Clinical Profile of Diabetic Foot and its Correlation with Microbiological Profile: A Prospective Study

Mohan Kumar[1], Vinay V.[2]

[1]Assistant Professor [2]Post Graduate, Department of General Surgery, MVJ Medical College and Research Hospital, Hoskote, Banagalore, Karnataka 562114, India.

Abstract

Objective of the study: 1. To study the clinical profile [mode of presentations– ulcer, gangrene, callosity, cellulitis] of diabetic foot. 2. To study the morbidity profile [limb salvage surgery, amputations] of diabetic foot. 3. To study the microbiological profile [type of organisms], antibiotic sensitivity and correlate it with prognosis. *Materials and Methods:* Study includes patients admitted in surgery department M.V.J Medical College & Research Hospital, Hoskote, Bangalore for diabetic foot. A total of 100 patients studied who had diabetic foot were studied. The study period was from january 2015 to July 2016. *Conclusion:* Based on the results of our study, it can be concluded that diabetic foot inVarious forms accounts for significant morbidity in the surgical wards. The factors Contributing mainly are poor glycemic control at the time of admission, presence of gangrene, associated risk factors like smoking, alcohol consumption and associated comorbidities (anemia, peripheral vascular disease, Hypertension, Ischemic disease). Diabetic foot infections are more prone for recurrence so preventive measures like diabetic control, foot care is needed. Multidisciplinary approach is needed in the control of diabetic foot infections and its complications.

Keywords: Clinical Profile of Diabetic Foot; Microbiological Profile.

Introduction

India has a diabetic population of about 50.8 million, which is expected to increase to 87million by 2030.[1]

Diabetic foot is one of the most feared complications of diabetes and is the leading cause of hospitalization in diabetic patients. Diabetic foot is characterized by several pathological complications such as neuropathy, peripheral vascular disease, foot ulceration, and infectionwith or without osteomyelitis, leading to the development of gangrene and even necessitating limb amputation [2,3].

Diabetic patients have a lifetime risk as high as 25% for developing foot ulceration [4].

Diabetic ulcers have 15–46 times higher risk of limb amputation when compared with foot ulcers dueto other causes [5].

Every year, more than a million diabetic patients require limb amputation [2].

Infected foot ulcer is a common cause of morbidity in diabetic patients, ultimately leading todreaded complications such as gangrene and amputations. Infection is most often a consequence of foot ulceration, which typically occurs after trauma to a neuropathic foot [6].

These infections are polymicrobial in nature. Escherichia coli, Proteus spp., Pseudomonas spp., Staphylococcus aureus and Enterococcus spp., are reported as frequent organism isolated from cases of diabetic foot infections [7]. The presence of MRSA and ESBL strains further worsen the prognosis and increase the risk of amputation [8].

Hence there arises the need to evaluate these infecting microorganisms on a routine basis in

addition to administering regular glycemic control, wound care, surgical debridement, pressure-off loading andmaintaining adequate blood supply.

Materials and Method

A prospective study was carried out on 100 patients with diabetic foot ulcers at M V J Medical College and Research Hospital, Hoskote over one and half years [January 2015 to july 2016].

Diabetic foot infection is defined as the presence of ulcers (superficial to deep) on examination or evidence of inflammation, i.e. cellulitis or purulent discharge, or evidence of necrosis, with or without osteomyelitis or systemic toxicity.

Diabetics are diagnosed on the basis of fasting plasma glucose of 126 mg/dl and above and a random plasma concentration of 200 mg/dl or more, on 2 different occasions.

History includes–Duration of diabetes mellitus, History of smoking, History of alcohol comsumption, History of ischaemic heart disease, History of treatment, Duration of ulcer, History of any antibiotic treatment before admission, History of previous amputation

Examination for ischemia–by pulsations of Dorsalispedis, Posterior tibial artery, Popliteal artery and Femoral artery.

- Ankle brachial index.

Investigations include

- FBS, PPBS. urine routine, urine ketone bodies.

- Pus culture and antibiotic sensitivity.

- X-Rays, Arterial Doppler, Categorisation of foot ulcers into five types based on Wagner's classification.

Treatment includes: Antibiotic, Limb saving procedures (debridement, skin grafting), Amputation

Laboratory procedures: Specimens for microbiological studies were obtained from the ulcer region.

By Direct smear, isolation, identification and antibiotic sensitivity of the microorganisms will be done according to standard microbiological procedures. Antimicrobial susceptibility testing will be performed by Kirby Bauer disc diffusion method as recommended by the Clinical and Laboratory standard Institute.

Inclusion Criteria

All adult patients (above 18 years) previously or newly diagnosed with diabetes mellitus presenting with foot infections of Wagner grade 1 or more.

Exclusion Criteria

1. Diabetic patients with Varicose ulcer, TAO.

2. Diabetic foot associated with conditions requiring antibiotics.[ie-pneumonia]

Statistical Calculation

Descriptive and inferential statistical analysis has been carried out in thepresent study.

Results

Majority of the people in this study belonged to the agegroup of 50-70 years. 20% of them were in the age group of 40-49, 27% in between the age of 50-59 years, 29% were in the age of 60-69 and 20% were in the age of 70-79 years.

Majority of the patients who presented with diabetic foot were males (81%), while females accounted for only 19% indicating a marked difference in the gender.

Most of the patients were ignorant in expressing the preciseduration of diabetes mellitus. However from the best of their knowledge it was expressed thattheaverage duration available, was 29% (1-5 years), 13% (6-10 years) and 13% (10-15 years)respectively.

Mode of Presentation: Diabetic foot complications manifests in various forms and here it was observed that 49% patients presented with ulcer, 24% with abscess, 18% with gangrene, and 09% with cellulitis

Duration of ulcer: In our study 31% of patients had<2 months duration, 37% had 2-3 months duration and 32% had 3-6 months duration.

Comorbidities: Majority of the patients affected with diabetes have also other comorbitieslike anemia (40%), hypertension (53%), COPD (07%) ofcases.
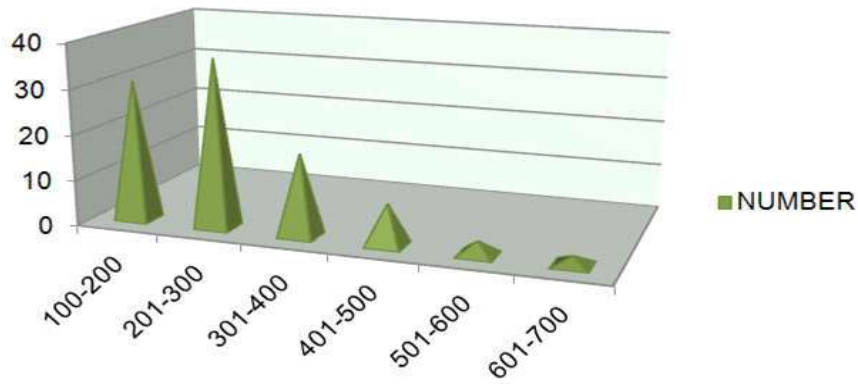
Surgery: Out of 100 patients 25% of them had previous surgical procedurelike disarticulation whereas rest of them do not have any previous surgeries.

Associated Risk Factors: Among 100 patients 74% had history of smoking and 54% had a history of alcohol whereas 45% had a history of both smoking and alcohol. Smoking plays important role in development of diabetic foot infection.
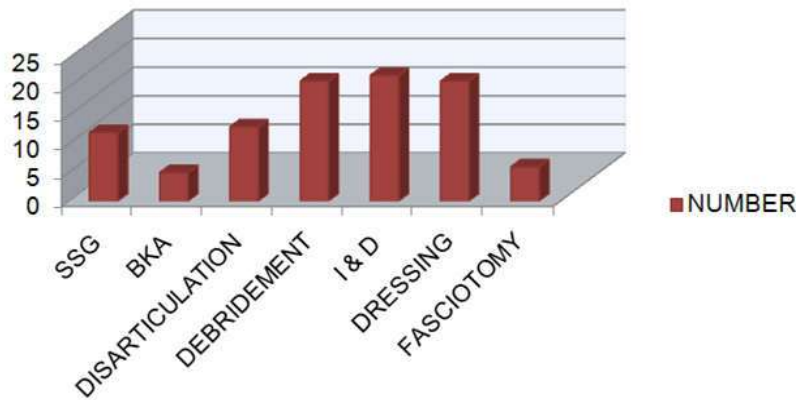
Random Blood Glucose Level: In majority of our patients the RBS was found to be in the range 0f 201-300 (37%), and 100- 200 in 31% cases, 301-400 in 18% of cases, 401-500 in 09% cases, 501-600 in 3% cases, and 601-700 in 2% cases. (Graph 1).

Surgical Treatment Given: Dressing, Incision and drainage (22%) and wound debridement/slough excision (21%) formed the major chunk of surgical intervention, whereas 13% of them underwent toe disarticulation and also 12% had split skin grafting, 5% had below knee amputation while fasciotomy was done in 6% of the cases. (Graph 2).

Treatment of Diabetes: Around 42% of the cases were treated with oral hypoglycemics, 24% with insulin, and 31% with both before admission.

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Graph 1:

Graph 2:

Wagners Grading: In this study, it was observed that majority cases fall under Wagner grade II (34%), followed by grade III (32%), and followed by grade I in 17% of cases. (Table 1).

Microbiological Study: The study showed 55% cases had a single microbial growth (55%) whereas 19% had multiple microbial growth. (Table 2).

Table 1:

Grade	Number	Percentage
1	17	17%
2	34	34%
3	32	32%
4	17	17%

Organisms Isolated

SITE: Majority of affected patients had ulcer in the toe (31%) followed by in heal in 19% cases, in the forefoot and below lateral malleolus with 17% in each and in midfoot in 11% cases (Table 3 and Graph 3, 4)

Table 2:

Organisms	Number	Percentage
Single	55	55%
Multiple	19	19%
No organisms	26	26%

Table 3:

| Organisms	Number	Percentage
Streptococcus	02	2.7%
Staphylococcus	25	33.78%
Klebsiella	14	18.9%
Proteus	09	12.1%
E.COLI	13	17.5%
MRSA	06	8.1%
PSEUDOMONAS	16	21.6%
ENTEROCOCCI	08	10.8%

Discussion

Based on the analysis of the results and comparing with other similar studies, following inferences can be drawn:

1. *Sex distribution:* In our study, diabetic foot was dominated by males (81%) which is comparable with the study done by C. Manikandan (1). This may be due to increased exposure of males to trivial trauma to the foot where as females are mostly indoors.

2. *Age Distribution:* Most of the patients belong to age group 60-69 years (29%), 50-59 years (27%), 70-79 years and 40-49 years (20%), <39 years (1%) and >80 years (3%).

Organisms Isolated

Graph 3:

Mode of Presentation of Organisms
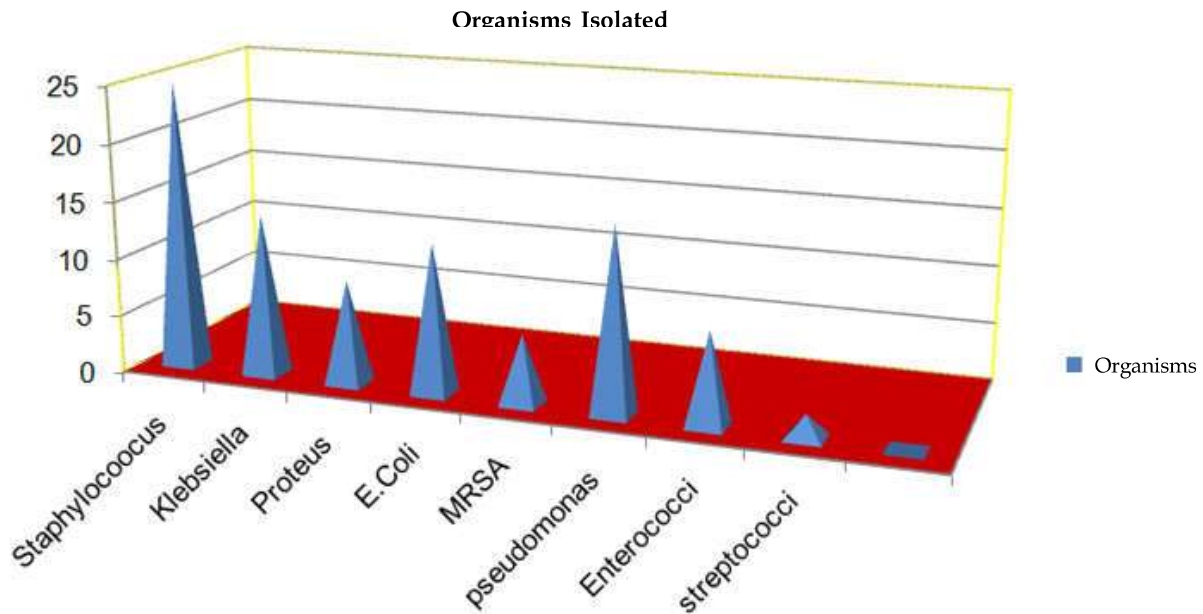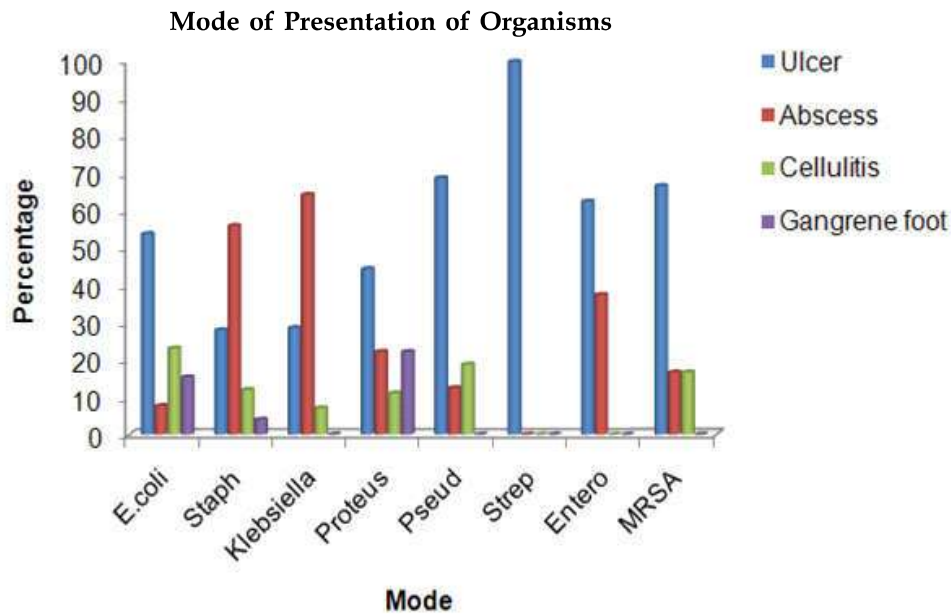
Graph 4:

In Bansal et al. [2], among those with diabetic foot ulcer 56.31% were in the age group of 51-70years which is comparable to our study. In C. Manikandan (66) study, 40-60 years were 46.3 and 60-80 years were 38.1%.

4. *Duration of diabetes mellitus:* The duration for which patient is suffering from diabetes is directly related to the degree of wounds and also indirectly making the patient more vulnerable due to the complications of diabetes like nephropathy, neuropathy and retinopathy in long term disease. 38% suffered from diabetes mellitus for 6-10 years followed by 1-5 years (32%) and 11-15years accounting for 18%.

In Bansal et al, 48.54% had diabetes mellitus for more than 10 years. Duration of foot infection in our study, 2-3 months were 37%, 3-6 months were 32%

and < 2 months were 31%whichis comparable to C. Manikandan study [1].

5. *Mode of presentation*: Patients with diabetic foot can manifest in myriad forms rangingfrom trivial non healing ulcer, abscess, toe gangrene, callosities to the florid necrotizing fasciitis and wet gangrene.

In our study, majority of them presented with abscess (24%), followed by 58% of the patients presented with cellulitis and foot ulcers. 18% had gangrene of one or more toes at the time of admission itself. It was noted that one fifth of the patients already had gangrene of one ormore toes at the time of admission that inevitably ended up in amputation.

6. *Wagners grading:* This is the most commonly and widely accepted classification forgrading of diabetic foot based on the depth of the wound.

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In our study, all grades except grade 5 wound were found. Grade 2 was the most predominantgroup constituting 34% which is comparable with the study by Catherine et al. (3) where Wagner grade 2 (30%) and grade 4 (36%) were the observations and in C. Manikandan [1] study grade 2 were 22%.

7. *Mode of treatmentof diabetes*: In our study 42% were treated with oral hypoglycemic drugs and 24% were treated with insulin which is comparable to C. Manikandan [1] study were 38.8% treated withOHA and 29.9% with insulin.

8. *Treatment:* The treatment options for diabetic foot are numerous depending on thevarious modes of presentation.

    Incision and drainage (22%), wound debridement/slough excision (21%) formed the majorchunk of the surgical intervention in our study which is consistent with the common modes of presentation (abscess, ulcer) as mentioned above. 13% underwent toe (single or multiple) disarticulation and 5% had below knee amputation. 12% of the diabetic foot were treated with split thickness skin grafting after dressing anddebridement.

    Out of 100 patients in our study 25% patients underwent disarticulation before.

9. *Associated co morbidities*: The diabetic foot complications are aggravated becauseof the commonly associated co morbidities like hypertension, anemia, peripheral arterialocclusive disease and ischemic heart disease. About half (53%) of patients had hypertension at the time of admission, 40% had anemia and 12% of the patients had ischemic heart disease.

    In Catherine et al., 25.4% had hypertension and 35.7% suffered from ischemic heart disease which is quite high compared to our study.

    Associated risk factors in our study showed 74% were smoker and 54% were alcoholic

10. *Glycemic control:* 69% of the patients had random blood sugar, more than 200 mg/dl and These results are comparable with Bansal et al. where random blood sugar >200mg/dl wasfound in 67%.

11. *Duration of hospital stay (post intervention)*: Diabetic foot is commonly associated with lengthy hospital stay adding on to the financial burden of the patients. In our study around 70% of patients stayed 20-30 days.

12. *Culture and sensitivity profile of the organism isolated from the wounds:*

- *Type and number of the organism isolated per culture:*

    ¤ Gram negative organism (58%) were the major isolates in our study which is comparable toC.Manikandan study in which 57.4% were gram negative organisms.

¤ 55% had grown single organism on culture. In C. Manikandan study 89.5% showed singleorganisms.

¤ Staphylococcus was the most common bacteria isolated constitutes 33.8%. In C. Manikandan study S. aureus and E. coli was the most predominant organism isolated from the lesions

¤ MRSA accounted for 8.1% of all the organism which forms a major chunk.

¤ Bansal et al. found that gram negative comprised 76% and Pseudomonas was the mostcommon isolate followed by Staphylococcus (18.18%).

¤ In Catherine et al., more than half (65%) presented with single organism.

¤ Proteus, being the most organism (13%) followed by E. Coli (12%).

- *Antibiotic sensitivity:*

    ¤ E. Coli – sensitive to Gentamicin, ciprofloxacin, cefotaxime.

    ¤ MRSA – are sensitive to Linezolid, Vancomycin and cotrimoxazole.

    ¤ Kleibsiella - all are sensitive to Imipenem and Meropenem.

    ¤ Staphylococcus-mostlysensitive to Ceftriaxone, Cotrimoxazole, levofloxacin, linezolid, cefotaxime.

    ¤ Pseudomonas - sensitive to gentamycin , Ceftriaxone-Sulbactam, Imipenem and piperacillin.

    ¤ In C. Manikandan [1] study the antimicrobial susceptibility pattern showed ofloxacin, vancomycin, ciprofloxacin, erythromycin and amoxyclav as effective antibiotics against grampositive organism while amikacin, cefotaxime, ceftazidime, ceftriaxone, gentamicin andimipenem as effective antibiotic against gram negative organism.

    ¤ Proteus-sensitive toimipenem, Piperacillin-Tazobactam, crfotaxime.

    ¤ In Bansal et al. >75% of gram positive strains were sensitive to Cephalosporins.

    ¤ Pseudomonas-sensitive to Amikacin, Cefoperazone- Sulbactam and Imipenem.

    ¤ All these are comparable to our study.

    ¤ All MRSA strains were sensitive to Vancomycin and resistant to Ampicillin and gentamicin which is similar to our findings.

13. *Association of bacteria with Wagner grading:*Majority of grade 2, 3 and 4 wounds isolated Staphylococcus and Pseudomonas in our study. MRSA equally distribute among grade 2 and 3 wounds

14. *Association of the mode of presentation with type of organism:* Staphylococcus and klebsiella was the most common organism grown in diabetic foot

with abscess. Pseudomonas, E.coli, proteus, enterococci and MRSA predominantly found in patients presenting with foot ulcers.

15. *Site*- In our study 31% of patient had toe infection/abscess/ulcer, 19% in heal, 17% over fore foot.

Conclusion

The study was done in MVJ Medical college and research hospital in department of general surgery showed that early diagnosis and treatment of diabetes is needed in the prevention ofdevelopment of foot infections. Diabetes is more common in males and they are more prone todevelop foot infections because of risk factors like smoking, alcohol consumption etc. Gram negative organisms are more common in the study but staphylococcus was most common organism isolated. Most common mode of presentation is ulcer and site is toes. Medical education to rural patients having diabetes regarding predisposing factors like smoking, alcohol consumption etc to prevent the complications of diabetes. Culture and sensitivity is needed very early in diabetic foot infection to prevent disarticulation and amputations along with good glycemic control. Diabetic patients are prone to recurrent foot infections so preventive measures in the form of glycemic control, local care etc are needed.

Multidisciplinary approach is needed in the control of diabetic foot infections and its complications.

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