Original Article

Relationship of Microbes to Different Grades of Wagner's Classification in Diabetic Foot & their Sensitivity to Commonly Available Antibiotics

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ABSTRACT

OBJECTIVE: To evaluate the relationship of microbes with different Wagner's Classification in diabetic foot infections and assess their susceptibility to the antibacterial agents.

METHODOLOGY: A prospective observational study was conducted from February 2014 to January 2019. A total of 100 patients of Type II Diabetic patients with age 30-70 years without any gender bar according to Wagner's type 2, 3, 4, and 5 were included. A sample of pus/tissue was taken by culture swab stick or sterile jar bottle from the Ulcer or infected tissue and sent for culture and sensitivity as per CLSI guidelines. Bacterial isolation concerning different grades of Wagner's Classification and their relative susceptibility to antibiotics was assessed.

RESULTS: Of 100 diabetic feet infections, the mean age of the patients was 43.1±10.0 years making male to female ratio 1.8 40% .1:of patients come in Wagner's grade III, followed by 38%, 12% and 10% in Wagner's grade IV, V and II, respectively. We found that out of n=190 microbes cultured maximum number n=85(44.7%) related with Wagner's grade IV from which 25(13.1%) species were gram +ve and 60 (31.5%) were gram–ve species, followed by 65(34.2%) microbes related with grade III from which 20 (10.5%) species were gram+ve and 45(23.6%) were gram–ve species, 23(12.1%) microbes related with grade II(gram+ve=08(4.2%), gram–ve=15(7.8%)) and 17(8.9) microbes related with grade V(gram +ve=07 (3.6%), gram–ve=10(5.2%)).

CONCLUSION: Maximum number of microbes related to Wagner grade IV and Imipenem was the most susceptible drug among all organisms, and Ampicillin was the most resistant drug.

KEYWORDS: Diabetic, Foot, Infection, Wagner grading, Microbes, susceptibility.

INTRODUCTION

Pakistan rank 6th among the world's known diabetic nation, with an estimated 5.2 million in the year 2000, which would increase to 13.9 million in the year 2030.[1] Diabetic patients may present with one of its common complication known as diabetic foot ulcers (DFUs) being a costly complication in the developing nation.[2] Diagnosis of DFIs depends upon clinical symptoms and signs of infection in addition to supplementary laboratory testing such as inflammatory markers and imaging studies.[3] The comprehensive patient assessment should include the predisposing risk factors for infection; the type, severity, and extent of the infection; and the assessment of neurologic and vascular status, comorbid conditions, and psychosocial factors.[4] The comprehensive management of DFIs includes not only effective antibiotic therapy but also surgical debridement, pressure offloading, wound care and moisture, maintaining good vascular perfusion, control of edema and pain, correction of metabolic abnormalities such as hyperglycemia, and addressing psychosocial and nutritional issues.[5]

Diabetic foot infections are usually treated by empirical antibiotics considering the severity of the infection, as severe infections require broad-spectrum therapy. In contrast, moderate to mild infections can be treated with narrow-spectrum antibiotics that cover both aerobic Gram-positive cocci, particularly Staphylococcus aureus (including methicillin-resistant S. aureus (MRSA) for high-risk patients) and aerobic Gram-negative. Parenteral therapy is needed for severe infections, but oral therapy is adequate for most mild or moderate infections.[6]

Patients with DFI have other pathogen isolates in various hospitals and locations. Therefore, the choice of optimal initial therapy depends upon the knowledge of the microbiological spectra of the particular person or place.[7] Infection is a common problem in diabetic foot, requiring culture-specific antibiotics to control the infection.[8-10]

In our local circumstances, due to a lack of health education among the public and socio-economical reasons, patients having diabetic foot ulcerations are

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sometimes treated by unqualified persons like quacks, Hakims and Jarrahs who claim complete remedy of the disease. But honestly, they further complicate the situation for the patient, putting their lives and limbs at risk, and also create considerable difficulties for the qualified physicians and surgeons for the proper management.

METHODOLOGY

This Prospective, observational study was conducted in the Department of Orthopaedic and Traumatology, Liaquat University of Medical & Health Sciences Jamshoro. A total of 100 patients Type2 Diabetic patients with wounds on the foot aged 30 to 70 years, both male and female Wagner type II, III, IV, V, were included. Non-diabetic patients with wounds on foot, Patients not willing to be part of this study, Wagner grade 0 and 1, and Other chronic systemic illnesses and already on antibiotic therapy were excluded.

These patients graded according to the Wagner classification. A sample of pus or tissue was taken by culture swab stick or sterile jar bottle from Ulcer or infected tissue and sent for culture and sensitivity according to the Clinical and Laboratory Standards Institute (CLSI) guidelines.[8-10]

After the culture report, bacterial isolation concerning different grades of Wagner Classification and their relative susceptibility to antibiotics was assessed. Data was compiled for statistical analysis using SPSS version 16. Demographic variables like age, gender, grading of diabetic foot, type and duration of diabetes mellitus. Variables of interest were Wagner II, III, IV, V, Gram +ve and –ve organisms.

RESULTS

One hundred patients with diabetic foot infections were recruited and evaluated; the mean age was 43.1±10.0 years. The mean age of the male patients was 45.5±7.3 years, and female patients were 41.3±11.2 years. Among the 100 diabetic patients, 65 (65%) were male, and 35(35%) were female, making male to female ratio 1.8.1:

The mean duration of diabetes is 15.4±5.5 years, ranging from 5 to 30 years. The mean fasting blood sugar level was 150.5±30.8 mg/dL, ranging from 100 to 250 mg/dL. The mean random blood sugar level was 288.5±50.2 mg/dL, ranging from 200-350 mg/dL. The mean foot infection duration at the initial visit was 20.8±10.5 days, ranging from 7 to 120 days. Mean HbA1c% was 8.1±1.7 ranges (5.6 to 10.7). Among the n=100 enrolled patients, n=90(90%) had Type-II diabetes, and only n=10(10%) had Type-I diabetes. The type of medication taken, n=90(90%) of patients were on insulin, and n=10(10%) patients were on oral hypoglycemic agents. Duration of foot infection was less than one month in 42(42%) patients and greater than one month in 58(58%) patients. For checking the glycemic control, HbA1c% were checked, and it was found that most of the patients had poor glycemic control: 67(67%) had HbA1c > 7%, and 33(33%) had HbA1c < 7%. During the distribution of Wagner grading of Ulcer among the study population, we found that out of n=100, the maximum number of 40% comes in Wagner grade III, followed by 38%, 12% and 10% in Wagner grade IV, V and II, respectively.

Table I shows the distribution of microbes isolated from diabetic foot. One hundred ninety microbes were growing on the 125 samples of culture from n=100 patients, from which 130 (68.4%) were Gram –ve species and 60(31.5%) were Gram +ve species. Among the 130(68.5%) gram –ve species most common were Escherichia coli 64(33.6%) followed by Pseudomonas ae 40(21.05%), Klebsiella p 10(5.2%), Klebsiella spp 7(3.6%) and other rare strains include Enterobacter spp 3(1.5%), Pseudomonas spp 3 (1.5%), Proteus spp 2(1.05%) and Citrobacter spp 1 (0.52%). Among the gram +ve most common were S. Aureus 25(13.1%) followed by S. Epidermidis 15 (7.8%), S. aglactiae 7(3.6%) and other rare strains include E. faecalis 5(2.6%), E. faecium 3(1.5%), S. Viridans 2(1.05%), Corynebacterium Spp 2(1.05%) and Bacillus Spp 1(0.52%).

Table I: Distribution of Microbes Isolated from Diabetic Foot (n=100)

Gram + organisms	No (%)	Gram – organisms	No (%)
S. Aureus	25(13.1)	Escherichia coli	64(33.6)
S. epidermidis	15(7.8)	Pseudomonas ae	40(21.05)
S. aglactiae	7(3.6)	Klebsiella p	10(5.2)
E. faecalis	5(2.6)	Klebsiella spp	7(3.6)
E. faecium	3(1.5)	Enterobacter spp.	3(1.5)
S. Viridans	2(1.05)	Pseudomonas spp	3(1.5)
Corynebacterium Spp	2(1.05)	Proteus mirabilis.	2(1.05)
Bacillus Spp	1(0.52)	Citrobacter spp.	1(0.52)
Total	60(31.5)	Total	130(68.4)

Table II highlights the relationship of microbes with grades of Wagner classification among the study population. We found that out of n= 190 microbes cultured maximum number of microbes n=85(44.7%) related with Wagner grade IV from which 25(13.1%) species were gram +ve and 60(31.5%) were gram –ve species, followed by 65(34.2%) microbes related with grade III from which 20(10.5%) species were gram +ve and 45(23.6%) were gram –ve species, 23 (12.1%) microbes related with grade II (gram +ve =08 (4.2%), gram –ve =15(7.8%)) and 17(8.9) microbes related with grade V (gram +ve =07(3.6%), gram –ve =10(5.2%)).

Table III shows the Antibiotic susceptibility and resistance of common Gram-ve bacteria isolated from diabetic foot. Out of n=130 Gram-ve bacteria, the most common bacteria was Escherichia coli N=64 (33.6%), showing 100% susceptibility to Amikacin, Cefaprazone/Sulbactum, Ciprofloxacin, Meropenem and Piperacillin/ Tazobactum and 100% resistance to

Ampicillin, Aztreonam, Ceftriaxone Cefotaxime, Cefixime and Sulphomethaxazole/ Trimethoprim but other antibiotic like, Ceftazidime and Moxifloxacin show mix pattern susceptible as well as resistant. 2nd most common Gram-ve bacteria was Pseudomonas n=40 (21.05%), showing 100% susceptibility to Cefaprazone/Sulbactum, Piperacillin/ Tazobactum, and 100% resistance to Sulphomethaxazole/ Trimethoprim but other antibiotics like Ampicillin, Amikacin Ciprofloxacin, Meropenem Amikacin, Ceftriaxone, Cefotaxime, Ceftazidime, show mix pattern susceptible as well as resistant. 3rd most common Gram-ve bacteria, Klebsiella p n=10 (5.2%), shows 100% susceptibility to Amikacin, Cefaprazone/ Sulbactum and Meropenem and 100% resistance to Ampicillin, Aztronem, Cefixime, Ceftriaxone Cefotaxime, Ciprofloxacin but other antibiotics like Moxifloxacin show mix pattern susceptible as well as resistant.

Table II: Relationship of Microbes with Grades of Wagner Classification Among Study Population (n=100)

Wagner grading of Ulcer	gram +ve No (%)	gram –ve No (%)	Total No (%)
II	08(4.2)	15(7.8)	23(12.1)
III	20(10.5)	45(23.6)	65(34.2)
IV	25(13.1)	60(31.5)	85(44.7)
V	07(3.6)	10(5.2)	17(8.9)
Total	60(31.5)	130(68.4)	190(100)

Table IV shows the Antibiotic susceptibility and resistance of common Gram+ve bacteria isolated from the diabetic foot. Out of n=60 Gram+ve bacteria, 1st most common bacteria were S. Aureus n=25 (13.1%) showing 100% susceptibility to Amikacin, Cefaprazone/Sulbactum, Ciprofloxacin, Meropenem and Piperacillin/ Tazobactum and 100% resistance to Ampicilin, Aztreonam, Ceftriaxone Cefotaxime, Cefixime and Sulphomethaxazole/ Trimethoprim but other antibiotic like, Ceftazidime and Moxifloxacin show mix pattern susceptible as well as resistant. 2nd most common Gram+ve bacteria was S. Epidermidis n=15 (7.8%) showing 100% susceptible to Cefaprazone/Sulbactum, Piperacillin/ Tazobactum, and 100% resistance to Sulphomethaxazole/ Trimethoprim but other antibiotic like Ampicilin, Amikacin Ciprofloxacin, Meropenem Amikacin, Ceftriaxone, Cefotaxime, Ceftazidime, show mix pattern susceptible as well as resistant. 3rd most common Gram+ve bacteria S. aglactiae n=7 (6.3%) showing 100% susceptible to Amikacin, Cefaprazone/ Sulbactum and Meropenem and 100% resistance to Ampicilin, Aztronem, Cefixime, Ceftriaxone

Table III: Antibiotic Susceptibility/Resistance of Common Gram -Ve Bacteria Isolated from Diabetic Foot (n=130)

Antibiotic Names	Common gram-negative species					
	Escherichia coli N=64 (33.6%)		Pseudomonas n=40 (21.05%)		Klebsiella spe n=10 (5.2%)	
	Susceptible	Resistant	Susceptible	Resistant	Susceptible	Resistant
Ampicillin	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Amikacin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Aztreonam	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Amoxicillin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Avelox	32(50%)	32(50%)	0(0%)	40(100%)	0(0%)	10(100%)
Cefixime	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%)
Cefotaxime	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%)
Ceftriaxone	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%))
Ceftazidime	32(50%)	32(50%)	18(45%)	22(55%)	10(100%)	0(0%)
Ciprofloxacin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Cefoperazone/ Sulbactum	64(100%)	0(0%)	19(47.5%)	21(52.5%)	10(100%)	0(0%)
Gentamycin	32(50%)	32(50%)	0(0%)	40(100%)	0(0%)	10(100%)
Imipenem			0(0%)	40(100%)	10(100%)	0(0%)
Moxifloxacin	64(100%)	0(0%)	19(47.5%)	21(52.5%)	9(90%)	1(10%)
Meropenem	64(100%)	0(0%)	40(100%)	0(0%)		
Piperacillin/ Tazobactum	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)	0(0%)
Penicillin	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Sulphomethaxazole/ Trimethoprim	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)

Table IV: Antibiotic Susceptibility/Resistance of Common Gram +Ve Bacteria Isolated from Diabetic Foot (n=60)

Antibiotic Names	GRAM +VE BACTERIA					
	S. Aureus n=25 (13.1%)		S. Epidermidis n=15 (7.8%)		S. aglactiae n=7 (6.3%)	
	Susceptible	Resistant	Susceptible	Resistant	Susceptible	Resistant
Ampicillin	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Amikacin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Aztreonam	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Amoxicillin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Avelox	32(50%)	32(50%)	0(0%)	40(100%)	0(0%)	10(100%)
Cefixime	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%)
Cefotaxime	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%)
Ceftriaxone	0(0%)	64(100%)	0(0%)	40(100%)	10(100%)	0(0%))
Ceftazidime	32(50%)	32(50%)	18(45%)	22(55%)	10(100%)	0(0%)
Ciprofloxacin	64(100%)	0(0%)	0(0%)	40(100%)	0(0%)	10(100%)
Cefoperazone/ Sulbactum	64(100%)	0(0%)	19(47.5%)	21(52.5%)	10(100%)	0(0%)
Gentamycin	32(50%)	32(50%)	0(0%)	40(100%)	0(0%)	10(100%)
Imipenem			0 (0%)	40(100%)	10(100%)	0(0%)
Moxifloxacin	64(100%)	0(0%)	19(47.5%)	21(52.5%)	9(90%)	1(10%)
Meropenem	64(100%)	0(0%)	40(100%)	0(0%)		
Piperacillin/ Tazoactum	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)	0(0%)
Penicillin	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)
Sulphomethaxazole/ Trime-thoprim	0(0%)	64(100%)	0(0%)	40(100%)	0(0%)	10(100%)

Cefotaxime, ciproflaxacin but other antibiotic like Moxifloxacin show mix pattern susceptible as well as resistant.

DISCUSSION

Infection is a common problem in diabetic foot, requiring culture-specific antibiotics to control the infection. The mean age of the patients in this study was 43.1±10.0 years, which was comparable with various studies by Amjad S.S.[11] mean age was 55±11.96 years, by Chaudhry et al. [12] the mean age 58.1 years, Anvarinejad M et al. [13] with a mean age of 55.5 years, by Kamtikar R et al. [14] the mean (SD) age was 52.12±9.2 years, by Mahmoud B et al. [15] the mean age was 47.1±1.0 years, by Manisha J et al. [16] the mean age was 50.25 + 12.5 and by Paul S et al[17] reported the mean age of the patients was 52.8±11.7

Males were predominant, 65(65%), and 35(35%) were female, making M: F ratio 1.8 .1:Gender distribution was comparable with other studies by Amjad S.S.[11] were 76(66.67%) males and 38(33.33%) females making M: F ratio 2.3 ,1:by Chaudhry et al.[12] 29(58%) were men and 21(42%) women making M: F ratio 1.3 ,1:by Anvarinejad M et al.[13] 56 males (65%) and 30 females (35%) making M: F ratio 1.8 ,1:by Sekhar SM et al.[18] 72.2% (78/108) were males and 27.8% (30/108) were females making M: F ratio 2.6.1:

Most of the patients had poor glycemic control: 67 (67%) had HbA1c > 7% and 33(33%) had HbA1c < 7% compared by Hayat AS[19] reported about HbA1c > 7% in 62(72.9%) and < 7% 23(27.0%), by Bansal E[20] showed HbA 1c > seven was found in 59(64%) patients, by Amjad S.S.[11] reporting Glycaemic control study population was unsatisfactory in 65.8% patients and 34% patients had satisfactory Glycaemic control.

During the distribution of Wagner grading of Ulcers among the study population, we found that out of n=100, the maximum number of patients, 40%, come in wagner grade III, 38%, 12% and 10% in Wagner grade IV, V and II respectively. A study by Kamtikar R et al. [14] his study showed Wagner's classification WI 0 (0), WII 7 (9.09%), WIII 32 (41.5%), WIV 20 (25.9%) and WV 18 (23.3%), by Hayat AS[19] showed study about types of ulcers (Wagners's grade) GI=2 (2.3%), GII=12 (14.1%), GIII=23 (27.0), GIV=42 (49.4) and GV=6 (7.0), by Paul S et al. [17] reported about types of ulcers (Wagners's grade) Grade 1 3 (4.0), Grade 2 26 (34.7), Grade 3 27 (36.0), Grade 4 13 (17.3) and Grade 5 6 (8.0), by Anvarinejad M et al.[13] reporting about the wagner grading of Ulcer 0=9 (11), I=17 (20), II=15 (17), III=31 (36) and IV=14 (16), by Mahmoud B et al[15] showing Wagner's classification GI= (13%), GII= (29%), GIII= (34%), GIV= (16%) and GV= (8%).

In this study, among Gram-negative bacteria most common were Escherichia coli 64(33.6%), followed by

Pseudomonas 40(21.05%) and Klebsiella p 10(5.2%). A study by Mahmoud B et al. [15] shows that among Gram-negative bacteria, the most common was Escherichia coli 35(15.8), Pseudomonas SPP 24 (10.9) and Klebsiella spp. 9(4.1) Sekhar SM et al. [18] reported that the most common Gram-negative bacteria was Pseudomonas aeruginosa (24%, 36/150), Kamtikar R et al. [14] showed the prevalence of P. aeruginosa is more than 37.5%.

In this study, among Gram-positive bacteria most common were S. Aureus 25 (13.1%), followed by S Epidermidis 15(7.8%) and S aglactiae 7(3.6%). In a study by Mahmoud B et al., [15] Gram-positive bacteria most common were Staphylococcus aureus 39 (17.6), Coagulase-negative staphylococci 22(9.9 and Streptococci 18(8.1) and Sekhar SM et al. [18] reporting the Staphylococcus aureus was the most frequent pathogen (28%, 42/150).

Relationship of microbes with grades of Wagner classification We found that out of n= 190 microbes cultured maximum number of microbes n=85 (44.7%) related with Wagner grade IV from which 25(13.1%) species were Gram +ve and 60(31.5%) were Gram –ve species, followed by 65(34.2%) microbes related with grade III from which 20(10.5%) species were Gram +ve and 45(23.6%) were Gram –ve species, 23 (12.1%) microbes related with grade II (gram +ve =08 (4.2%), Gram –ve =15 (7.8%)) and 17(8.9%) microbes related with grade V(Gram +ve =07 (3.6%), Gram –ve =10 (5.2%)). A study by Mahmoud B et al. [15] showed gram-positive cocci (staphylococci and streptococci) were predominant in Wagner grade I. In contrast, Gram-negative bacilli were the most common isolates in other grades. In polymicrobial profiles, anaerobic isolation was found only in deep limb infections (grades III, IV, and V) mixed with aerobic Isolates.

In this study, the most common bacteria Escherichia coli N=64 (33.6%), showed 100% susceptibility to Amikacin, Cefaprazone/Sulbactum, Ciprofloxacin, Meropenem and Piperacillin/ Tazobactum and 100% resistance to Ampicilin, Aztreonam, Ceftriaxone Cefotaxime, Cefixime and Sulphomethaxazole/ Trimethoprim but another antibiotic like, Ceftazidime and Moxifloxacin show mix pattern susceptible as well as resistant. A study by Amjad S.S.[11] reporting E. coli infections, 81% showed sensitivity to Imipenem, 69% to Aminoglycosides, 41% to Vancomycin, 31% to Quinolones, 12% to Co-amoxiclav, 31% to Clindamycin, and 34% to Cephalosporins. Out of 32 patients with E. coli infection, 31% showed resistance to Quinolones, 12.5% to Co-amoxiclav, 40.6% to Vancomycin, 31% to Clindamycin, 81% to Imipenem, 69% to Aminoglycosides and 34% to Cephalosporins. Chaudhry W.N.[12] shows all gram□negative isolates exhibited high susceptibility to chloramphenicol and meropenem. K. Pneumoniae and P. aeruginosa were found to be the most resistant, with >60% of strains exhibiting antibiotic resistance, whereas for Proteus spp. and E. coli, <55% of strains were resistant, and 75% of the E. coli isolates were found to be resistant to ceftazidime, by Sekhar SM et al. [18] reporting the Extended-spectrum beta-lactamase (ESBL) producing Escherichia coli was resistant to most of the antibiotics except cefoperazone/sulbactam, meropenem, piperacillin/tazobactam, and ticarcillin/clavulanic acid. Bansal E[20] showing In E. coli, majority of strains were resistant to Penicillins, while sensitivity was shown to Imepenem (100%), Cefoperazone + Sulbactum (96%), Amikacin (90%).

2nd most common Gram-ve bacteria in this study was Pseudomonas n=40 (21.05%), showing 100% susceptibility to Cefaprazone/Sulbactum, Piperacillin/ Tazobactum, and 100% resistance to Sulphomethaxazole/ Trimethoprim but other antibiotic like Ampicilin, Amikacin Ciprofloxacin, Meropenem Amikacin, Ceftriaxone, Cefotaxime, Ceftazidime, show mix pattern susceptible as well as resistant. In a study by Amjad S.S.[11] reporting patients with Pseudomonas infection, 86% showed sensitivity to Aminoglycosides, 71% to Imipenem, 43% were sensitive to Cephalosporins, 43% had sensitivity to Vancomycin, 28.5% to Quinolones, 28.5% to Co-amoxiclav and 28.5% were susceptible to Clindamycin, and Among Pseudomonas infection, 28.5% showed resistance to Quinolones, 28.5% to Co-amoxiclav, 42.8% to Vancomycin, 28.5% to Clindamycin, 71% to Imipenem, 86% to Aminoglycosides and 43% to Cephalosporins. Chaudhry W.N.[12] showing all P. aeruginosa were found to be resistant to ceftazidime. A study from India by Sekhar SM et al. [18] reported the P. aeruginosa toward commonly used antibiotics, but our studies showed a different susceptibility pattern. Bansal E[20] shows Almost all the isolates of P. aeruginosa were sensitive to Cefoperazone + Sulbactum, Ceftazidime and Imepenem, while Piperacillin showed good activity. Very high resistance was shown to Cotrimoxazole (100%) Amoxycillin + Clavulanic Acid (97%).

Out of n=60 Gram+ve bacteria, 1st most common bacteria were S. Aureus n=25 (13.1%), showing 100% susceptibility to Imipenem, Amikacin, Fosfomycin, Levofloxacin, Vancomycin, and 100% resistance to Ampicilin but other antibiotic like Ceftriaxone Cefotaxime, Ceftazidime, Cefoperazone, Cefazolin, Cefuroxime, Gentamycin, Co-amoxiclav, Ciprofloxacin and Ofloxacin show mix pattern susceptible as well as resistant. A study by Amjad S.S.[11] from Pakistan reported that Among patients with S. aureus infection, 92% showed sensitivity to Vancomycin, 42% were sensitive to Co-amoxiclav, 27% to Quinolones, 67% to Clindamycin, 85% to Imipenem, 54% to Aminoglycosides and 15% to Cephalosporins. Among S. aureus infection, 73% were resistant to Quinolones, 57.6% to Coamoxiclav, 7.6% to Vancomycin, 32.7% to Clindamycin, 15.4% to Imipenem, 46% to Aminoglycosides and 84.6% to Cephalosporins. Chaudhry W.N.[12] showed all S. aureus isolates were resistant to penicillin, of which 90% exhibited

resistance against oxacillin, cefoxitin and ceftazidime. Vancomycin showed inhibitory effects for only 20% of the S. aureus isolates. A study from India by Sekhar SM et al. [18] reported the S. aureus isolates were 100% (48/48) sensitive to cotrimoxazole and resistant to Ciprofloxacin. A study from Egypt by Mahmoud B et al. [15] showed S. aureus and coagulase-negative staphylococci (CoNS) isolated from diabetic lesions were susceptible to Amikacin (100%), Imipenem (92.3 and 100%, respectively), and cotrimoxazole (74.4% of S. aureus). Paul S[17] shows S. aureus isolated; 43.8% were methicillin-resistant or MRSA, while all were sensitive to Vancomycin. Resistance to cotrimoxazole, Ciprofloxacin and tetracycline was 62.5%, 75% and 56.3% respectively. Bansal E[20] showing the Antibiotic sensitivity pattern of S. aureus showed that Oxacillin resistance, i.e., Methicillin-resistant S. aureus (MRSA), was 55.50%. Almost all the strains were sensitive to Ceftriaxone and Imepenem. Amikacin and Ciprofloxacin also showed good sensitivity.

In this study 2nd most common Gram+ve bacteria was S. Epidermidis n=15 (7.8%) showing 100% susceptible to Imipenem, Amikacin, Fosfomycin, Levofloxacin, Vancomycin, Ceftazidime, Cefoperazone, Co-amoxiclav, Ciprofloxacin and Ofloxacin, and 100% resistance to Cefuroxime and Ampicilin but other antibiotic like Ceftriaxone, Cefotaxime, Cefazolin, Gentamycin, show mix pattern susceptible as well as resistant. A study from India by Sekhar SM et al. [18] reported that the Enterococci and Beta hemolytic streptococci isolates were 100% (12/12, 6/6, respectively) susceptible to chloramphenicol, gentamicin, and doxycycline.

CONCLUSION

A maximum number of microbes related to Wagner grade IV and Imipenem is the drug of choice for most Diabetic Foot infections with Wagner Class II, III, IV, and V among all organisms. Ampicilin was the most resistant drug.

Ethical Permission: Liaquat University of Medical & Health Sciences ERC letter No. LUMHS/PG-712/17

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AUTHOR'S CONTRIBUTION

Makhdoom A: Final approval of study
Jehanzaib: Principle researcher, data collection
Tunio ZH: Data collection and compilation
Jokhio MF: Data collection and compilation
Maheswari LD: Statistical Analysis
Mahar IK: Analysis and data collection
Ahmed N: Analysis and data collection
Shaikh MT: Article writing

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