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Clinicomicrobiological spectrum of diabetic foot infections in tertiary care hospital

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Abstract

Introduction: Diabetes mellitus is a major public health problem in India and worldwide. One of its most common and feared complications is Diabetic foot infections (DFIs), which, if neglected, very often terminate in limb amputation. Limb-threatening DFIs are usually polymicrobial. Proper management of these infections requires appropriate antimicrobial selection based on culture and antimicrobial susceptibility results; however, initial management comprises empirical antimicrobial therapy. Knowledge of likely etiologic agents can help guide this decision and result in limb salvage.

AIM of study: To study the common clinical presentation of DFIs, isolate the organisms responsible and to determine the antimicrobial susceptibility pattern of the isolates.

Materials and methods: During the period from Aug 2016-July2018, age, sex, clinical presentation of diabetic foot infections noted and pus and tissue samples were taken from the affected feet of 100 DFI patients and subjected to smear microscopy, culture & sensitivity. The antimicrobial susceptibility testing of the isolates was done by Kirby Bauer disc diffusion method.

Results: Most of the study patients males 70%, mean age 58years presented with advanced clinical features such as ulcer (56%), limb cellulitis (22%), Gangrene (14%) and abscess 8%. Overall, the most common isolate was Staphylococcus aureus (26%) second most common organism is klebsiella. Gram negative organisms (62%) were isolated more frequently than gram positive organisms (38%). Gram positive isolates showed 100% sensitivity towards linezolid. All the major groups of organisms showed high sensitivity towards third generation cephalosporins. High sensitivity towards imipenem, meropenem, and other newer generation antimicrobials including piperacillin-tazobactam, tigecycline and colistin was noted among the gram negative isolates.

Keywords: Clinicomicrobiological spectrum, infections, tertiary

Introduction

Diabetes is a global epidemic and a leading cause of death by disease. According to International Diabetes Federation 2017, the prevalence of diabetes is about 425 million people worldwide, or 8.8% of adults. In India, an estimated 72.9 million people suffer from diabetes; this figure is predicted to increase to 134.3 million by 2045 [1].

Diabetes is the most common underlying cause of foot ulcers, infection, and ischemia, which are among the most serious complications of diabetes.

Diabetic foot infection, defined as soft tissue or bone infection below the malleoli, is the most common complication of diabetes mellitus leading to hospitalization and the most frequent cause of non-traumatic lower extremity amputation [2].

Diabetic foot infections (DFIs) are a common and potentially serious problem in persons with diabetes. Compromise of blood supply from micro vascular disease, often in association with lack of sensation because of neuropathy, predisposes persons with diabetes mellitus to foot infections. They usually arise from either a skin ulceration that occurs secondarily to peripheral neuropathy or in a wound caused by some form of trauma. The infection usually involves one or more bacteria and can spread to contiguous tissues including bone, causing an osteomyelitis [3].

Among persons diagnosed as having diabetes mellitus, the lifetime risk of developing a foot ulcer is estimated to be 15%. Ulceration is the most common precursor of amputation and has been identified as a component in more than two-thirds of lower-limb amputations [4]. Lower extremity amputation may best exemplify the impact of diabetes because it is a measure of end-stage disease and, in many cases, treatment failure. Patients with diabetes are 15 to 30 times more likely to have an amputation than are patients without diabetes [5].

Proper management of these infections requires appropriate antimicrobial selection based on culture and antimicrobial susceptibility results; however, initial management comprises

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Empirical antimicrobial therapy. Knowledge of likely etiologic agents can help guide this decision and result in limb salvage. Hence in this study an attempt has been made to study the most common bacterial pathogens from the diabetic foot infections and antimicrobial susceptibility testing of the isolates and most common presentation of DFI

Objectives

To study the age sex, common clinical presentation of DFIs, isolate the organisms responsible and to determine the antimicrobial susceptibility pattern of the isolates.

Materials & Methods

Source of data: This study was conducted comprising of 100 patients of Diabetic foot diseases admitted in the surgical department of SS Institute of Medical Sciences & Research Center from August 2016 to July 2018 followed for a period of 3 months. Approved by ethical clearance committee

Inclusion Criteria

- 1) 100 cases of diabetic ulcers admitted in hospital from August 2016
- 2) All Patients in age group of 30-70 years
- 3) Patients with a known history of diabetes and diagnosed at time of admission with a diabetic foot disease.

Exclusion criteria

- 1) Patients with Patients with systemic disease like IHD, CKD, CVA are not included in the study.
- 2) Patients with venous ulcers are not included in the study.
- 3) Other clinically significant medical conditions that would impair wound healing including renal, hepatic, haematological, neurological and immunological diseases are not included.
- 4) Patients receiving corticosteroids, immunosuppressive agents, radiation, or chemotherapy within one month prior to entry into study were also excluded

Methods of collection of data

After registration and admission, detailed clinical history of patient taken. This was followed by detailed Clinical examination of patient with particular reference to the lesion of foot. The name, age, sex, address and profession of each patient was noted. The Clinical features were recorded in chronological order and each symptom was elaborated in detail. The institutional ethical clearance was obtained prior to the study. The informed consent was obtained from the patients prior to sampling. After clinical assessment of the enrolled cases, the ulcers were graded according to the Wagner’s grade.

Sample collection and antibiotic sensitivity

During the period from Aug 2016-July2018, pus and tissue samples were taken from the affected feet of 100 DFI patients and subjected to smear microscopy, culture & sensitivity. The antimicrobial susceptibility testing of the isolates was done by Kirby Bauer disc diffusion method.

Results

A total of 100 patients were presented in this study, which included 70(%) males and 30 (%) females. Highest number of cases were found in the age group of > 60 years. The average age of presentation of patient is 58years

Age of the participants	Total number of participants	Percentage
≤40 years	10	10%
41-50 years	21	21%
51-60 years	29	29%
≥ 60 years	40	40%
Total participants	100	100

Mean of age in years 58

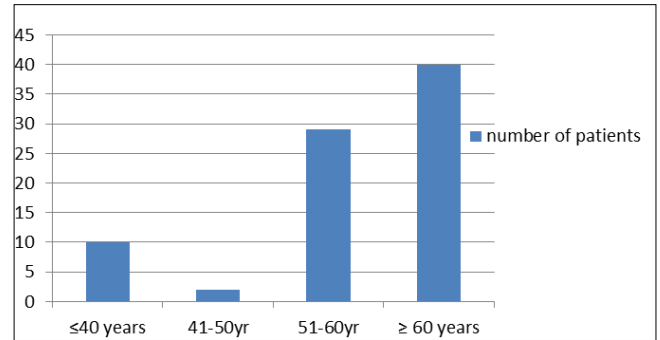


Fig 1: Age distribution

Table 2: Sex Distribution

Gender of the study participants	Total number of participants	Percentage
Male	70	70
Female	30	30
Total	100	100

Of the total 100 cases studied 70 are males and 30 are females

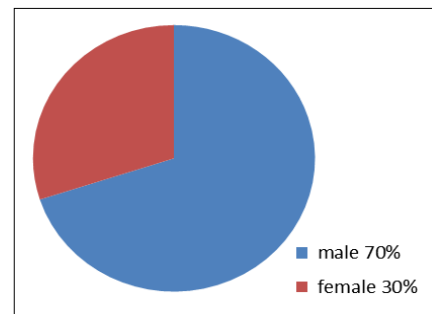
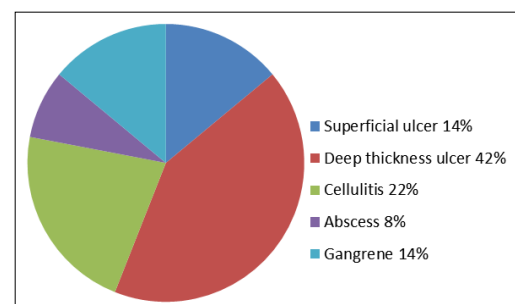


Fig 2: Sex Distribution

Table 3: Nature of lesion

Mode of presentation of the ulcer	Total number of participants	Percentage
Superficial ulcer	14	14
Deep thickness ulcer	42	42
Cellulitis	22	22
Abscess	8	8
Gangrene	14	14
Total	100	100



Graph 3: Mode of presentation

In our study Ulcers are the most common presentation (56%), which includes both superficial ulcer (14%) and deep ulcer (42%), followed by cellulitis (22%).

Table 4: Culture Results of the Study Participants

Cultural colonies	Total number of participants	Percentage
Proteus	12	12%
Klebsiella	20	20%
Pseudomonas	18	18%
Staphylococci	26	26%
Streptococci	12	12%
E. Coli	12	12%
Total	100	100%

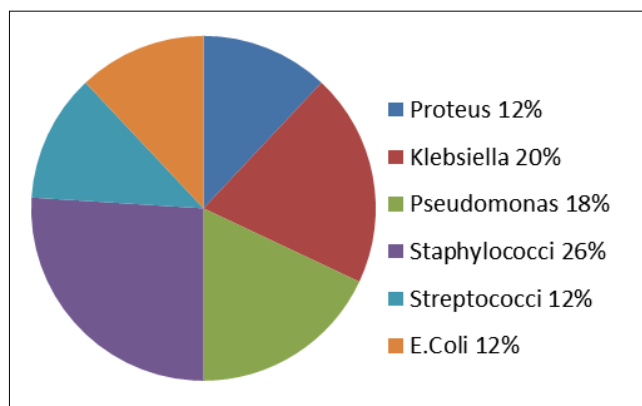


Fig 4: Cultural colonies

The commonest organism identified was staphylococcus followed by Klebsiella.

Overall, the most common isolate was Staphylococcus aureus (26%) second most common organism is klebsiella. Gram negative organisms (62%) were isolated more frequently than gram positive organisms (38%). Gram positive isolates showed 100% sensitivity towards linezolid. All the major groups of organisms showed high sensitivity towards third generation cephalosporins. High sensitivity towards imipenem, meropenem, and other newer generation antimicrobials including piperacillin-tazobactam, tigecycline and colistin was noted among the gram negative isolates.

Discussion

Diabetic foot ulcer (DFU) is the most common complication of diabetes mellitus that usually fail to heal, and leading to lower limb amputation. Early effective management of DFU as follows: education, blood sugar control, wound debridement, advanced dressing, offloading, advance therapies and in some cases surgery, can reduce the severity of complications, and also can improve overall quality of life of patients especially by using a multidisciplinary team approach.

Age - Age distribution of 100 cases, of which the age of young patient is 33 years and the age of eldest patient is 70 years. Highest number of cases were found in the age group of > 60 years. The average age of presentation of patient is 58 years.

Age	Present study	Madan <i>et al</i>	Gohel <i>et al</i> ¹⁷
< 40 yrs	10%	11%	12.5%
41-50 yrs	21%	15%	29.5%
51-60 yrs	29%	33%	27.5%
>60 yrs	40%	42%	30.5%

Majority of our cases were in the age group above 60 years,

same as in Madan *et al*^[6] and Gohel *et al*^[7], but the proportion of patient are slightly less when compared to study by Madan *et al*^[6], but more when compared to Gohel *et al*^[7]. The mean age of presentation in our study is 57.4 years, but it is 65 years in study conducted by Madan *et al*^[6]

Sex - Of the 100 cases studied 70 cases were males and 30 cases were females. As compared to study by D G Mote *et al*,^[10] Madan *et al*^[6] Griffith and Jeffery⁸ and there are more male patients and less female patients in our study. Higher incidence of diabetic foot in males may be due to the exposure to injuries during their work, which subsequently leads to injury mostly to the insensitive foot and also can be attributed to habit of smoking.

Sex	Present study	D G Mote <i>et al</i> ¹⁰	Madan <i>et al</i> ⁶	Giffith and Jeffery <i>et al</i> ^[8]
Male	78%	66.66%	70%	60%
Female	22%	33.33%	30%	40%

Mode of Presentation

Of the 100 cases studied, ulcer 56% was the most common presentation followed by cellulitis 22%. In our study ulcer is classified again in to superficial ulcer 14% and deep thickness ulcer 42%. Superficial ulcers include lesions that involve skin and immediate subcutaneous tissue, where as deep thickness ulcers are deeper and may penetrate to tendon, bone or joint capsule. Abscess was seen in 8%, gangrene was seen in 14% of the patients. 8% of the patients had lesion which required amputation.

Mode of presentation	Present study	Madan <i>et al</i> ^[6]	Gohel <i>et al</i> ^[7]
Abscess	8%	10%	54.5%
Cellulitis	22%	8%	8.5%
Ulcer	56%	66%	8%
Gangrene	14%	16%	29%

As compared to the study by Madan *et al*,^[6] there are more cellulitis and less ulcer cases in our study. Both abscess and gangrene are comparable to the study by Madan *et al*,⁶ but abscess and gangrene are more in study by Gohel.⁷ The occurrence of these lesions are common in agriculturists who walk barefoot and are prone for infections.

Bacteriology of infections

Culture colonies	Present study	Madan <i>et al</i> ⁶	Md Shakeel <i>et al</i> ⁹
Staphylococci	30%	32%	40%
Streptococci	12%	2%	11%
Klebsiella	20%	12%	17%
Pseudomonas	18%	20%	19%
E.coli	12%	17%	13%
Proteus	14%	9%	-

Diabetic foot infection is usually polymicrobial in nature consisting of gram

Positive and gram negative aerobes as well as anaerobes. Most common organism isolated is Staphylococci 30%, but proportion is less when compared to the study by Madan *et al*^[6] 32%, Md Shakeel^[9] 40%, and D G Mote *et al*^[10] 43.3%. Klebsiella is the second most common organism isolated in our study. However when deeper tissues are invaded by the organisms, anaerobes are more frequently found.

Overall, the most common isolate was Staphylococcus aureus

(26%) second most common organism is klebsiella. Gram negative organisms (62%) were isolated more frequently than gram positive organisms (38%). Gram positive isolates showed 100% sensitivity towards linezolid. All the major groups of organisms showed high sensitivity towards third generation cephalosporins. High sensitivity towards imipenem, meropenem, and other newer generation antimicrobials including piperacillin-tazobactam, tigecycline and colistin was noted among the gram negative isolates.

Conclusion

Proper education and awareness about DFIs, aggressive antimicrobial therapy and foot care can reduce the associated morbidity and help in limb salvage. Initial empirical therapy with a broad spectrum antimicrobial such as third generation cephalosporins is recommended. With several reported advantages, including excellent efficacy, good soft tissue penetration and tissue concentrations even in the presence of limb ischemia, significantly shorter length of hospital stay, decreased parenteral antibiotic duration and higher early discharge rates, ability to institute oral-only therapy on an out-patient basis, and consequent cost-effectiveness, linezolid has emerged as a good treatment choice in pure gram positive infections, especially against multidrug resistant strains, and in chronic, recalcitrant cases

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