Original Article

COMMONLY ISOLATED ORGANISM IN DIABETIC FOOT AND ITS ANTIBIOTIC SENSITIVITY, AN EXPERIENCE AT TERTIARY CARE HOSPITAL

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ABSTRACT:

BACKGROUND & OBJECTIVE: To determine the commonly isolated organism in ulcers of diabetic foot and its sensitivity to antibiotics.

METHODOLOGY: A total of 167 patients of diabetic foot were included in this descriptive Cross-sectional study. All the patients were informed and consent was obtained according to ethical criteria approved by the ethical committee. The use of antibiotics in last 72 hours was strictly observed. The samples were obtained under aseptic conditions by applying the swab slightly to the exudate or base of the ulcer and were then carefully transferred in to the container and were then sent to the laboratory on the same date. The culture sensitivity was performed. Data was analyzed using SPSS. 20.

RESULTS: A total of 140 samples were positive for 8 types of bacteria out of 167. 94 samples were monomicrobial were as 46 were polymicrobial. Over all Staphylococcus aureus 63(40.3%) was the most commonly isolated bacteria followed by Pseudomonas aeruginosa 40 (25.6%). S. aureus was most sensitive to imipenem/ meropenem (79.3%) followed by vancomycin (71%), linezolid (69.8%) and moxifloxacin (69.8%). P. aeruginosa was sensitive to impenem/ meropeneum (90%) followed by Ticarcilline/ clavulante (92.5%), amikacin (87.5%) and pipracilline / tazobactom (80%). Most of the gram positive and negative bacteria were resistant to commonly available antibiotic like ampiciline/ cloxacillin, amoxicilline/ clavulanate and cephradine.

CONCLUSION: Most of the commonly used antibiotics has developed resistance. S. aureus was most common bacteria from the isolates and was sensitive to impenem/meropenem, vancomycin and linezolid. Gram-negative bacteria showed sensitivity to impenem/meropeneum, pipracilline/ tazobactom, Ticarcilline/ clavulanate and amikacin.

KEYWORDS: Diabetic Foot, Diabetes Mellitus, Antibiotic Sensitivity.

INTRODUCTION:

Diabetes mellitus is the leading cause of morbidity and mortality and responsible for 3.8 million deaths annually [1,2], with a dramatic rise in number of new reported cases worldwide. The estimated numbers of cases in 2000 were 177 million, which rushed to 285 million in 2010. The estimated number of cases in 2030 will be 439 million [3,4,5].

The mortality or morbidity of diabetes mellitus is associated with its long term complications [6]. Among its other complications, foot infection and ulceration is the major cause of hospitalization and amputation. The treatment of such patients is mainly dependent on proper assessment of host factors like renal and vascular impairment, reliable microbiological data and well assessment of severity of sepsis [4,7]. The pathogenesis of diabetic foot is basically neuropathic and vascular impairment which leads to loss of skin integrity with minor trauma followed by impaired healing [8,9,10]. Diabetic foot ulcers are one of the leading causes of hospital admissions and death among diabetic patient [6]. It is estimated that 15% of diabetic patients presents with diabetic ulcers and it's the leading cause of non-traumatic lower limbs amputation in United States [4,11].

Well clinical assessment of ulcer with signs of infection and bone exposure, should always raise the suspicion of osteomyelitis. In such patients aggressive surgical debridement, proper I/V antibiotics and meticulous wound care can help to restore body's own bacterial barrier which can prevent amputations which is the most serious complications of such wounds[9,10,12].

The organism found in these wounds differ not only in patient to patient and hospital to hospital but also from one part of the country to another[13,14,15,16].

Selection of the appropriate antibiotic against specific organisms is one of the mainstays of treatment of such wounds. Curettage of the base of the foot ulcer and deep tissue are the reliable method to identify the specific organism and the antibiotic sensitivity [17,18].

These diabetic foot ulcers are true emergencies and prompt diagnosis, surgical debridement and selecting appropriate antibiotic can improve the chances of limb salvage [4,13,15,19].

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Even in most sophisticated setup there is always delay in the laboratory results for culture and sensitivity, therefore the initial empiric therapy must be started as soon as possible [16,20].

The aim of our work was to study the bacteriology of diabetic foot ulcers in patients presenting to Sandman Provincial Teaching Hospital Quetta, the relative frequency of bacteria isolated cultured from foot infection and to study their antimicrobial sensitivity to variety of commonly used antibiotics.

METHODOLOGY:

This cross-sectional descriptive study was conducted in the Department of Surgery Sandman (Prov) Teaching Hospital Quetta for a period of 02 years from July 2016 to June 2018. The study has been approved by the Ethical review committee of Sandman (Prov) Teaching Hospital Quetta. Convenient sampling technique was used for taking samples. A total of 167 patients were included in this study with well-established diagnosis of chronic diabetes mellitus that have foot ulcer at least from the last one month. Patients who had history of direct trauma, some sort of surgical debridement, any local or systemic antibiotic therapy were excluded from the study. The age of studied patients ranges from 35 to 85 years, 57 patients were male and 110 patients were female.

All the patients were informed and a written consent was taken first and demographic characteristics were noted. The specimens were collected. A swab was applied gently to the base of the ulcer or its exudate under aseptic conditions and then the swab was carefully transferred to the container. The container was then sent to laboratory on the same date and laboratory was requested for culture sensitivity test for most commonly used antibiotics. The results were then analyzed using SPSS 20 and were than presented in the form of tables.

RESULTS:

A total number of 167 patients were included in our study out of which 57 (34.1%) were male and 110(65.9%) were female as shown in table no. 1. It was seen that the age of the patients ranges from 35 to 85 years of age with mean age of 68.09 ± 9.85 as shown in (Table-I).

Regarding duration of the ulcer, it was seen that 10(5.9%) patients had history of less than 10 days of ulcer duration, 99(59.3%) patients had 10 to 20 days of duration of ulcer and 58(34.8%) patients had 20 to 30 days of duration of ulcer. It was seen that 62(37.1%) patients had superficial ulcers of grade 1 and 2 were as 105(62.9%) patients had deep ulcer of Wagner grade 3, 4 and 5. It was seen that out of 167 patients 27(16.2%) patients had shown no growth of bacteria, 94(56.3%) patients had shown monomicrobial growth and 46(27.5%) patient had shown polymicrobial growth as shown in (Table-II).

It was studied that among Gram positive bacteria, Staphylococcus aureus was the most common bacteria 63(40.3%) were as Staphylococcus epidermidis was seen in 12(7.6%) samples only as shown in (Table-III). Similarly, among Gram negative bacteria Pseudomonas aeruginosa was most common 40(25.6%) were as Escherichia coli was second most common 30(19.2%), Proteus was isolated from 5(3.2%) samples and Klebsiella was isolated from 6(3.8%) samples as shown in (Table-III).

In this study we have seen that Staphylococcus aureus was most sensitive to Imepenem/ Meropenem 50(79.3%), the second most effective antibiotic for Staphylococcus aureus was seen to be vancomycin 45(71%) followed by Linezolid 44(69.8%), Moxifloxacin 44(69%) as shown in (Table-IV). Similarly, Staphylococcus epidermidis was seen to be more sensitive to Imepenem/Meropenem 10(83.3%) followed by vancomycin and Linezolid 9(75%) both as shown in (Table-IV).

It was further studied that among gram negative bacteria pseudomonas aeruginosa was most sensitive to Ticarcilline/ clavulante 37(92%) followed by Imepenem/ meropeneum 36(90%), amikacin 35(87.5%) and pipracilline/ tazobactom 32(80%). It was studied that E. coli was most sensitive to Imepenem/ meropenem 24(80%) followed by Ticarcilline/ clavulante 23(76.6%), pipracilline / Tazobactom 22(73.3%). It was also seen that proteus was most sensitive to Imepenem/ meropeneum 3(60%) and pipracilline/ tazobactom 3(60%) followed by Ticarcilline/ clavulante 2 (40%), amikacin 2(40%), and moxifloxacin 2(40%). It was seen further that Klebsiella was most sensitive to Imepenem/ meropenem and pipracilline / tazobactom 5(83.3%) each followed by Ticarcilline/ Clavulante and moxifloxacin 4 (66%) each as shown in (Table-V).

Table-I: Demographic Features of the patients included in this study.

	Group	Number of Patients	Percentage
Age	35- 45 Year	16	9.5%
	46- 55 Years	3	1.8%
	56- 65 Years	47	28.2%
	66- 75 Years	43	25.6%
	76- 85 Years	58	34.9%
	Total	167	100%
	Mean ± S.D	68.09 ± 9.85	
Gender	Male	57	34.1%
	Female	110	65.9%
	Total	167	100

Table-II: Pathological Features of the patients included in this study.

Pathological Features	Grade of Ulcer	No. of Patients	Percentage
Duration of Ulcer	**Less than 10 Days**	10	5.9%
	10 – 20 days	99	56.3%
	20 – 30 days	58	34.8%
	Total	**167**	**100%**
Grade of Ulcer	Grade of Ulcer	No. of Patients	Percentage
	Superficial (Wagner 1& 2)	62	37.1%
	Deep (Wagner 3, 4 & 5)	105	62.9%
	Total	167	100%
No. of Bacteria Isolated	No. of Bacteria per patient	No. of Patients	Percentage
	No. Growth	27	16.2%
	Monomicrobial	94	27.5%
	Polymicrobial	46	56.3%
	Total	**167**	**100%**

Table-III: Isolated Bacteria n=156.

	No. of Bacteria	Frequency	Percentage
Gram Positive Bacteria n= 75	S. aureus	63	40.4%
	S. epidermidis	12	7.6%
Gram Negative Bacteria n= 81	P. aeruginosa	40	25.6%
	E. coli	30	19.3%
	P. mirabulus	5	3.3%
	Klebsiella	6	3.8%
	Total	156	100

Table-IV: Antibiotic Sensitivity for Gram Positive Bacteria.

Antibiotics	Staphylococcus Aureus n=63	Staphylococcus Epidermidis n=12
Ampicillin-Cloxacillin	22(34.9%)	7(58.3%)
Amoxicillin-Clavulanate	39(61.9%)	6(50%)
Cephradine	26(41.2)	5(41.6%)
Cefuroxime	40(63.4%)	8(66.6%)
Ceftriaxone	39(61.9%)	5(41.6%)
Cefepime	40(63.4%)	9(75%)
Moxifloxacin	44(69.8%)	9(75%)
Imepenem/Meropenem	50(79.3%)	10(83.3%)
Flucloxacillin	29(46%)	5(41.6%)
Methicillin	33(52.3%)	7(58.3%)
Vancomycin	45(71%)	9(75%)
Fusidic acid	36(57.1%)	7(58.3%)
Linezolid	44(69.8%)	9(75%)

Table-V: Antibiotic Sensitivity for Gram Negative Bacteria.

Antibiotics	Pseudomonas Aeruginosa	E. coli	Proteus	Klebsiella
Ampicillin-Cloxacillin	0(0%)	0(0%)	0(0%)	0(0%)
Amoxicillin-Clavulante	2(5%)	8(26.6%)	1(20%)2	2(33.3%)
Cephradine	0(0%)	0(0%)	0(0%)	0(2%)
Cefuroxime	4(10%)	5(16.6%)	0%	0%
Ceftriaxone	28(70%)	5(16.6%)	1(20%)	1(16.6%)
Cefipime	16(37.5%)	7(23.3%)	1(20%)	3(50%)
Moxifloxacillin	24(60%)	15 (50%)	2(40%)	4(66.6%)
Imepenam/Meropenam	36(90%)	24(80%)	3(60%)	5(83.3%)
PippercillinTazobactem	32(80%)	22(73.3%)	3(60%)	5(83.3%)
Ticarcillin-Calvulante	37(92.5%)	23(76.6%)	2(40%)	4(66.6%)
Amikacin	35(87.5%)	20(66.6%)	2(40%)	3(50%)

DISCUSSION:

The pathogenesis of diabetic foot includes diabetic neuropathy, peripheral disease, high plantar pressure and minor traumas which goes un-noticed [4, 5, 21]. Once there is a breach in the skin, infection may occur due to impaired healing process in diabetic patients leading to infected ulcers. These infected ulcers do not get proper antibiotics due to poor understanding of commonly involved bacteria and their sensitivity to antibiotics [1,22].

In our study we had seen that out of 167 patients 94(56.3%) patients had polymicrobial growth whereas 46(27.5%) patients had mono microbial growth, these results were close to a study conducted by Alavi SM et al [7]. Some other authors had similar results[23,24]. In comparison to study conducted by Anandi C et al had much higher rate of mono microbial infection [24]. This might be due to lower positive growth of organisms in our data.

In our study we have seen that gram negative bacteria (52%) were commonly isolated as compared to gram positive bacteria (48%). These results were close to other studies by Umaclevi S et al and other authors [23,25,26,27]. Overall S.aureus (40.4%) was seen to be the

most commonly isolated organism, similar results were seen in other studies as well[1,28,29,30]. It was further seen that Pseudomonas Aeruginosa was the most commonly isolated gram negative bacteria, accounting almost 25.6% which is close to results of other studies[29,31,32,33].

In our data it was studied that S.aureus was more sensitive to impenem/ meropenam (79.3%) followed by vancomycin (71%), moxifloxacin (69.8%), linezolid [69.8%] and Cefipime (63.4%). It was also noted that S.aureus was resistant to more commonly available antibiotic like ampicillin /cloxacillin (39.9%), Amoxacillin-Clavulanate (61.9%) and methicillin (52.3%), similar results were seen in other studies [1,4,5,25,26,27,34]. These results are may be due to improper and unchecked use of antibiotic by quakes in the periphery.

It was further seen that P.aeruginosum was most sensitive to Ticarcillin-clavulanate (92.5%) followed by impenem /meropenam (90%), Amikacin (87.5%) and Pipracilline/ Tazobactom (80%). These results were similar to other researches [10,23,34]. It was also observed that all the gram negative bacteria showed poor sensitivity to commonly available penicillin and cephalosporin. Similar patterns were studied in other study by Umadevi S et al [23]. This pattern of resistance is alarming and might be due to casual use of these easily available antibiotics in the market and easy access by everyone to them.

CONCLUSION:

We concluded that the treatment of the diabetic foot should be started with proper specimen collection for culture and sensitivity before starting the empirical antibiotic therapy. The empirical therapy should be started with combination of two antibiotics e.g. Vancomycin or Linezolid plus Imipenem/ Meropenem or a Cephalosporin. This combination should be changed later with results of the culture and sensitivity.

CONFLICT OF INTEREST: All authors disclose no conflict of interest.

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Authors' Contribution:

Muhammad Iqbal khan: Study Design and final approval of manuscript.
Riffat Arbab: Data collection, statistical analysis and literature search.
Abdullah Khan: Over all Supervision of data collection, analysis and manuscript writing.
Maria Mehmood: Help in data collection analysis and final draft of study.
Aisha Arshad: Help in data collection analysis and final draft of study.
Hafsa Jaffar: Manuscript writing and proof reading.
Hafsa Qazi: Manuscript writing and data collection.

Failures are often the results of timidity and fears; disappointments are the results of bashfulness; hours of leisure pass away like summer-clouds, therefore, do not waste opportunity of doing good

Hazrat Ali (Karmulha Wajhay)