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Drug Resistance in an Organisms of Diabetic Foot Patients attending Tertiary Care Hospital in Kulasekharam

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A B S T R A C T

Diabetes mellitus is a metabolic disorder characterised by chronic glycemia[1] Twenty five percent diabetic patients have a risk of developing foot ulcer and limp amputation was 15-45%higher than non diabetic ulcer[2]. Aims are to determine the antibiotic resistance pattern of diabetic foot isolates. A total of 75 specimens (pus, swab, aspirated pus, debridement tissue) were collected from diabetic ulcer patients and the specimens processed by manually. Majority of patients (80%) were in the age group of 51to70 years. The aerobic pathogens isolated were predominantely gram negative (79) and gram positive (28) bacteria. Of these 107, 70 gram negative bacilli and 20 gram positive cocci were isolated in the age group between 51 to 70 years. Of 70 gram negative bacilli *Pseudomonas* species was the predominant, among the gram positive cocci *Staphylococcus aureus* was predominant. In most of the infections in the age group between 51 to 70 years, it was polymicrobial. The antibiogram of the isolates showed that most of the Pseudomonas species was resistant to 3rd generation cephalosporins (74%), quinolones (76.9%). *Klebsiella* species 100% resistant to amoxicillin and majority of them also resistant to 3rd generation cephalosporins, *E. coli* showed high amount of resistance to amoxicillin, cefotoxime, piperacillin. *Citrobacter* species showed 100% resistant to amoxicillin, cefuroxime, cephalexin. *Acinetobacter* species showed 100% resistant to amoxicillin, 3rd generation cephalosporins, meropenem, ciprofloxacin, gentamicin. *Staphlococcus aureus* 100% sensitivity to vancomycin, chloramphenicol, novobiocin.

Introduction

Diabetes mellitus is a metabolic disorder characterised by chronic hyperglycemia and about 150- 170 million people are suffering worldwide from this diseases, as per WHO reports the prevalence of diabetes will be double by 2025. Diabetes mellitus is a worldwide phenomenon, type 2 diabetes is the most common form of diabetes in developing countries like India, hence called diabetic capital of the world. In India prevalence of diabetes in rural population is about 2.4 %, and in urban population is about 4-11.6 %. Complications of diabetes mellitus are peripheral vascular disease, cardiovascular disease, nephropathy, retinopathy, neurological and infections. Uncontrolled

hyperglycemia, atherosclerotic vascular disease, sensory neuropathy are the most important risk factors developing diabetic foot ulcer.[1]

Twenty five percent diabetic patients have a risk of developing foot ulcer and limp amputation was 15- 45% higher than non diabetic ulcer.[2]

Pathogenesis

For development of diabetic foot ulcer, the most important risk factors are peripheral neuropathy and impaired blood circulation from peripheral vascular disease.[3, 4, 5] In diabetes mellitus patients, one of the major complications is diabetic ulcer. Fifteen percent diabetes mellitus patients develop diabetic foot ulcer and leads to 84% of foot amputation.[6]

Neuropathy

Development of neuropathy is as a result of hyperglycemia induced metobolic disorder. The most important one is polyol pathway. Hyperglycemia state will favour aldose reductase and sorbitol dehydrogenase which will convert intracellular glucose to sorbitol and fructose and due to the accumulation of these sugar products leads to decrease in the synthesis of myoinositol, which is needed for normal neuron conduction. The conversion of glucose leads to depletion of nicotinamide adenine dinucleotide phosphate which is required for detoxification of reactive oxygen species and for synthesis of vasodilator nitric oxide. This leads to oxidative stress on nerve cells and increase vasoconstricton leads to ischaemia, which result will nerve cell injury and death. This also contributes to abnormal glycation of nerve cells and leads to inappropriate action of protein kinase C and leads to further nerve damage. In diabetic patients neuropathy develop in motor, sensory, autonomic components of nervous system. Imbalance between flexion and extension due to damage of innervatons of intrinsic foot muscles, leads to foot deformities that create abnormal bony prominence and pressure points, which favour for skin break down and ulceration.

Autonomic neuropathy leads to suppression of the function of sweat and oil gland. Foot loses natural function of the moisturising the skin and becomes dry which leads breakdown and gradually develop infection.

Sensory neuropathy wounds are unnoticed by the patients which worseness and exacerbates the development of ulcer.

Vascular disease

The persistent hyperglycemic state leads to endothelial cell dysfunction and smooth cell abnormalities in peripheral arteries which result in the decreases of endothelium derived vasodilator that leads to vasoconstriction. The diabetes hyperglycemic state leads to increase in thromboxane A2, a vasoconstrictor, platelet aggregation which promote the risk for hypercoagulability, and alteration in the vascular extra cellular matrix leads arterial lumen stenosis. The other factors like smoking, hypertension, hyperlipidemia contribute to the development of peripheral arterial disease.[3]

The present study was carried out to determine the aerobic bacterial isolates cultured from diabetic foot infections and their susceptibility to commonly used antibiotics.

Materials and Methods

The study was conducted in a tertiary care hospital at Kulasekharam from june 2014 to August 2015. The study was approved by the Institutional Ethical and Research committee.

A total of 75 specimens (pus, swabs, aspirated pus, debridement tissue) were collected from diabetic ulcer patients[7]. The samples were collected in dressing room for out patients and in wards for inpatient and then immediately transported to the laboratory and the specimens were processed without any delay by manually[8, 9, 10].

Phenotypic screening of ESBL detection with combination disk method (ceftazidime (30microgram) /ceftazidime (30microgram) and clavulinic acid (10 microgram) & cefotaxime (30microgrm)/ cefotaxime (30 microgram)/and clvulinic acid (10 microgram). [2, 11]

Inclusion criteria: Patient admitted with clinically diagnosed diabetes mellitus, supported by laboratory findings and presented with ulcer.

Exclusion criteria: Patient with ulcers, who are not diabetic proved by clinical or laboratory investigations & Gestational diabetes mellitus with ulcer.

Results and Discussion

The age group varied from 41 to 90 years. Majority of patients (80%) between 41to 70 years (Table 1). The predominant pathogens isolated were gram negative bacilli constituting 73.8% and gram positive cocci constituting 26, 2%. Among the gram negative bacilli *Pseudomonas* species was predominant having 36.2% incidence and among the gram positive cocci *Staphylococcus aureus* were the predominant pathogens accounting 42.8% (Fig. 1). *Pseudomonas* species shows resistant to cefotoxime (100%), ciprofloxacin (77%), gentamicin (72%), piperacillin (71%), ceftazidime (61%), cefoperazone (61%), meropenem (46%. Sensitivity to piperacillin/tazobactum (68%, netimicin (66%), amikacin (52%) (Table 2). *Klebsiella* species resistant to amoxicillin (100%), cefolexin (80%), ceftozidime (80%), cefotoxime (79%), cefuroxime (69%), cotrimoxazole (67%), ciprofloxacin (67%), gentamicin (50%). Sensitivity to meropenem (91%), netilmicin (79%), amikacin (69%), piperacillin (65%) (Table 2). *Proteus* species shows resistant to cefolexin (80%), amoxicillin (79%), cotrimoxazole (67%), cefotoxime (62%), cefoperazone (57%). sensitivity to piperacillin/tazobactum (87 %), meropenem (85%), piperacillin (64%), netilmicin (64%) (Table 3). *E. coli* was 89% resistant to amoxicillin, piperacillin, cefotoxime and cefolexin (78%), cefoperazone (71%), cefuroxime (67%), ciprofloxacin (67%), piperacillin/tazobactum (63%), cotrimoxazole (50%). Sensitivity to netilmicin (86%), amikacin (78%), meropenem (67%), gentamicin (67%) (Table 3). *Citrobacter* species was 100% resistant to amoxicillin, cefolexin, cefuroxime and cefotoxime (83%), ceftazidime (83%). sensitivity to netilmicin was (100%), cotrimoxazole (83%), amikacin (80%) meropenem (67%) (Table 4). *Enterobacter* species shows 100% sensitivity to amoxicillin, piperacillin/tazobactum, netilmicin, gentamicin, ciprofloxacin, cotrimoxazole, cefolexin, ceftazidime, cefuroxime, cefotoxime, cefoperazone, meropenem (Table 4). *Acinetobacter* species was 100% resistant to amoxicillin, piperacillin/tazobactum, piperacillin, ciprofloxacin, cefolexin, cefotoxime, cefuroxime, gentamicin, meropenem. Sensitivity to amikacin (40%) (Table 5). *Staphylococcus aureus* shows 100% sensitivity to vancomycin, novobiocin, chloramphenicol and clindamycin (92%), teicoplanin (90%), cefoxitin (83%), netilmicin (78%). Resistant to penicillin (91%), cotrimoxazole (81%) and erythromycin (69%). CONS was resistant to erythromycin (100%), penicillin (83%), cotrimoxazole (67%), ciprofloxacin (60%) and sensitivity to vancomycin, novobiocin and chloramphenicol

was 100% respectively, teicoplanin (80%), gentamicin (75%), netilmicin (60%) (Table 6). *Streptococcus pyogenes* shows 100% sensitivity to penicillin, netilmicin, cefuroxime, cefotoxime and amikacin (75%), ciprofloxacin (75%), tetracycline (66%) (Table 7). *Streptococcus* species shows 100% sensitivity to penicillin, amikacin, netilmicin, vancomycin, and 50% resistant to tetracycline, cotrimoxazole, ciprofloxacin.

Enterococcus species shows 100% sensitive to ciprofloxacin, cefotoxime, cefuroxime, vancomycin and 50% resistant to tetracycline, amikacin, netilmicin, cotrimoxazole (Table 8). Among the gram negative bacilli 67% of *E.coli*, 47% of *Klebsiella*, 17% of *Citrobacter* species, 15% of *Pseudomonas* species, 13% of *Proteus* species were ESBL producers (Table 9 and Fig. 2).

This study presents clinical and microbiological profile of Diabetic foot ulcers. About 150 to 170 million populations are suffering from diabetes mellitus worldwide.[1] In India nearly 40 million people are diabetics and their socioeconomic status is poor.

Diabetic foot infections are seen in 20% of the patients and hence are the most commonly faced clinical problem. Ulcers treated inappropriately may lead to amputation or disarticulation in varying levels atleast once in such patients' life time.[12]

This study was carried out at SMIMS, Kulasekharam from June 2014 to August 2015. Samples (swabs, aspirated pus, debrided tissue) from 75 patients of diabetic foot ulcer was collected after receiving written consent from the patient. Majority of patients (80%) were in the age group of 51 to 70 years. The aerobic pathogens isolated were predominantly gram negative (79) followed by gram positive (28) bacteria (Fig. 1). Of these 107, 70 gram negative bacilli and 20 gram positive cocci were isolated in the age group between 51 to 70 years.

Of 70 gram negative bacilli isolated in the age group of 51 to 70 years, *Pseudomonas* species was the predominant isolate followed by *Klebsiella* species, *Proteus* species, *E.coli*, *Citrobacter* species, *Acinetobacter* species and *Enterobacter* species.

Among the gram positive cocci organisms isolated in this age group (51 to 70years), *Staphylococcus aureus* was the predominant pathogen followed by coagulase negative Staphylococci, Streptococci pyogenes, other beta hemolytic Streptococci, *Streptococcus* species and only one Enterococcus species was isolated in this age group. A evidenced by Shanmugam.P *et al.,* Pappu.K *et al.,* also have shown the similar findings.[8, 13.]

In most of the infections in the age group between 51 to 70 years it was polymicrobial (31 cases), whereas monomicrobial etiology was seen in 27 cases. As also reported by Chopdekar *et al.,* 2011.[14] There was no growth in two clinical samples this could be due to the prior antibiotic therapy before coming to the hospital or could be anerobic organisms the isolation of which was not attempted in the study.

The antibiogram of the isolates showed that most of the *Pseudomonas* species was resistant to 3rd generation Cephalosporins (74%) followed by Quinolones (76.9%) (Table 2). Twenty five (68.4%) isolates were sensitive to Piperacillin/Tazobactam followed by Netilmicin (65.8%) and Meropenem (53.8%) Gentamicin (74%). Shanmugam *et al.,* (2013) in their study also have shown, *Pseudomonas* being 50% resistant to Gentamicin and Quinolones, 61% resistant to 3rd generation Cephalosporin but 100% resistant to Meropenem. But in our study resistant to Meropenem was 46.2%.

Table.1 Distribution of age

Age	Patients	Percentage
41 to 50	8	11
51 to 60	30	40
61 to 70	30	40
71 to 80	6	8
81 to 90	1	1

The age group varied from 41 to 90 years (Table 1)

Table.2 Antibiogram

	***PSEUDOMONAS* SP**			***KLEBSIELLA* SP**		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
PENICILLIN	-	-	-	-	-	-
AMOXYCILLIN	-	-	-	0.00%	0.00%	100%
TETRACYCLINE						
AMIKACIN	52.17%	8.69%	39.13%	69.23%	0.00%	30.76%
PIPERACILLIN/TAZOBACTUM	68.42%	0.00%	31.58%	42.85%	21.42%	35.71%
NETILMICIN	65.83%	15.38%	19.23%	78.57%	0.00%	21.43%
PIPERACILLIN	28.57%	0.00%	71.43%	6.66%	28.34%	65%
CIPROFLOXACIN	23.07%	0.00%	76.92%	25.25%	8.33%	66.66%
COTRIMOXAZOLE				33.33%	0.00%	66.67%
MEROPENEM	53.85%	0.00%	46.15%	90.91%	0.00%	9.09%
GENTAMYCIN	24%	4%	72%	50%	0.00%	50%
VANCOMYCIN	-	-	-			
CEFOLEXIN				20.00%	0.00%	80.00%
CEFUROXIME				23.08%	7.69%	69.23%
CEFOTOXIME	0.00%	0.00%	100.00%	21.43%	0.00%	78.57%
CEFOPERAZONE	30.7%	7.69%	61.5%	20%	13.33%	66.66%
CEFTAZIDIME	33.33%	5.56%	61.11%	20%	0.00%	80%

Seventy four percent of *Pseudomonas* species was resistant to 3rd generation Cephalosporins. (Table:2)

Table.3 Antibiogram

	PROTEUS SPECIES			*E.COLI*		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
PENICILLIN	-	-	-			
AMOXYCILLIN	21.42%	0.00%	78.57%	11%	0.00%	89.00%
TEICOPLANIN	-	-	-	-	-	-
CLINDAMYCIN	-	-	-	-	-	-
ERYTHROMYCIN	-	-	-	-	-	-
TETRACYCLINE	-	-	-			
AMIKACIN	64.28%	0.00%	35.71%	78%	0.00%	22%
PIPERACILLIN/TAZOBACTAM	86.66%	13.33%	0.00%	37.50%	0.00%	62.50%
NETILMICIN	63.63%	0.00%	36.36%	86%	0.00%	14%
PIPERACILLIN	63.64%	0.00%	36.36%	11%	0.00%	89%
CIPROFLOXACIN	40%	13%	47.00%	33%	0.00%	67%
COTRIMOXAZOLE	33%	0.00%	67%	50%	-	50%
MEROPENEM	84.62%	7.69%	7.69%	67%	11%	22%
GENTAMICIN	53%	0.00%	47%	67%	0.00%	33%
VANCOMYCIN	-	-	-	-	-	-
CEFOLEXIN	20%	0.00%	80%	22%	0.00%	78%
CEFUROXIME	27%	0.00%	73%	33%	0.00%	67%
CEFOTOXIME	30.77%	7.69%	61.54%	11%	0.00%	89%
CEFOPERAZONE	35.71%	7.14%	57.14%	29%	0.00%	71%
CEFTAZIDIME	53%	13.33%	33%	33%	0.00%	67%

shows *Proteus* species 87% sensitivity to Piperacillin/Tazobactam, 85% to Meropenem and *E.coli* shows 89% resistant to Amoxicillin, Piperacillin, Cefotoxime

Table.4 Antibiogram

	CITROBACTER SPECIES			*ENTEROBACTER* SPECIES		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
AMOXYCILLIN	0.00%	0.00%	100.00%	100.00%		
TETRACYCLINE						
AMIKACIN	80%	0.00%	20%			
PIPERACILLIN/TAZOBACTUM	17%	17%	67%	100.00%		
NETILMICIN	100%	0.00%	0.00%	100.00%		
PIPERACILLIN	20.00%	13%	67%	0.00%	100.00%	
CIPROFLOXACIN	50%	0.00%	50.00%	100.00%		
COTRIMOXAZOLE	83%	0.00%	17%	100.00%		
MEROPENEM	67%	0.00%	33%	100.00%		
GENTAMYCIN	25.00%	25.00%	50.00%	100.00%		
CEFOLEXIN	0.00%	0.00%	100.00%	100.00%		
CEFUROXIME	0.00%	0.00%	100.00%	100.00%		
CEFOTOXIME	0.00%	17%	83.00%	100.00%		
CEFOPERAZONE	17%	17%	67%	100.00%		
CEFTAZIDIME	17%	0.00%	83%	100.00%		

Table.4 shows *Citrobacter* and *Enterobacter* species shows 100% sensitivity to Netilmycin

Table.5 Antibiogram

	Acinetobacter SP		
	Sensitive	**Intermediate**	**Resistant**
PENICILLIN			
AMOXYCILLIN	0.00%	0.00%	100.00%
TEICOPLANIN	-	-	-
CLINDAMYCIN	-	-	-
ERYTHROMYCIN	-	-	-
TETRACYCLINE			
AMIKACIN	40.00%	0.00%	60.00%
PIPERACILLIN/TAZOBACTAM	0.00%	0.00%	100.00%
NETILMICIN	40.00%	0.00%	60.00%
PIPERACILLIN	0.00%	0.00%	100.00%
CIPROFLOXACIN	0.00%	0.00%	100.00%
COTRIMOXAZOLE	20.00%	40.00%	40.00%
MEROPENEM	0.00%	0.00%	100.00%
GENTAMICIN	0.00%	0.00%	100.00%
CEFOLEXIN	0.00%	0.00%	100.00%
CEFUROXIME	0.00%	0.00%	100.00%
CEFOTOXIME	0.00%	0.00%	100.00%
CEFOPERAZONE	0.00%	0.00%	100.00%
CEFTAZIDIME	0.00%	0.00%	100.00%

Table.5 *Acinetobacter* species 100% resistant to Amoxicillin, Piperacillin/Tazobactam, Piperacillin, Ciprofloxacin, Meropenem, Cefotoxime, Cefuroxime, Cefolexin, Gentamicin

Table.6 Antibiogram

	S. aureus			CONS		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
PENICILLIN	9.00%	0.00%	91.00%	0.00%	17.00%	83.00%
AMOXYCILLIN				-	-	-
TEICOPLANIN	90.00%	10.00%	0.00%	80.00%	0.00%	20.00%
CLINDAMYCIN	91.67%	0.00%	8.33%	60.00%	0.00%	40.00%
ERYTHROMYCIN	15.38%	15.38%	69.23%	0.00%	0.00%	100.00%
TETRACYCLINE	58.00%	17.00%	25.00%	50.00%	0.00%	50.00%
AMIKACIN	63%	25%	12.5%	50.00%	16.67%	33.33%
PIPERACILLIN/TAZOBACTAM						
NETILMICIN	78%	0.00%	22%	60.00%	0.00%	40.00%
PIPERACILLIN						
CIPROFLOXACIN	33%	0.00%	67%	40.00%	0.00%	60.00%
COTRIMOXAZOLE	19.00%	0.00%	81.00%	33.33%	0.00%	66.67%
MEROPENEM						
GENTAMICIN	40.00%	20.00%	40.00%	75.00%	0.00%	25.00%
VANCOMYCIN	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
NOVOBIOCIN	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
CHOLORAMPHENICOL	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
CEFOXITIN	83.33%	0.00%	16.67%	50.00%	0.00%	50.00%
CEFOTOXIME				-	-	-
CEFOPERAZONE						
CEFTAZIDIME						

Table.6 Eight one percentage of *Staphylococcus aureus* was resistant to cotrimaxozole in our study followed by Erythromycin (69%), Ciprofloxacin (67%), Gentamicin (40%)

Table.7 Antibiogram

	Streptococcus pyogenes			BETA - HEMOLYTIC *Streptococcus*		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
PENICILLIN	100.00%	0.00%	0.00%	100.00	0.00%	0.00%
AMOXYCILLIN				-	-	-
TEICOPLANIN	-	-	-	-	-	-
CLINDAMYCIN	-	-	-	-	-	-
ERYTHROMYCIN	-	-	-	-	-	-
TETRACYCLINE	66.67%	0.00%	33.33%	50.00%	0.00%	50.00%
AMIKACIN	75.00%	0.00%	25.00%	100.00%	0.00%	0.00%
PIPERACILLIN/TAZOBACTAM						
NETILMICIN	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
PIPERACILLIN						
CIPROFLOXACIN	75.00%	0.00%	25.00%	50.00%	0.00%	50.00%
COTRIMOXAZOLE						
MEROPENEM						
GENTAMYCIN						
CEFUROXIME	100%	0.00%	0.00%			
CEFOTOXIME	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%

Streptococcus pygenes and other beta hemolytic streptococci were 100% sensitive to penicillin (100%). However *Streptococcus pygenes* was also sensitive to Netilmicin, Cefotoxime and Cefuroxime (100%) as showed in Table:7

Table.8 Antibiogram

	***Enterococcus* sp**			***Streptococcus* SP**		
	Sensitive	**Intermediate**	**Resistant**	**Sensitive**	**Intermediate**	**Resistant**
PENICILLIN				100%		
AMOXYCILLIN	-	-	-			
TEICOPLANIN	-	-	-			
CLINDAMYCIN	-	-	-			
ERYTHROMYCIN	-	-	-			
TETRACYCLINE	50.00%	0.00%	50.00%	50.00%		50.00%
AMIKACIN	50.00%	0.00%	50.00%	100.00%		0.00%
PIPERACILLIN/TAZOBACTUM	-	-	-			
NETILMICIN	50.00%	0.00%	50.00%	100.00%	0.00%	0.00%
PIPERACILLIN	-	-	-			
CIPROFLOXACIN	100.00%	0.00%	0.00%	50.00%	0.00%	50.00%
COTRIMOXAZOLE	50.00%	0.00%	50.00%	50.00%	0.00%	50.00%
MEROPENEM	-	-	-			
GENTAMYCIN	-	-	-			
VANCOMYCIN	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
CEFUROXIME	100.00%	0.00%	0.00%			
CEFOTOXIME	100.00%	0.00%	0.00%			

Table.8 shows Enterococcus species 100% sensitive to ciprofloxacin, cefotoxime, cefuroxime and Vancomycin

Table.9 ESBL

***KLEBSIELLA* SP**	**47%**
E.COLI	**67%**
***PSEUDOMONAS* SP**	**15%**
***PROTEUS* SP**	**13%**
***CITROBACTER* SP**	**17%**

Table.9 shows *E. coli* was the dominant ESBL producer (67%)

Fig.1 List of organisms: The predominant pathogens isolated were gram negative bacilli constituting 73.8% and gram positive cocci constituting 26.2%. Among the gram negative bacilli *Pseudomonas* species was predominant having 36.2% incidence and among the gram positive cocci *Staphylococcus aureus* were the predominant pathogens accounting 42.8%

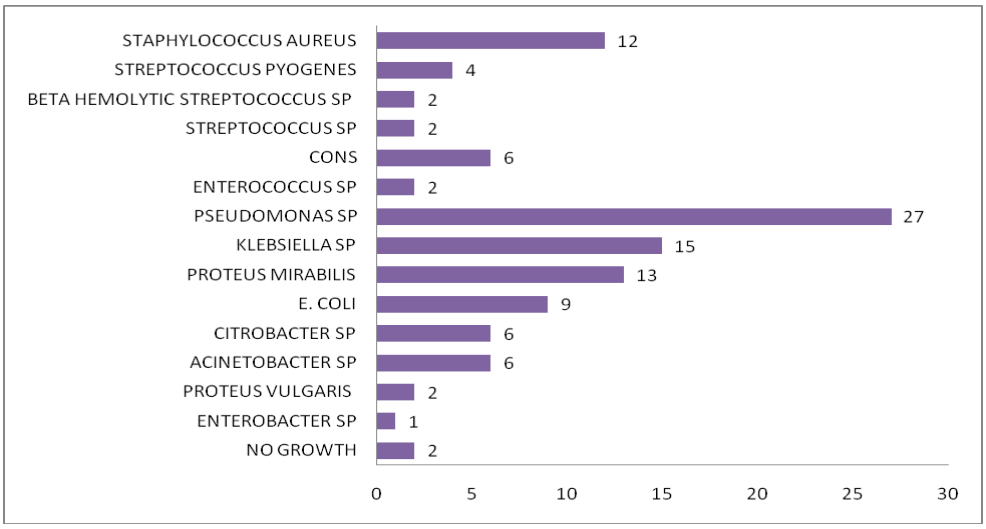
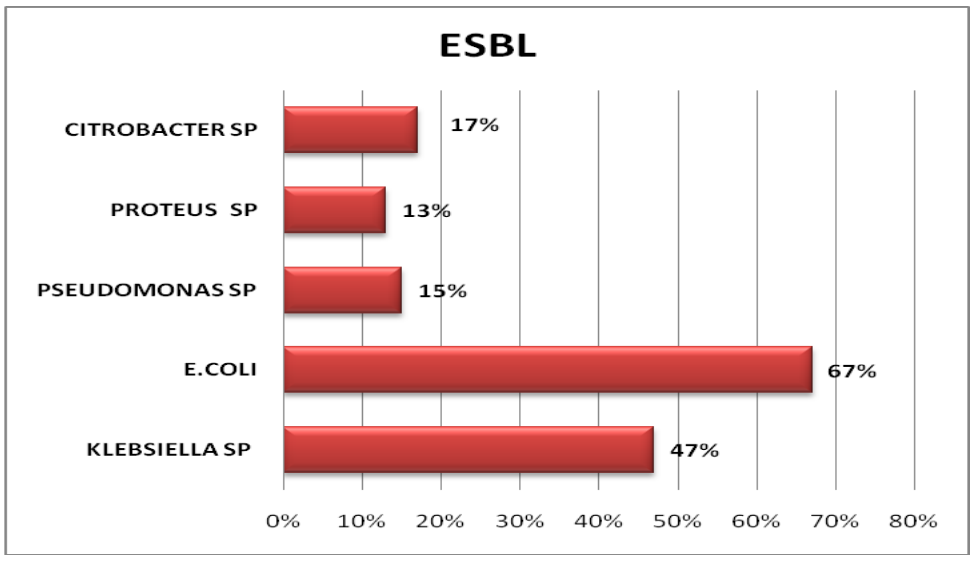


Fig.2 List of organisms Producing ESBL



It is surprising to note that high amount resistant to Meropenem which could be probably due to use of Carbapenems prescribed by general practitioners which must have resulted in developing resistance to Mereopenem before coming to our hospital.

Klebsiella isolates were 100% resistant to Amoxicillin. Majoritry of them were also resistant to 3rd generation Cephalosporin but 91% of the isolates were sensitive to Meropenem followed by Netilmicin (78.5%), Amikacin (69.2%), Gentamycin (50%). Majority of *Proteus* species showed sensitivity to Piperacillin/Tazabactam (86.7%) followed by Meropenem (84.6%). *E.coli* showed high amount of resistance to Amoxicillin, Cefotoxime, Piperacillin. However majority of orgainsms were sensitive to Netilmicin (86%), Amikacin (78%) followed by Gentamicin and Meropenem (67% each).

Citrobacter species showed 100% resistant to Amoyxicillin, Cefuroxime, Cephalexin.However they were 100% sensitive to Amikacin and Netilmicin.

Enterobacter species showed 100% sensitivity to most of the antibiotic used.

Acinetobacter species showed 100% resistant to Amoxicillin, all the 3rd generation Cephalosporins and Meropenem, Ciprofloxacin and Gentamicin. Only Amikacin and Netilmicin showed 40% sensitivity.

Among gram positive organisms *Staphylococcus aureus* was the predominant pathogen and the antibiogram showed 100% sensitivity to Vancomycin, Choloramphenicol and Novabiocin followed by Clindamycin (91.7%) and Teicoplanin (90%). Of the total 18 *Staphylococcus aureus*, 2 were MRSA. Kaur.N *et al.*, 2014, [15] also showed less sensitivity to Clindamycin is contrast to our study.

CONS showed a similar pattern of sensitivity to Vancomycin, Novobiocin, Choloramphenicol as *Staphylococcus aureus*. However they were less sensitive to Clindamycin (Table 6). One Coagulase negative Staphylococcus was resistant to Methicillin. Paul.S *et al.*, 2009, [56] found that 8.7% of Methicillin Resistant in their study.

All the *Streptococcus* pyogens were sensitive to Penicillin, they were also 100% sensitive to Netilmicin, Cefotoxime and Cefuroxime (Table 7) Enterococcus showed 100% sensitivity to Vancomycin, Cefuroxime, Cefotoxime. Ciprofloxacin seems to be good antibiotic for treating infections with Enterococcus species, since they showed 100% sensitivity in our study.

Extended spectrum beta lactamase producing organisms were mainly seen in *E.coli* (67%), *Klebsiella* (47%). However ESBL was not a major problem in *Pseudomonas* species, *Proteus* species, *Citrobacter* species. However AmpC, MBL were not looked for in our study (Table 9).

In conclusion,

- Diabetic foot ulcer infection should be treated according to culture and sensitivity report.
- To avoid unnecessary usage of antibiotic which may result in development of Multi Drug Resistant strains.
- Emprical treatment should be based on recent report of articles of same geographical region.
- Sensitivity pattern varies from place to place. This study could help clinician to know the sensitivity pattern of organism.
- Diabetic foot ulcer treatment should be based on multidisciplinary approach.

It is health providers responsibility to enlighten the foot care in diabetes and consequences of foot infection and use of Proper foot wear which could decrease development of foot ulcer.

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