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 imipenem/meropenem (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/ cloxacinil, amoxicilin/ 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 imipenem/meropenem, vancomycin and linezolid. Gram-negative bacteria showed sensitivity to imipenem/meropenem, pipracilline/tazobactom, Ticarcilline/clavulanate and amikacin.

KEYWORDS: Diabetic Foot, Diabetes Mellitus, Antibiotic Sensitivity.

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INTRODUCTION:

Diabetes mellitus is the leading cause of morbidity and mortality and responsible for 3.8 million deaths annually \(^1\), 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 \(^2\). The mortality or morbidity of diabetes mellitus is associated with its long term complications \(^3\). 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 \(^4\). 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 \(^5\). 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 \(^6\). 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 \(^7\). These diabetic foot ulcers are true emergencies and prompt diagnosis, surgical debridement and selecting appropriate antibiotic can improve the chances of limb salvage \(^8\).

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.

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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/meropenem 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/meropenem 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%       |
| Gender      |                    |            |
| Male        | 57                 | 34.1%      |
| Female      | 110                | 65.9%      |
| Total       | 167                | 100%       |

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).
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**    | 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.

| Gram Positive Bacteria n= 75 | No. of Bacteria | Frequency | Percentage |
|------------------------------|-----------------|-----------|------------|
| S. aureus                    | 63              | 40.4%     |
| S. epidermidis               | 12              | 7.6%      |

| Gram Negative Bacteria n= 81 | No. of Bacteria | Frequency | Percentage |
|------------------------------|-----------------|-----------|------------|
| P. aeruginosa                | 40              | 25.6%     |
| E. coli                      | 30              | 19.3%     |
| P. mirabulus                 | 5               | 3.3%      |
| Klebsiella                   | 6               | 3.8%      |
| **Total**                    | 156             | 100%      |
DISCUSSION:

The pathogenesis of diabetic foot includes diabetic neuropathy, peripheral disease, high plantar pressure and minor traumas which goes unnoticed [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 [23]. Some other authors had similar results [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

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-Clavulanate| 2(5%)                  | 8(26.6%)| 1(20%)  | 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%)   |
| Cefepime               | 16(37.5%)              | 7(23.3%)| 1(20%)  | 3(50%)     |
| Moxifloxacin           | 24(60%)                | 15(50%) | 2(40%)  | 4(66.6%)   |
| Imepenem/Meropenem     | 36(90%)                | 24(80%) | 3(60%)  | 5(83.3%)   |
| PipercillinTazobactem  | 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%)     |
It was further seen that *P. aeruginosa* was most sensitive to Ticarcillin-clavulanate (92.5%) followed by impenem/meropenem (90%), Amikacin (87.5%) and Pipracilline/Tazobactom (80%). These results are similar to other researches. It was also noted that *S. aureus* was resistant to more commonly available antibiotic like ampicillin /cloxacillin (39.9%), Amoxicillin-Clavulanate (61.9%) and methicillin (52.3%), similar results were seen in other studies. These results are may be due to improper and unchecked use of antibiotic by quakes in the periphery.

It was further seen that *P. aeruginosa* was the most commonly isolated gram negative bacteria, accounting almost 25.6% which is close to results of other studies. In our data it was studied that *S. aureus* was more sensitive to impenem/meropenem (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%), Amoxicillin-Clavulanate (61.9%) and methicillin (52.3%), similar results were seen in other studies. These results are similar to other researches. 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. 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: Overall 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)