (27.5%), followed by 41-50 years category, 49 (24.5%) and 51-60 years, 42 (21%) cases (Table-2). Inpatients, 104 (52%), outnumbered the outpatients, among culture positive cases (Table-3). Out of the total 250 isolates made, methicillin sensitive Staphylococcus aureus (MSSA) were the most predominant, 52 (20.8%), organisms among the gram-positive organisms, followed by Enterococcus spp, 16 (6.4%), methicillin resistant Staphylococcus aureus (MRSA), 10 (4%) and Streptococcus pyogenes, 8 (3.2%), in that order (Table-4). Among the gram-negative bacilli, Klebsiella spp, 45 (18%), showed highest prevalence, followed by Escherichia coli and Pseudominas spp, 38 (15.2%) and Proteus spp, 17 (6.8%), (Table-5).

Table 1: Sex-wise distribution of culture positive cases (n=200)

Number of culture positive cases	New born	Male	Female
	21 (10.5%)	85 (42.5%)	94 (47%)

Table 2: Age wise distribution of culture positive cases (n=200)

Number of culture positive cases	<1	1-10	11-20	21-30	31-40	41-50	51-60	>60
	22 (11%)	3 (1.5%)	4 (2%)	7 (3.5%)	18 (9%)	49 (24.5%)	42 (21%)	55 (27.5%)

Table 3: Inpatient and outpatient distribution of culture positive cases (n=200)

Number of culture positive cases	Inpatient	Outpatient
	104 (52%)	96 (48%)

Table 4: Prevalence rate of gram-positive organisms among total isolates (n=250)

Organism	*Staphylococcus aureus*		*Streptococcus pyogenes*	*Enterococcus spp.*	*CONS*	*Candida spp*
Number of isolates	MRSA 10 (4%)	MSSA 52(20.8%)	8 (3.2%)	16 (6.4%)	4 (1.6%)	3 (1.2%)

Table 5: Prevalence of gram-negative bacilli among total isolates (n=250)

Organism	Escherichia coli	Klebsiella spp.	Pseudomonas spp.	Proteus spp.	Acinetoba-cter spp.	Entero-bacter spp.	*Citrobacter* spp.
Number of isolates	38 (15.2%)	45 (18%)	38 (15.2%)	17 (6.8%)	8 (3.2%)	5 (2%)	6 (2.4%)

Among MSSA isolates, highest level of resistance was recorded against Penicillin (65.4%), followed by Erythromycin (34.6%). Incidentally 100% of the strains were sensitive to Cloxacillin, Cefazolin, Cefuroxime, Linezolid and Vancomycin (Table-6, Figure-1). Of the 10 MRSA, 100% of the strains were resistant to Cloxacillin, Cefuroxime and Penicillin, followed by Cefazolin and Erythromycin showing 70% resistance (Table-7, Figure-2). The susceptibility pattern of coagulase negative Staphylococci (Table-8) and Streptococcus pyogenes (Table-9) are tabulated. Among Enterococcus spp, 75% of the strains were resistant to Cotrimoxazole, followed by Ceftriaxone (68.8%), Clindamycin (62.5%), Erythromycin and high-level gentamicin (50%) in that order. 100% of the strains were sensitive to Chloramphenicol, Linezolid and Vancomycin (Table-10, Figure-3).

Table 6: Antibiotic susceptibility pattern of *Staphylococcus aureus* (MSSA) n=52

Antibiotic	Number of isolates	% of isolates
Cotrimoxazole S	**44**	**84.6**
R	**8**	**15.4**
Cloxacillin S	**52**	**100**
R	**0**	**0**
Clindamycin S	**42**	**80.7**
R	**10**	**19.3**
Cefazolin S	**52**	**100**
R	**0**	**0**
Cefuroxime S	**52**	**100**
R	**0**	**0**
Erythromycin S	**34**	**65.4**
R	**18**	**34.6**
Gentamicin S	**47**	**90.4**
R	**5**	**9.6**
Linezolid S	**52**	**100**
R	**0**	**0**
Penicillin S	**18**	**34.6**
R	**34**	**65.4**
Rifampicin S	**45**	**86.5**
R	**7**	**13.5**
Vancomycin S	**52**	**100**
R	**0**	**0**

Table 7: Antibiotic susceptibility pattern of MRSA (n-10)

Antibiotic	Number of isolates	% of isolates
Cotrimoxazole S	**8**	**80**
R	**2**	**20**
Cloxacillin S	**0**	**0**
R	**10**	**100**
Clindamycin S	**6**	**60**
R	**4**	**40**

Cefazolin S	3	30
R	7	70
Cefuroxime S	0	0
R	10	100
Erythromycin S	3	30
R	7	70
Gentamicin S	8	80
R	2	20
Linezolid S	10	100
R	0	0
Penicillin S	0	0
R	10	100
Rifampicin S	8	80
R	2	20
Vancomycin S	10	100
R	0	0

Table 8: Antibiotic susceptibility pattern of CONS (n=4)

Antibiotic	Number of isolates
Cotrimoxazole S	3
R	1
Cloxacillin S	3
R	1
Clindamycin S	4
R	0
Cefazolin S	2
R	2
Cefuroxime S	3
R	1
Gentamicin S	3
R	1
Linezolid S	4
R	0
Penicillin S	2
R	2
Rifampicin S	4
R	0
Vancomycin S	4
R	0

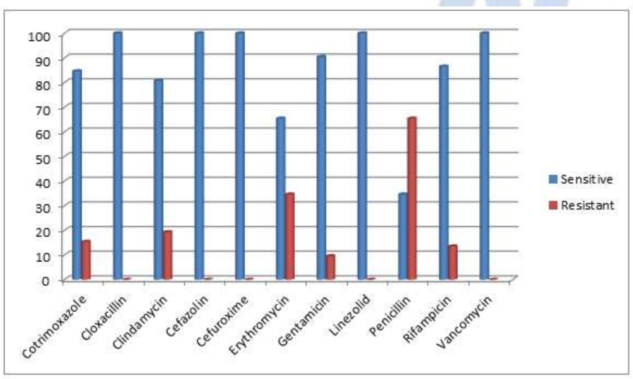
Table 9: Antibiotic susceptibility pattern of *Streptococcus pyogenes* (n=8)

Antibiotic	Number of isolates
Ampicillin S	8
R	0
Chloramphenicol S	7
R	1
Cotrimoxazole S	7
R	1
Clindamycin S	8
R	0
Ceftriaxone S	8
R	0
Erythromycin S	8
R	0
Gentamicin S	7
R	1
Linezolid S	8
R	0

Penicillin S	**7**
R	**1**
Vancomycin S	**7**
R	**1**

Table 10: Antibiotic susceptibility pattern of *Enterococcus spp* (n=16)

Antibiotic	Number of isolates	% of isolates
Ampicillin S	**12**	**75**
R	**4**	**25**
Chloramphenicol S	**16**	**100**
R	**0**	**0**
Cotrimoxazole S	**4**	**25**
R	**12**	**75**
Clindamycin S	**6**	**37.5**
R	**10**	**62.5**
Ceftriaxone S	**5**	**31.2**
R	**11**	**68.8**
Erythromycin S	**8**	**50**
R	**8**	**50**
Gentamicin S	**10**	**62.5**
R	**6**	**37.5**
High level gentamicin S	**8**	**50**
R	**8**	**50**
Linezolid S	**16**	**100**
R	**0**	**0**
Penicillin S	**13**	**81.2**
R	**3**	**18.8**
Vancomycin S	**16**	**100**
R	**0**	**0**



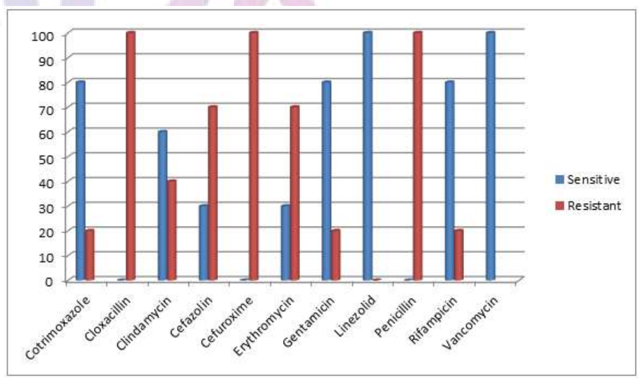


Figure 1 **Figure 2**

Figure 1: Antibiotic susceptibility pattern of *Staphylococcus aureus* (MSSA) isolates in %, (n=52); **Figure 2:** Antibiotic susceptibility pattern of MRSA isolates in % (n=10)

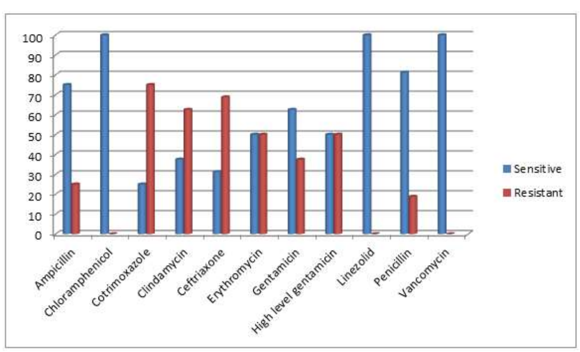


Figure 3: Antibiotic susceptibility pattern of *Enterococcus spp* isolates in % (n=16)

Of the total 45 Klebsiella spp isolates (excluding 15 MDR strains), all the strains (100%)were resistant for Ampicillin, followed by Cefixime (71.1%), Amoxyclave, Ceftriaxone (68.9% each), Cefoperazone/sulbactam and Cefuroxime (64.4% each), (Table-11, Figure 4). Among the total of 38 Escherichia coli isolates, the highest % of resistance (89.5%) was against Ampicilln, followed by Amoxyclave and Cefuroxime (73.7%). Most strains are susceptible to Meropenem (97.4%), followed by Amikacin (94.7%), Piperacillin/tazobactam (89.5%) and Cefoperazone/sulbactam (78.9%)(Table-12, Figure-5). Of 38 Pseudomonas spp isolates, 81.6% of the strains were resistant to Cotrimoxazole, followed by Piperacillin (47.4%). 89.5% of the isolates were susceptible to Piperacillin/tazobactam, followed by netilmycin, Meropenem and Ceftazidime (78.9% each), (Table-13, Figure-6). A maximum of 11 isolates (64.7%) out of the total of 17 of Proteus spp, were resistant to Ampicillin. Against other drugs, resistance level was very less. 100% of the strains were sensitive to Piperacillin/tazobactam and Meropenem, followed by Cefoperazone/sulbactam and Gentamicin (88.2%), (Table-14, Figure-7). The sensitivity pattern of Acinetobacter spp, Citrobacter spp. And Enterobacter spp are depicted in Table-15. Klebsiella spp showed a maximum of 15 MDR strains, followed by 2 in Pseudomonas spp and 1 in Escherichia coli.

Table 11: Antibiotic susceptibility pattern of *Klebsiella spp* (n=45)

Antibiotic	Number of isolates	% of isolates
Amikacin S	**28**	**62.2**
R	**17**	**37.8**
Amoxycillin/Clavulanic acid S	**14**	**31.1**
R	**31**	**68.9**
Ampicillin S	**0**	**0**
R	**45**	**100**
Cefixime S	**13**	**28.9**
R	**32**	**71.1**
Cefoperazone/sulbactam S	**16**	**35.6**
R	**29**	**64.4**
Ciprofloxacin S	**20**	**44.5**
R	**25**	**55.5**
Cotrimoxazole S	**15**	**33.3**
R	**30**	**66.7**
Ceftriaxone S	**14**	**31.1**
R	**31**	**68.9**
Cefuroxime S	**16**	**35.6**
R	**29**	**64.4**
Gentamicin S	**23**	**51.1**
R	**22**	**48.9**
Meropenem S	**27**	**60**
R	**18**	**40**
Piperacillin/tazobactam S	**25**	**55.5**
R	**20**	**44.5**

Table 12: Antibiotic susceptibility pattern of *Escherichia coli* (n=38)

Antibiotic	Number of isolates	% of isolates
Amikacin S	**36**	**94.7**
R	**2**	**5.3**
Amoxycillin/clavulanic acid S	**10**	**26.3**
R	**28**	**73.7**
Ampicillin S	**4**	**10.5**
R	**34**	**89.5**
Cefixime S	**13**	**34.2**
R	**25**	**65.8**
Cefoperazone/sulbactam S	**30**	**78.9**
R	**8**	**21.1**
Ciprofloxacin S	**20**	**52.6**
R	**18**	**47.4**
Cotrimoxazole S	**17**	**44.7**
R	**21**	**55.3**
Ceftriaxone S	**14**	**36.8**

R	24	63.2
Cefuroxime S	10	26.3
R	28	73.7
Gentamicin S	25	65.8
R	13	34.2
Meropenem S	37	97.4
R	1	2.6
Piperacillin/tazobactam S	34	89.5
R	4	10.5

Table 13: Antibiotic susceptibility pattern of *Pseudomonas spp*. (n=38)

Antibiotic	Number of isolates	% of isolates
Amikacin S	28	73.7
R	10	26.3
Ceftazidime S	30	78.9
R	8	21.1
Cefoperazone/sulbactam S	30	78.9
R	8	21.1
Ciprofloxacin S	25	65.8
R	13	34.2
Cotrimoxazole S	7	18.4
R	31	81.6
Gentamicin S	28	73.7
R	10	26.3
Meropenem S	30	78.9
R	8	21.1
Piperacillin S	20	52.6
R	18	47.4
Piperacillin/tazobactam S	34	89.5
R	4	10.5
Tobramycin S	26	68.4
R	12	31.6
Netilmicin S	30	78.9
R	8	21.1

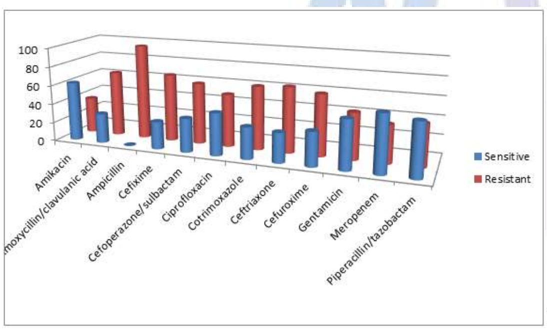
Table 14: Antibiotic susceptibility pattern of *Proteus spp*. (n=17)

Antibiotic	Number of isolates	% of isolates
Amikacin S	14	82.4
R	3	17.6
Amoxycillin/clavulanic acid S	11	64.7
R	6	35.3
Ampicillin S	6	35.3
R	11	64.7
Cefixime S	12	70.6
R	5	29.4
Cefoperazone/sulbactam S	15	88.2
R	2	11.8
Ciprofloxacin S	12	70.6
R	5	29.4
Cotrimoxazole S	11	64.7
R	6	35.3
Ceftriaxone S	12	70.6
R	5	29.4
Cefuroxime S	9	52.9
R	8	47.1
Gentamicin S	15	88.2
R	2	11.8
Meropenem S	17	100

R	**0**	**0**
Piperacillin/tazobactam S	**17**	**100**
R	**0**	**0**

Table 15: Antibiotic susceptibility pattern of Acinetobacter, Citrobacter and Enterobacter spp. (Acinetobacter n=8, Citrobacter n=6 and Enterobacter n=5)Number of isolates

Antibiotic	Acinetobacter	Citrobacter	Enterobacter
Amikacin S	**5**	**6**	**5**
R	**3**	**0**	**0**
Amoxycillin/clavulanic acid S	**1**	**2**	**0**
R	**7**	**4**	**5**
Ampicillin S	**0**	**0**	**0**
R	**8**	**6**	**5**
Cefixime S	**0**	**3**	**4**
R	**8**	**3**	**1**
Cefoperazone/sulbactam S	**4**	**6**	**5**
R	**4**	**0**	**0**
Ciprofloxacin S	**4**	**4**	**4**
R	**4**	**2**	**1**
Cotrimoxazole S	**2**	**4**	**5**
R	**6**	**2**	**0**
Cefuroxime S	**1**	**3**	**4**
R	**7**	**3**	**1**
Gentamicin S	**4**	**3**	**5**
R	**4**	**3**	**0**
Meropenem S	**7**	**6**	**5**
R	**1**	**0**	**0**
Piperacillin/tazobactam S	**4**	**5**	**5**
R	**4**	**1**	**0**



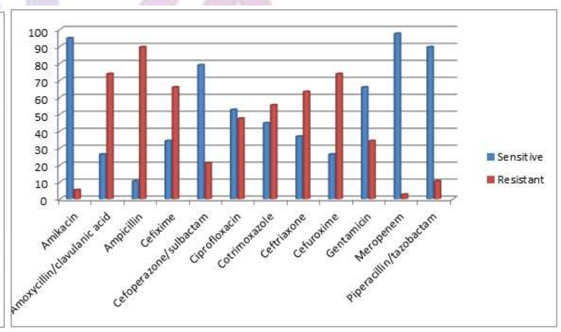
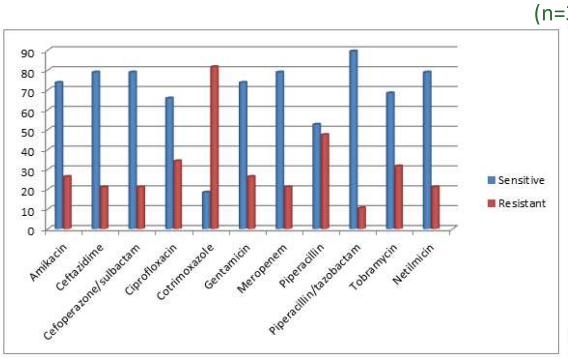


Figure 4 **Figure 5**

Figure 4: Antibiotic susceptibility pattern of *Klebsiella spp* isolates in % (n=45); **Figure 5:** Antibiotic susceptibility pattern of *Escherichia coli* (n=38)



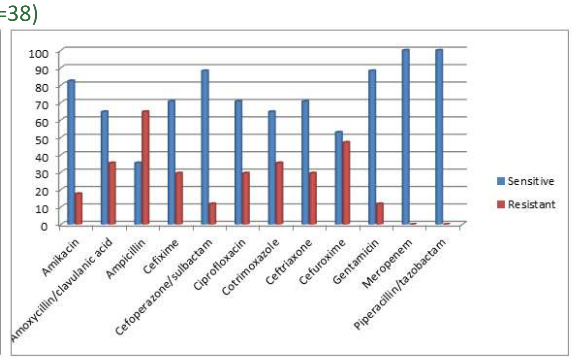


Figure 6 **Figure 7**

Figure 6: Antibiotic susceptibility pattern of *Pseudomonas spp* in % (n=38); **Figure 7:** Antibiotic susceptibility pattern of *Proteus spp* in % (n=17)

DISCUSSION

Our study showing 72.5% isolation rate was in correlation with a study in Bengaluru, wherein 79.5% was the isolation rate.[12] Also in another study in Tamil Nadu, 100% of the samples were culture positive.[13] Rate of recovery was also higher (83%) in another study in Bayelsa, Nigeria and also few other studies.[14,15,16,17,18] In our study, female patients accounted for 47% of the total culture positive cases, as compared to male, which was 42.5%. New borns (<1 year) accounted for 10.5%. But in another study in Nepal, male culture positive cases were more (46.5%) than that of female (36.1%)[19]. In our study maximum culture positive cases was recorded in the age group of >60 (27.5%), followed by 41-50 group (24.5%). But in another study from Kanchipuram, Tamil Nadu, 41-50 age group showed highest rate of culture positivity (31.1%).[20] Inpatients reported more culture positive cases (52%), as compared to outpatients (48%), in our study. This was in correlation with the observations of Mahat *et al.*, who recorded 53% culture positivity in inpatients, out of the total culture positive cases.[19] Staphylococcus aureus was the predominant isolate (24.8%) in our study. In this 20.8% of the isolates were MSSA and 4% MRSA. This was in correlation with another study by Roopashree *et al.*,[12] who depicted 31.25% isolation rate of Staphylococcus aureus, highest among the isolates. Sawdekar *et al.* also reported predominance of Staphylococcus aureus.[21] The second most predominant isolate was Klebsiella spp (24%), followed by Escherichia coli and Pseudomonas spp (15.2%). A matter of concern was the recording of 10 MRSA, 15 MDR strains of Klebsiella spp, 2 of Pseudomonas spp and 1 MDR in Escherichia coli, which prompts to conduct isolation and resistance pattern studies of such strains against antibiotics, at regular intervals. The resistance pattern of MRSA strains recorded in our study varies from a study in Nepal,[22] but the sensitivity of such strains to Linezolid and Vancomycin more or less correlates with them. The increasing number of MRSA developing drug resistance in recent times is evident from our study. Not much of resistance was recorded in MSSA strains. The percentage of strains showing resistance to Erythromycin of 34.6% varies from Bidhya Maharjan *et al.*, who reported 55% resistance.[22] The sensitivity pattern of these strains, especially to Linezolid and Vancomycin correlates with other reports, Nirmala *et al.*,[23] Khan [24] *et al.* Enterococcus spp isolates showing resistance to high level gentamicin correlates with the study of Roopashree *et al.*, who reported majority of the strains being resistant, but the 100% sensitivity to Linezolid is same as our study.[12] Rampant MDR strains among Klebsiella spp were mostly resistant to aminoglycosides, cephalosporins and even carbapenem drugs, for which detection of ESBL, AmpC or MBL genes is required, as a future study. In another study from China, 60% of the Klebsiella spp isolates were resistant to cotrimoxazole.[25] Among Escherichia coli isolates, high level of resistance was recorded against Ampicillin, Amoxyclav, Cefuroxime and Cefixime. 97.4% of the strains were sensitive to Meropenem, 94.7% sensitive to Amikacin and 89.5% strains sensitive to Piperacillin/tazobactam. In another study from Ahmedabad, 92.14% of the Escherichia coli isolates were resistant to Ciprofloxacin. They recorded increased level of reisistance of 23.5% and 28% of strains against Imipenem and Amikacin,[26] respectively, which was only 2.6% and 5.3% correspondingly, in our study. Mahmood *et al.*[27] also documented similar results as the Ahmedabad study. In pseudomonas isolates higher level of resistance was recorded against Cotrimoxazole, Piperacillin and Ciprofloxacin. In another study in Kanchipuram, Tamil Nadu,[28] the level of resistance recorded against Ciprofloxacin and Piperacillin was more than our study. In another study published by us earlier,[9] we found less resistance to Piperacillin and higher resistance to Ciprofloxacin compared to the present work. Among the proteus isolates, higher level of resistance was recorded against Ampicillin and Cefuroxime, with 100% strains sensitive to Meropenem and Piperacillin/tazobactam. In another study in Quetta, Pakistan,[29] the authors showed increase in % of strains resistant to Ampicillin and Cefuroxime compared to our study. Surprisingly, they showed that 96.8% of the strains resistant to Imipenem, may be attributed to inappropriate treatment. 100% of the strains were sensitive to Ciprofloxacin and Gentamicin in another study from Nigeria.[30] Other less isolated species were coagulase negative staphylococcus, Streptococcus pyogenes, Acinetobacter spp, Enterobacter, Citrobacter spp, whose sensitivity patterns were tabulated under results.

CONCLUSION

Our study revealed the presence of 10 methycillin resistant Staphylococcus aureus (MRSA) strains, out of the total 62 S. aureus isolates. These strains were resistant to most of the antibiotics used, Linezolid and Vancomycin and to some extend to Gentamicin and Rifampicin (80% sensitive). Nowadays Vancomycin resistant Staphylococcus aureus (VRSA) were also reported in some studies. Among 60 Klebsiella isolates, 15 were multi-drug resistant, strains, resistant to all the antibiotics used. Among Escherichia coli and Pseudomonas isolates also 1 or 2 MDR were recorded in our study, which required further studies to include more number of isolates, to have a clear idea of the prevalence of these MDR strains. With all these indications, more and more studies are required at regular intervals to assess the antibiotic resistance pattern exhibited by pathogenic gram positive and gram-negative organisms in wound infections. This will help in formulating appropriate antibiotic treatment for various infections, including wound infections, both community and hospital acquired.

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