

The effectiveness of some antibiotics used against bacteria isolated from diabetic .

Yasmin Farag Abushalla.

Medical Laboratory Engineer Misurata Medical Center.

E-mail: jasamen84@gmail. Com.

Submission data: 22.6.2020 Acceptance data:20.7.2020, Date of electronic publishing 1.8.2020

<https://www.misuratau.edu.ly/journal/sci/upload/file/R-1267-ISSUE-10%20PAGES%2075-80.pdf>

Abstract: Diabetic foot is a general health problem for diabetics and the knowledge of the organisms that make them an important role to know the type of antibiotics suitable for them, the diabetic foot includes many complications such as nerve damage and lack of blood ischemia, many reports have shown that there are many antibiotic-resistant microbes in this study, the aim was to determine the extent of microorganisms in diabetes and to measure the sensitivity of antibiotics, the study was conducted in a period of five months at Misurata Medical Center in the period from January to May of 2016 and the clinical characteristics of patients were identified antibiotic sensitivity tests were also performed using the method of spreading the disc, during which time 10 species of microorganisms were isolated gram-positive bacteria *Staphylococcus aureus* 30%, *Staphylococcus epidermidis* (17%), *Gamma Streptococcus* 2%, and gram-negative bacteria, which included *Pseudomonas aeruginosa* 17%, *Proteus spp* 8%, *Klebsiella spp* 8%, *Serratia spp* 6%, *Proidvencia stuartii* 5%, *Enterobacter spp* 5%, *Morganella morgni* 2%, the results showed the presence of many bacteria for one patient polymicrobial 48%, and the proportion of monomicrobial 52%, and used five types of antibiotics were varied in their effect on Gram negative bacterial isolated and Gram positive bacterial, we find that most of the antibiotic still have an effect on bacteria, especially (Imipenem, Ciprofloxacin, Amoxicillin clavulanic acid, Ceftriaxone), While Metronidazole did not have any effect on the bacterial species isolated from the diabetic foot, because of the has evolved of organisms for some qualities and the emergence of resistance to many antibiotics doctors advise to develop a strategy for treatment.

Keywords: Diabetic foot, Microbial infections , Antibiotics.

Introduction

Diabetes is an imbalance in sugar metabolism that leads to abnormally high blood sugar (glucose) for various reasons that may be psychological or organic or due to excessive intake of sugars or genetic factors[1], depending on the type of treatment, diabetics are divided into two types: The first type who rely on insulin in the treatment, and this type mostly affects children and adults under the age of thirty years, and symptoms of thirst, frequent urination, appetite and weight loss, with the presence of secondary complications include neuropathy, renal failure and retinopathy and others [2, 3], and the second type who do not rely on insulin in their treatment and usually affects adults, and begins after the age of forty years, and symptoms that appear gradually are: the occurrence of coma and recurrent fungal infections due to immune deficiency in patients, and blurred vision when high blood sugar, and in this Type The pancreas produces insulin but may be insufficient. It represents the majority (90%) of diabetics, and the

patient with this type of sugar responds to tablet therapy[4].

Diabetic foot is one of the most important complications of diabetes, where 15% of cases develop to the diabetic foot, and be the main reason for the entry of 20% of patients to hospital[5], patients are at increased risk of bacterial infection[2], this is due to poor function of mononucleosis and poor control of glucose, leading to ischemia of the foot[6], it makes patients vulnerable to diabetic foot and neuropathy, the foot feels no heat or cold when it hits objects, and becomes vulnerable to wounds and ulcers that are a suitable medium for microbial growth[7], they develop into serious complications making it difficult to heal the wound The neglect of patients for treatment and follow-up and not wearing appropriate shoes leads to the development of injury which helps to worsen and delayed recovery[8], diabetic foot is affected by several factors, including the patient's age, educational status, weight of the disease and type of diabetes[9]. foot diabetes is a serious complication associated with diabetes, according to the World Health Organization, diabetes affects 194 million people worldwide,

and is expected to increase to 344 million by 2030 of these patients 2-6% develop complications to the diabetic foot annually [10], patients suffer from many disorders and complications, which leads to the aggravation of the problem and the decline of their health, and the complications of the disease the occurrence of diabetes foot[11], diabetic foot is caused by a number of causes including: foot ischemia, decreased blood vessel supply and weak immune response, changes in the foot and ulcers with damage to the peripheral nerves, causing loss of sense of the impact of collisions objects, and ends up the destruction of tissues and the incidence of gangrene[5], and Then to partial or total amputation of the foot, the ulcers are related to the presence of various microbes, whether aerobic or non-

Material and Methods

Population study and data collection:

The study was conducted on diabetes patients with diabetic foot visiting the outpatient clinic at Misurata Medical Center in the period from January to May 2016 , and after taking the written consent from the workplace and the oral consent of the patients, the patients were sampled in the morning after being diagnosed by the attending physician so that one day a week was identified with non-recurrence of the patient and information was collected such as sex and age of the patient.

Isolate the bacteria from diabetic foot:

The bandage was removed from the diabetic foot with used a sterile glove and the samples were taken by sterile cotton swabs by rotating them on the site of infection, and was inoculated on to the bacteria media (Blood agar, MacConkey agar, Chocolate agar).

Definition of isolated bacteria:

Table (1): antibiotic used of study.

Antibiotic	Concentration	Code
Imipenem	10µg	IMP
Amoxicillin clavulanic acid (Augmentin)	30µg	AMC
Ceftriaxone	30µg	CRO
Metronidazole	5µg	MTZ
Ciprofloxacin	5µg	CIP

Results and Discussion

The study was conducted in the period mentioned above and targeted diabetic foot patients and included 40 patients, it included

aerobic bacteria, the most important bacteria present on wounds are *Proteus spp*, *Pseudomonas spp*, *Staphylococcus aureus*, *Clostridium perfringens*, *Enterobacteria spp.* , *Escherichia coli* , recent studies have shown that antibiotic-resistant bacteria, whether resistant to methicillin or beta-lactamase-expressing bacteria are resistant to many antibiotic[11], which threaten the patient's life as well as amputation, the early diagnosis of bacteria by laboratory tests and the choice of appropriate antibiotic for treatment prevents the development of complications in the future, so this study addressed the identification of bacterial species isolated from the diabetic foot and the use of appropriate antibiotic.

Gram stain test was used to identify isolated between gram negative and positive bacteria, as used catalase test to differentiate between *Staphylococcus spp* and *Strepto cocci spp* and coagulation test used to differentiate between *Staphylococcus aureus* and other *Staphylococcus spp* and API20E test used definition for Gram negative bacteria, and *p. aeuiginosa* was identified by the oxidase test.

Sensitivity of the bacterial isolates to antibiotics commonly used:

Bacterial suspension and calibrated with standard were compared with a McFarland solution (0.5w / v) was prepared by a cotton swab, take from the bacterial suspension by swab cotton and plan the bacterial dish Mueller Hinton and leave the dish for 10 minutes to dry and used of Antibiotics are prescribed as shown in the table (1) and incubate at 37 ° C for 24 hours[12, 13]

28 men and 12 women, and the proportion of males 70%, while females 30% as figure(1) , similar to a study in Pakistan[14], where the

proportion of men is higher than females, the reason may be due to the lack of attention of men.

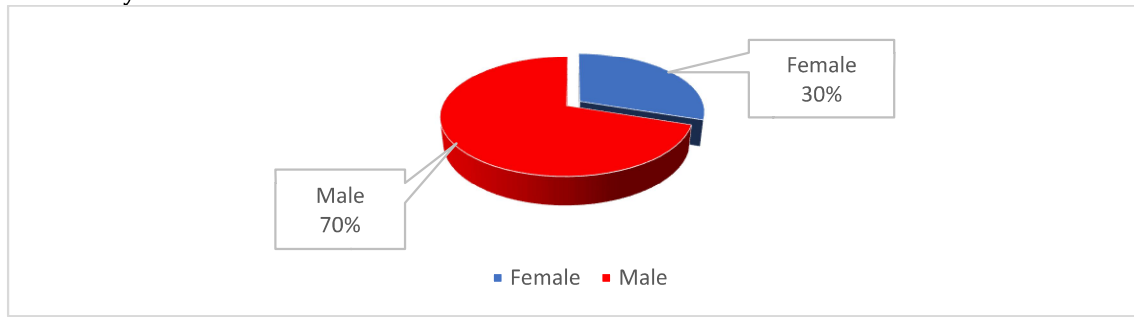


Figure (1): The proportion of males to women

While age ranged from 30 to 82 years and the majority of cases were between 50 and 69 year as table (2), the reason may be because the sample was taken randomly as for the

prevalence of diabetic foot is the lack of regulation of diabetes and attention to the feet of patients as similar age to study in India [15]

Table (2): age of cases.

Age groups	Male	Female	Total
30-49	6	5	11
50-69	13	6	19
70-82	9	1	10
	28	12	40

After taking the information from the cases found that the duration of diabetic foot for most cases 30 days while the duration ranged between a week to 3 years, the length of the

injury may be due to the lack of spread of awareness of the risk of developing diabetic foot among patients as table (3).

Table (3): Incidence period for cases.

Incidence period for cases	Number patient
1week- 1month	26
More than 1month-2month	2
More than 2month-4month	3
More than 4month -2year	9
	40

Also information on the type of treatment most of the cases were type I insulin-dependent in their treatment and there were 31 cases.

Sample were taken from the depth of the wound, isolating 63 bacterial isolates, which were 32 Gram negative bacterial isolates and 31Gram positive bacterial isolates it was similar to the study in India [16]as Figure (2).

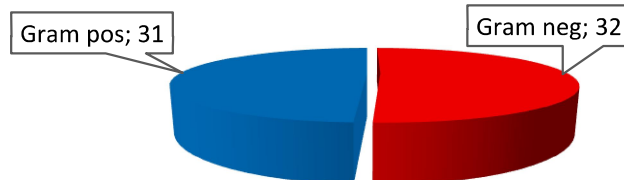


Figure (2): Number of gram positive and gram negative.

The results showed the presence of many bacteria for one patient polymicrobial 48%, and the proportion of monomicrobial 52%

same to the study in Sudan[17], the cause may be due to the length of the injury and showed in figure (3).

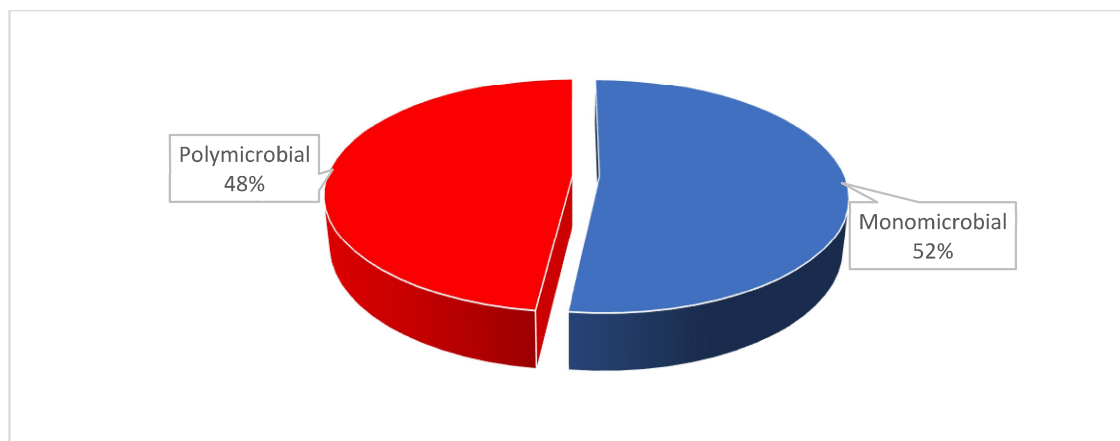


Figure (3): The proportion of monomicrobial to polymicrobial.

Sixty 63 bacterial isolates were isolated from the present study and included positive bacterial species *Staphylococcus spp* 48%, *Streptococcus spp* 2%, while Gram negative included *P. aeruginosa* 17%, *E. cloace* 3%, *K.*

oxytoca 5%, *K. pnemoniae* 3%, *S. orderifera* 1%, *P. stuatti* 5%, *P. mirabilis* 5%, *P. penneri* 2%, *P. vulgaris* 2%, *M. morganii* 2%, *S. marscens* 5%, *E. sakasaki* 1% as figure (4) , and it was similar to the study in Saudi [18].

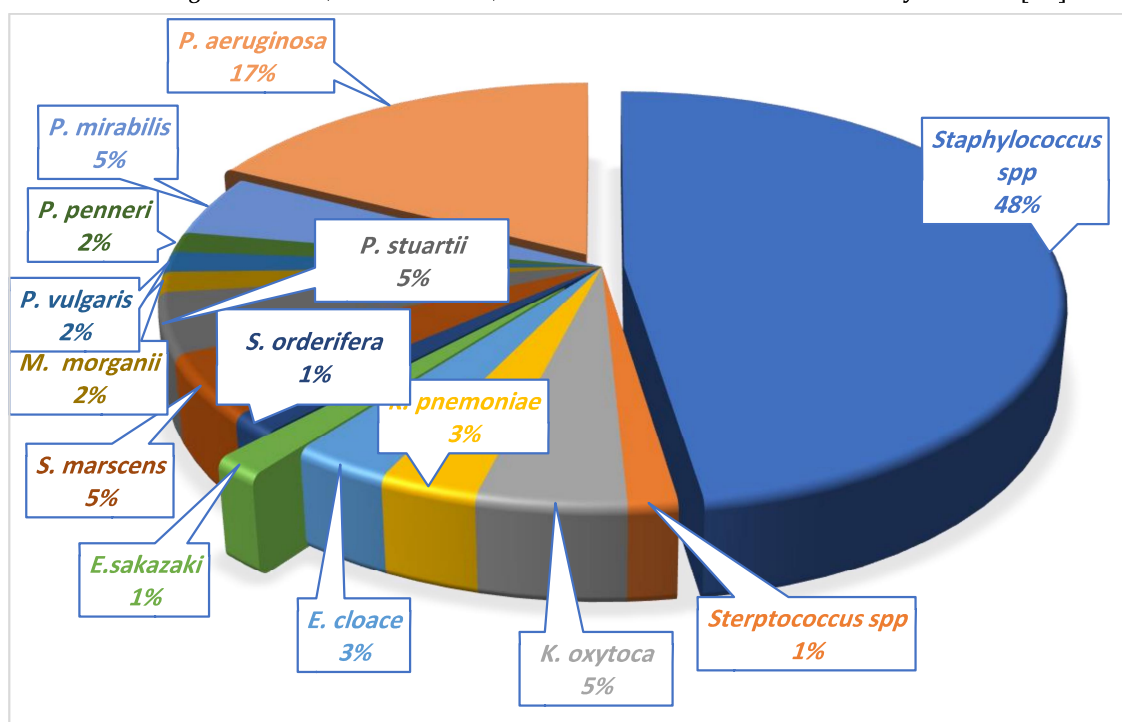


Figure (4): The percentage of gram-positive and gram-negative isolated bacteria from the diabetic foot.

Five types of antibiotics are among the most type commonly used, So that the effect of antibiotics on the isolated bacterial species is uneven, we find that the antibiotic the Amoxicillin clavulanic acid (Augmentin) showed an effect on most species, especially the bacterial species *proteus spp*, *E. sakazakii*, *K. pnemoniae* it was similar study [19], While the Imipenem antibiotic had an effect on most

species except *proteus spp* similar to the study in Saudi[18], While Ceftriaxone had no effect on *p. aeuginosa*, *Klebsiella spp*, *M. morganii*, *P. stuarii* not identical to the study in Egypt[20], While Ciprofloxacin had no effect on most of the isolated negative bacterial species except *p. mirabilis*, *K.oxytoca*, *M. morganii* similar to the study in India[21], While Metronidazole had no effect on positive and negative bacteria

not different to the study as in the two studies in India and Malaysia, the antibiotic had no

effect on bacteria [22, 23] as figure (5).

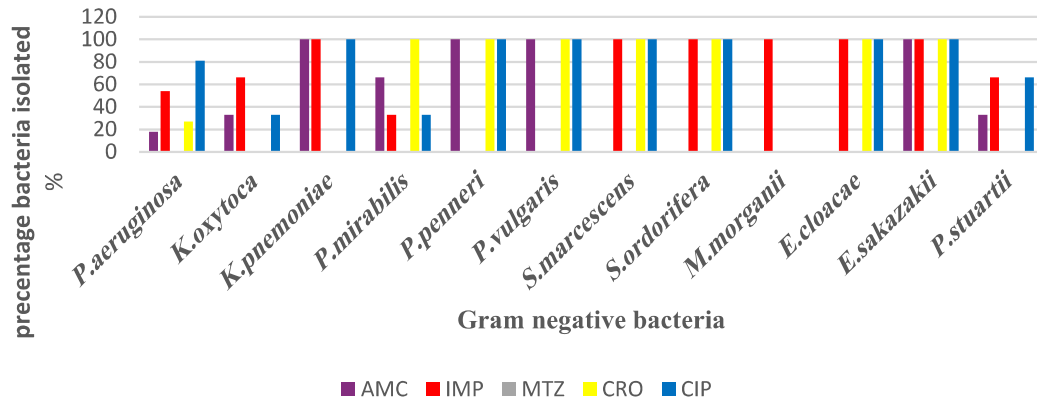


Figure (5): Effect of antibiotics used on negative bacteria isolated from diabetic foot.

While the effect of antibiotics on positive bacterial species was also different, we found that antibiotic Augmentin, Imipenem, and Ciprofloxacin had an effective effect on the

isolated bacterial isolates, while Ceftriaxone had no effect on the bacterial species *S. aureus*, *Gamma streptococcus* it was similar to the study in India (15) as figure (6).

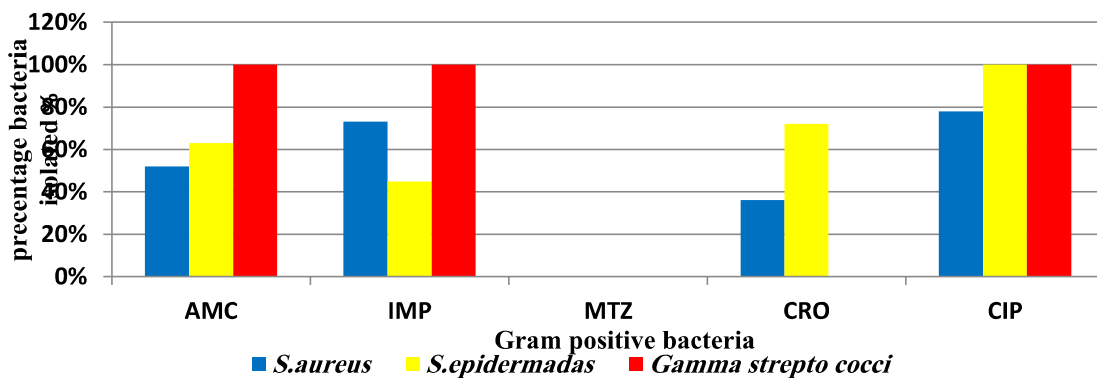


Figure (6): Effect of antibiotics used on positive bacteria isolated from diabetic foot.

Conclusions

We conclude from the current study that the antibiotics used varied in their effect on bacterial isolated negative and positive, we find

that most of the antibiotic still have an effect on bacteria, especially (Imipenem, Ciprofloxacin, Ceftriaxone), While Metronidazole did not have any effect on the bacterial species isolated from the diabetic foot.

Recommendations

- A. Take a sample of the patient before starting treatment by a doctor.
- B. Non-random use of antibiotics by the patient as this creates bacteria resistant to antibiotics.

- C. Intensive treatment of the wound by the doctor because the length of the injury, the foot is predisposed to the growth of more than a bacterial type.
- D. Another study on the diabetic foot of anaerobic bacterial isolates.

References

1. Alberti, K.G.M.M. and P.Z. Zimmet, *Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation.* Diabetic medicine, 1998. **15**(7): p. 539-553.
2. Alsaimary, I.E.A., *Bacterial wound infections in diabetic patients and their therapeutic implications.* Med Pract Rev, 2010. **1**(2): p. 12-15.
3. Atkinson, M.A. and G.S. Eisenbarth, *Type 1 diabetes: new perspectives on disease pathogenesis and treatment.* The Lancet, 2001. **358**(9277): p. 221-229.
4. Association, A.D., *Type 2 diabetes in children and adolescents.* Pediatrics, 2000. **105**(3): p. 671-680.
5. Markakis, K., F. Bowling, and A. Boulton, *The diabetic foot in 2015: an overview.* Diabetes/metabolism research and reviews, 2016. **32**: p. 169-178.
6. Bhatia, J., et al., *Postoperative wound infection in patients undergoing coronary artery bypass graft surgery: a prospective study with evaluation of risk factors.* Indian journal of medical microbiology, 2003. **21**(4): p. 246.
7. Armstrong, D.G., L.A. Lavery, and L.B. Harkless, *Validation of a diabetic wound classification system: the contribution of depth, infection, and ischemia to risk of amputation.* Diabetes care, 1998. **21**(5): p. 855-859.
8. Armstrong, D.G., A.J. Boulton, and S.A. Bus, *Diabetic foot ulcers and their recurrence.* New England Journal of Medicine, 2017. **376**(24): p. 2367-2375.
9. Sunilkumar, S., *Amputation of right little toe with traumatic ulcers in type-2 Diabetes Mellitus: Antibiotics and Split thickness Skin Grafting Technique (STSG).* International Journal of Pharmacy Research & Technology, 2020. **10**(1): p. 9-11.
10. Sikotara, D. and K.J. Patel, *A Clinical Study in Surgical Management of Diabetic Foot.* International Journal of Contemporary Surgery, 2017. **5**(2): p. 106-110.
11. Sugandhi, P. and D.A. Prasanth, *Bacteriological profile of diabetic foot infections.* nature, 2014. **3**(7): p. 1107-1111.
12. McFarland, J., *The nephelometer: an instrument for estimating the number of bacteria in suspensions used for calculating the opsonic index and for vaccines.* Journal of the American Medical Association, 1907. **49**(14): p. 1176-1178.
13. Wayne, P., *Performance standards for antimicrobial susceptibility testing. CLSI approved standard M100-S23.* Clin Lab Stand Inst, 2013. **33**: p. 118-156.
14. Miyan, Z., et al., *Microbiological pattern of diabetic foot infections at a tertiary care center in a developing country.* Age (years), 2017. **53**: p. 10.20.
15. Saraswathy, K.M., et al., *Bacteriological Profile and their Antibiotic Susceptibility Pattern in Diabetic Foot Ulcers in a Tertiary Care Hospital, Puducherry, India.* Int. J. Curr. Microbiol. App. Sci, 2017. **6**(3): p. 1560-1566.
16. Kavitha, Y., S. Mohan, and S.K. Moinuddin, *Bacteriological profile of diabetic foot infection with special reference to ESBL and MRSA in a coastal tertiary care teaching hospital.* Indian Journal of Microbiology Research, 2017. **4**(1): p. 68-73.
17. Ibrahim, S.A., *Frequency Rate of Microbial Wound Infections among Sudanese Diabetic Foot Patients.* African Journal of Medical Sciences, 2017. **2**(2).
18. El-Tahawy, A., *Bacteriology of diabetic foot.* Saudi medical journal, 2000. **21**(4): p. 344-347.
19. Bello, O.O., et al., *Antibiotic Susceptibility Profiles of Bacteria from Diabetic Foot Infections in Selected Teaching Hospitals in Southwestern Nigeria.* International Annals of Science, 2018. **4**(1): p. 1-13.
20. Hefni, A.A.-H., et al., *Bacteriological study of diabetic foot infection in Egypt.* Journal of the Arab Society for Medical Research, 2013. **8**(1): p. 26-32.
21. Elakkiya, K., et al., *International Journal of Current Research in Medical Sciences.* Int. J. Curr. Res. Med. Sci, 2016. **2**(1): p. 29-34.
22. Panda, B.K., S.S. Chandorkar, and N. Bafna, *CURRENT STATUS OF ANTIMICROBIAL PRESCRIBING PATTERN FOR DIABETIC FOOT IN INDIAN TERTIARY CARE TEACHING HOSPITAL.* BIOPHARM JOURNAL, 2017. **2**(3): p. 98-107.
23. Joehaimy, J., et al., *Pattern of Organisms and Antibiotics Used in Treating Diabetes Foot Infection.* International Medical Journal Malaysia, 2016. **15**(1).