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Original Research Article

A Clinical Study in Diagnosis and Management of Diabetic Foot

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Abstract: India has the dubious distinction of becoming the diabetic capital of the world within the next few years; with its attendant complications, it is going to burden the resources of the country. The countries with the greatest number of individuals with diabetes in 2013 are China and India. A majority of diabetic patients develop foot ulcers in one point of time or other during the course of their illness. A significant number of such patients will require long-term hospital treatment and amputations. The etiopathogenesis of diabetic foot lesions are multifactorial. The classical triad of neuropathy, ischaemia and infection characterizes the diabetic foot. The objective of study is to analyse the various modes of clinical presentation. To determine commonest microorganisms infecting the diabetics and to evaluate the usefulness of management protocols with special emphasis on strict glycaemic control. This is a prospective study of 50 diabetic patients with foot problems who attended department of General Surgery of Mahadevappa Rampure Medical College, Kalaburagi from December 2015 to May 2016. These patients underwent thorough evaluation and treatment on IPD basis. Documentations of patients which includes identification, history, clinical findings, investigative tests, treatment given were all recorded in a proforma. In our series of 50 patients, the highest incidence was in the age group of 51-60 years with mean age of 61.2 years, 76% were males; most common presentation was cellulitis(50%). 72% of them had history of trauma, most have duration of diabetes 1-5 years. Majority had both neuropathy and vascular disease, only 20% had osteomyelitis; majority were farmers(54%), and most common organism was Staph aureus. Only 16% had HbA1 c level < 7mg% and they have shorter hospital stay. Most common presentation was cellulitis. Common etiology was trauma. Most common organism infecting was Staph aureus. Most common modality of treatment was debridement and patients whose HbAlc was <7mg% had shorter hospital stay indicating strict glycemic control was necessary for better wound healing.
Keywords: Diabetic foot lesions, Debridement, Osteomyelitis, STSG

INTRODUCTION

India has the dubious distinction of becoming the diabetic capital of the world within the next few years; with its attendant complications, it is going to burden the resources of the country. The countries with the greatest number of individuals with diabetes in 2013 are China and India [1]. A majority of diabetic patients develop foot ulcers in one point of time or other during the course of their illness. A significant number of such patients will require long-term hospital treatment and amputations. The etiopathogenesis of diabetic foot lesions are multifactorial. The classical triad of neuropathy, ischaemia and infection characterizes the diabetic foot [2].

Diabetes is a worldwide problem [3]. A majority of diabetic patients develop foot ulcers in one point of time or other during the course of their illness. A significant number of such patients will require long-term hospital treatment and amputations. The etiopathogenesis of diabetic foot lesions were multifactorial. Diabetic neuropathies, vasculopathy, poor control of diabetes and bacterial infection are some of them.

The reasons for diabetic foot are;

1. Foot is the most vulnerable part of body for injury and infection neglected by patient.
2. The site of preference for neuropathy and ischaemia is also the foot. Diabetes is one of the major problems of this generation with worldwide dimension.

According to Modi *et al.*, overall incidence of diabetics in India is 1.2%. The death in each year is due to its complications (2.1% in urban, 1.5% in rural), which are usually common in age group of 40 — 60 years affecting both sexes equally. The complications are more prevalent among the people of lower economic due to negligence, illiteracy and poverty.

Need for study

Frequent complication of diabetes mellitus is foot infection. This affects l2% of patients with diabetes mellitus and remains one of the leading reason for the patients morbidity. As the diabetes mellitus has become a common men's disease, many diabetic patients presents with foot infections and also with serious foot complications to Mahadevappa Rampure Medical College, Kalaburagi. If it is neglected patient may lose his foot and also his life. Treatment includes thorough wound management, good microbiological control using appropriate antibiotics and strict glycemic control. Many recent approaches like vacuum dressing, platelet derived growth factors, larval therapy have revolutionized the management of diabetic foot. Hence the present study has been undertaken to evaluate the predisposing factors, modes of presentation and management protocols in diabetic foot. Diabetes has been the disease affecting younger age to old age causing significant burden in life style, thus making a need to study on age pattern and occupation of the patient. Long standing uncontrolled diabetes causes peripheral vascular changes and neurological changes which aggravates the disease course through ulceration, infections, deformities and other systemic complications, making an impetus to study the mode of presentation and various measures to prevent these complications.

OBJECTIVES OF THE STUDY

1. To analyse the various modes of clinical presentation.
2. To determine commonest micro organism infecting the diabetics.
3. To evaluate the usefulness of management protocols with special emphasis on strict glycaemic control.

Wagner diabetic foot lesion grading system [4]

Table 1: Wagner Grades lesions of diabetic foot from 0-5 by depth and extent

Grade	Description
0	No ulcer but high risk foot
1	Superficial ulcer (Commonest site is head of 1st metatarsal)
2	Deep ulcer with no bony involvement
3	Abscess with bony involvement
4	Localised gangrene
5	Gangrene of whole foot.

Complications of diabetic ulcers

- Cellulitis
- Necrosis
- Septicemia
- Osteomyelitis
- Abscess
- Charcot foot

Investigations [5]

The following investigations are done for the diagnosis and treatment of diabetic foot:

1. To demonstrate the extent and severity of the disease process.
2. To screen diabetic patients for peripheral vascular insufficiency.
3. To confirm and control the diseases interfering with the healing process.

Urine Examination

- Albumin
- Sugar

Glycosuria: Glucose in urine in concentration less than 0.1 % to be considered normal. Benedict' qualitative and quantitative test, enzymatic test, and clinical tests are used.

Ketonuria: If glucose is present in urine, ketone bodies should also be determined. It can be detected by Rotheras acetone test. It is the first sign to be recognised in ketosis.

Blood Examination [5]

Fasting Blood Sugar: Hyperglycemia is most decisive indication of diabetes. Fasting blood sugar more than-126 mg% is indicative of diabetes.

Post Prandial Blood Sugar: After overnight fasting, the patient is given breakfast of 100 gms of carbohydrates. Then venous blood is checked for glucose level every half hour for two hours, if it exceeds 180 mg% is indicative of diabetes mellitus.

Oral Glucose Tolerance Test: Sample of blood and urine are taken prior to the test. 100 gms of glucose in water are administered orally to an overnight fasting patient. Once again venous blood and urine samples are taken half-hourly intervals. For about two to three hours blood samples are examined quantitatively and urine sample quantitatively for glucose. This gives glucose tolerance curve.

In normal subject fasting blood sugar is 80-120 mg % and peak of the curve is not above 180 mg %. The blood sugar value returns to normal fasting level or slightly lower at the end of two hours and there is no sugar in any sample.

Intravenous Glucose Tolerance Test: Intravenous GTT is indicated in certain conditions where there is inadequate absorption of glucose from intestine as in steatorrhoea, pancreatic islet cell tumours, Addison's disease, hypopituitary states or post-gastrectomy syndrome.

Cortisone Glucose Tolerance Test: This test may reveal prediabetic patients especially in relatives of known diabetics. Cortisone promotes intolerance in latent or mild diabetes.

HbA1C Levels In Blood[5]: Its method of assessing long term glycemic control that is for about 3 months. It is measured once in 3 months and the target suggested by International federation of diabetes is 6.5% and in general <7%.

Lipid Profile5: Optimum level of LDL is <100 mg/dl, HDL is>40 mg /dl and total cholesterol is <200 mg/dl.

Culture And Sensitivity Tests

Pus from infected area is cultured for microorganisms and their sensitivity to various antibiotics is tested so that appropriate antibiotic can be administered to control the infection.

X-Ray [6]

X-ray of the foot should be taken, if there is any suspicious infection deep to the foot e.g. abscess or osteomyelitis. The sign, which suggests the presence of osteomyelitis, is destruction of bone commonly seen at metatarsophalangeal joint or in the interphalangeal joint of the great toe. Sequestrum and subperiosteal new bones formations are common. A small amount of gas in the tissues or in the abscess cavity may be seen.

Several equipments are used to determine the hemodynamic status in an entirely non invasive fashion:

1. Toe pressure

They provide a highly accurate method for determining the success in the healing of an ulcer or in minor amputation. A toe pressure of 20 - 30 mm Hg, below which healing is doubtful.

2. Duplex scanning with ultrasound analysis (Doppler study)

The recorded Doppler signal is used in two ways:

• To measure segmental systolic pressure

• To provide flow velocity wave form patterns for analysis

This combines B - mode anatomic capabilities of revealing the location and amount of vessel lumen and stenosis can be recorded with Doppler derived velocity recordings.

3. Others

- Photoplethysmography
- Segmental Pressure
- Waveform Evaluation

Invasive Techniques

1. Angiography
2. Digital subtraction angiography
3. Radionuclide bone scintigraphy
4. Computed tomography
5. Magnetic resonance imaging

Conservative Management Of Diabetic Foot [7]

Diabetic foot is usually dry due to automatic neuropathy. This will lead to cracks and maceration and subsequent infection. Hence lubricants such as petroleum jelly, non-scented hand lotions or aqueous lanolin are used. Lubricants should not be used in between toes.

Treatment Of Diabetic Foot Ulcers [8]

The treatment of infected diabetic foot ulcers is difficult problem and can be divided into two major categories namely the primary and secondary approach. The primary approach in treatment of foot ulcer consists of

1. Evaluation: Clinically as well as radiologically to establish depth presence of osteomyelitis and foreign bodies.
2. Metabolic control: Leucocytes do not function well when blood sugar is high. Strict perioperative control of blood glucose levels is mandatory [9].
3. Culture: Should be cultured aerobically.
4. Antibiotic Therapy: Begin at once and then changed according to antibiotic sensitivity. Parenteral antibiotics are preferred as oral route fails to achieve therapeutic levels in ischemic areas.
5. Daily debridement.
6. Do not soak the feet.
7. No weight bearing: This is essential in healing of ulcers. Modern contact casts allow patient to bear weight. These casts protect the ulcer, decrease edema, and redistribute pressure. Casts are contraindicated in patients with severe peripheral vascular, obesity, osteomyelitis, ataxia, and blindness in the aged.
8. Growth factor therapy: Non healing wounds result from insufficient or inadequate growth factors in the wound environment. Recombinant molecular biologic means permit the purification of high concentrations of individual growth factors. At present, only platelet-derived growth factor BB (PDGF-BB) is currently approved by the Food and Drug Administration for treatment of diabetic foot ulcers [10].
8. Vascular surgery: When ulcer not healing even after intensive treatment vascular surgery should be considered

Reconstructive Options for the Diabetic Foot [11]
Forefoot V-Y advancement
Toe island flap
Single toe amputation
Lisfranc's amputation
Midfoot V-Y advancement
Medial plantar artery flap
Free tissue transfer
Transmetatarsal amputation
Hindfoot Lateral calcaneal artery flap
Reversed sural artery flap
Medial plantar artery flap ± flexor digitorum brevis
Abductor hallucis muscle flap
Abductor digiti minimi muscle flap
Syme's amputation
Foot dorsum Supramalleolar flap
Reversed sural artery flap
Thinner free flaps (e.g., temperoparietal fascia, radial forearm, groin flaps)

Lavery *et al* [12] in his prospective study said that foot infections occur relatively frequently in individuals with diabetes, almost always follow trauma, and dramatically increase the risk of hospitalization and amputation. Efforts to prevent infections should be targeted at people with traumatic foot wounds, especially those that are chronic, deep, recurrent, or associated with peripheral vascular disease.

Kimberlee *et al* [13] concluded that Understanding the pathophysiology and promptly identifying risk factors for DFI is essential. A thorough evaluation of DFI utilizing a multidisciplinary team is recommended to achieve optimal outcomes. It is important to accurate classify DFI to guide treatment regimens, facilitate consistent communication between health care providers and predict patient outcomes. Prompt recognition and treatment of DFI is mandatory to achieve a goal of maximal limb salvage.

Uckay *et al* [14] stated that The worldwide increase in the incidence of diabetes will undoubtedly increase the incidence of DFIs. Clinicians caring for diabetic patients should have an understanding of current methods for preventing, diagnosing, and treating DFIs.

Ramanujam *et al* [15] quoted that one of the most devastating foot and/or ankle complications in the diabetic population with peripheral neuropathy is the presence of Charcot neuroarthropathy (CN). In recent years, diabetic limb salvage has been attempted more frequently as opposed to major lower extremity amputation for CN of the foot and ankle with ulceration and/or deep infection.

Capobianco *et al* [16] concluded that Delayed treatment of any diabetic foot infection can lead to a limb- or life-threatening scenario. Urgent and/or emergent surgery may be necessary in the early diagnosis of a severe diabetic foot infection that is followed by staged reconstructive procedures.

MATERIALS AND METHODS

A total of 50 patients with diabetes mellitus admitted at Mahadevappa Rampure Medical College surgical ward who have foot manifestations during the period of December 2015 to May 2016 was included in the study.

STATISTICAL METHODS

My study is a type of prospective study and results are expressed in diagrammatic presentation Mean ± SD. Tests of significance such as 'Z', 'T', test were applied.

Inclusion Criteria

All the patients with Diabetes Mellitus presenting with foot ulcers, infection of foot and gangrene of foot.

Exclusion Criteria

1. Patients with foot infections without Diabetes.
2. Patients with ulcer and Gangrene of foot other than Diabetic etiology

RESULTS

An analysis of 50 cases of Diabetic foot ulcer was done. These cases were admitted
and treated in Department of General Surgery, Mahadevappa Rampure Medical College, Kalaburagi during period of December 2015 to May 2016 .

Age

Age of the 50 patients were studied and ranged from 30 years to 86 Years, average being 61 years.

Table 2: Age distribution of patients

Age	No. of cases	Percentage (%)
30-40	4	8
41-50	8	16
51-60	14	28
61-70	11	22
71-80	6	12
81-90	7	14
Total	50	100%

Mean ± SD: 61.2 ± 13.28 years

Sex

In the present study out of 50 cases 38 were males and 12 were females.

Table 3: Distribution patients according to sex

Sex	No. of cases	Percentage
Males	38	76
Females	12	24
Total	50	100%

Mode Of Clinical Presentation

During my study out of 50 cases 25 presented with cellulitis, 14 cases with ulcer , 8 cases with abscess and 3 cases with gangrene

Predisposing Factors

In the present study trauma is the most common predisposing factor, which was present in 36 cases and constitutes 72%.

Site Of Lesion

The most common site of lesion in diabetic foot was sole of the foot which accounted for 48% of all cases.

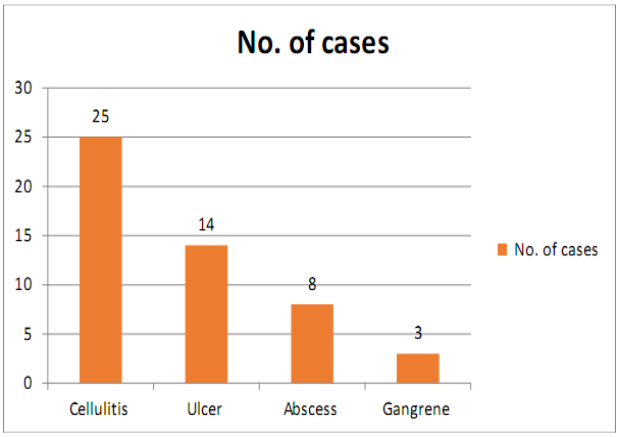

Fig-1: Distribution of patients according to mode of clinical presentation

Above graph shows cellulitis is the most common presentation.

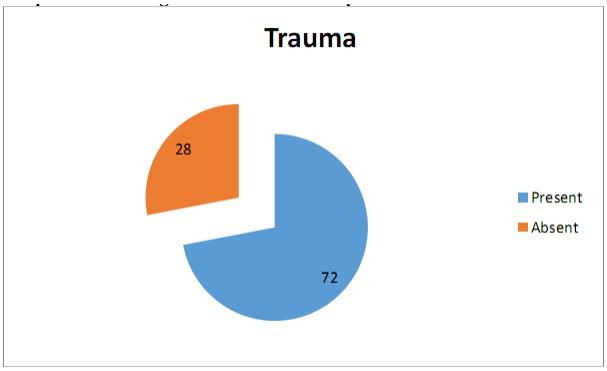

Fig-2: Percentage of cases with history of trauma

Above graph shows that most common predisposing factor is trauma.

Duration Of Diabetes Mellitus

In the study 12 cases were freshly detected at the time of admission and 38 patients were known diabetics. In 22 patients (44%) duration was between 1-5 years.

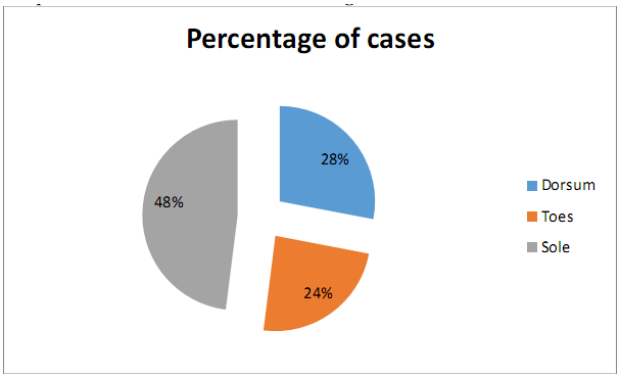

Fig-3: Distribution of cases according to site of lesion

Above graph shows that most common site of lesion is sole.

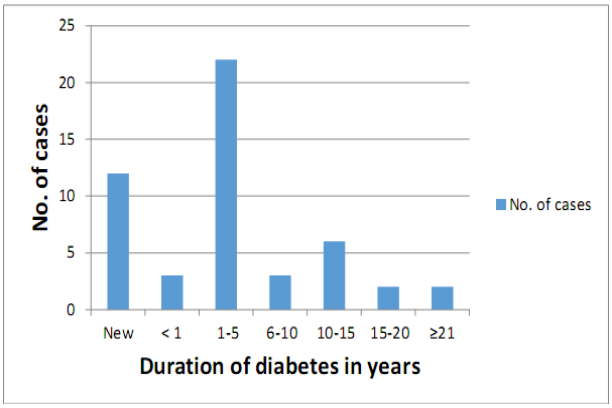

Fig-4: Distribution of cases according to duration of diabetes

Incidence Of Peripheral Neuropathy And Vascular Disease

Below graph shows majority of patients presented with both neuropathy and vasculopathy.

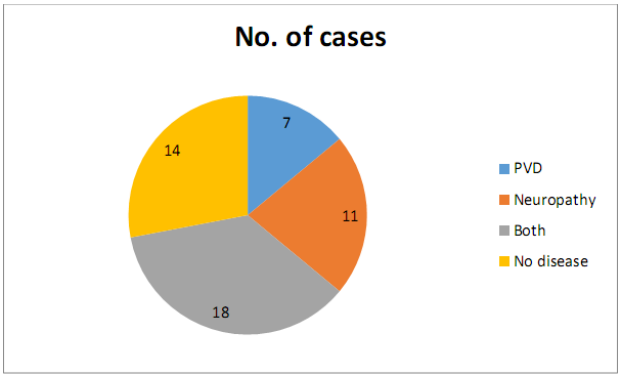

Fig-5: Distribution of cases with neuropathy, vascular disease and both

Incidence Of Bone Infection

Out of 50 patients 10 patients showed osteomyelitis in x ray.

Table 4: shows incidence of osteomyelitis.

Osteomyelitis	No. of cases	Percentage
Present	10	20
Absent	40	80
Total	50	100%

So the incidence of osteomyelitis in present study was 20%

Incidence Of Different Causative Organisms

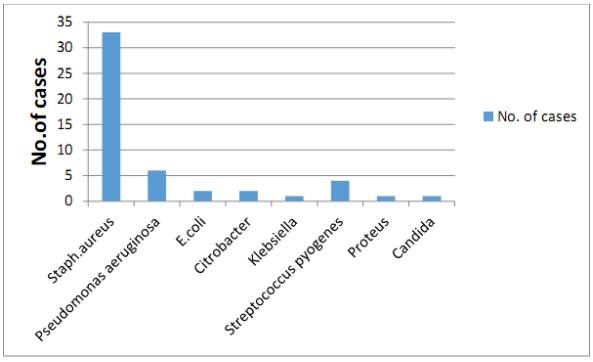

Fig-6: Shows different causative organism

Occupation

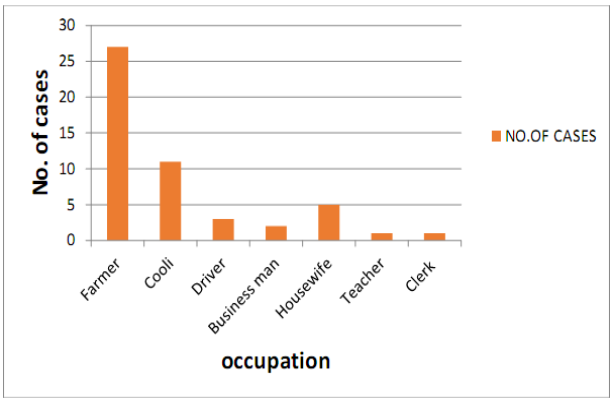

Fig-7: Distribution of cases according to Occupation

Above graph shows farmers were most commonly infected.

Treatment

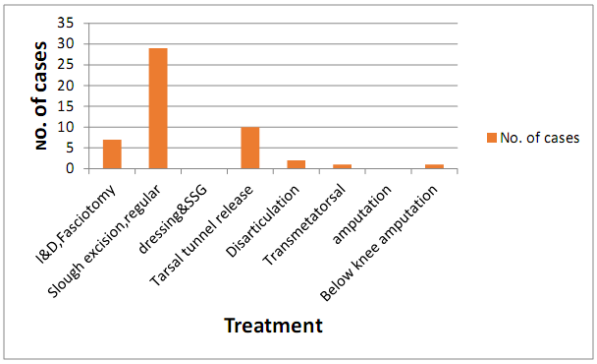

Fig-8: Distribution of cases according to treatment

Above graph shows treatment received by the patients in the study. Most patients underwent thorough debridement then split skin grafting once the wound becomes healthy.

HbA1C Level

In the study all patients are investigated for level of HbA1C in blood, only 16% of patients had HbA1C level < 7mg% and they had shorter hospital stay compared to others.

Table 5: Distribution of cases according to HbA1C level

HbA1C level	No. of cases	Percentage
< 7 mg%	8	16
> 7 mg%	42	84
Total	50	100%

Hospital Stay

In the study average duration of hospital stay was about 31.94 days with minimum being 3 days with maximum being 110 days. The maximum number of patients were in 21-40 days group.

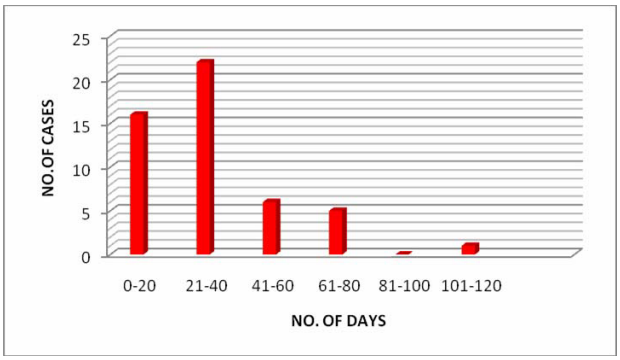

Fig-9: Distribution of cases according to hospital stay

Above graph shows that most patients stayed between 21-40 days.

DISCUSSION

Foot infections are frequent and serious complication of diabetes mellitus, which is a syndrome of metabolic, vascular and neuropathic components which are interrelated. The prevalence of foot infections among diabetics is 14-24%. 15% of all diabetics develop foot ulcer in their life time and 50 % of non traumatic amputations are due to diabetes mellitus.[1]

50% of amputations can be reduced in diabetics by educating about DO'S and DONT'S in diabetics as mentioned before. In the present study total 50 patients studied in the period of December 2015 to May 2016 and discussion of this is as follows.

Age

Most common age group who presented with diabetic foot in the present study was between 51 – 60 years with an average of 61.2 years. In JOS university study [17] it was 63.2 years and in and in Seattle series [18] it was 64.7 years. Thus in the present study presentation was most common in 5th to 6th decade. This early presentation may be due to poor glycemic control.

Sex

In the present study 76% were males and 24% were females. In seatle study [19] its 67% and in JOS university study its 65%. Male prepondarence in the present study was may be due to males were more exposed to injuries during their occupational and recreational activities. This was comparable to Diabetic Research Centre Chennai Study at 2005 [20].

Mode Of Clinical Presentation

In the present study majority of patients presented with cellulitis (50%), 28% with ulcer, 16% with abscess and 6% with gangrene. And this was comparable to JOS University study [17] in which cellulitis was 50% ulcer 28% abscess 12% and gangrene 10%.

History Of Trauma

In the present study 72% of patients were presented with history of trauma and it was absent in 28% of remaining patients. This was comparable to reiber *et al* [21] series in which 77% of patients had history of trauma. Because of sensory neuropathy Diabetics will be having insensate foot so they are predisposed to repetitive unrecognised minor trauma and abnormal distribution of pressure on the feet hence emerge as a principle factor in causing foot ulcers.

Table 6: Out of 50 patients studied, most common site of lesion is was sole of foot (48%).

Site of lesion	Present study (%)	Apelquist study (%)	Reiber Series(%)
Sole	48	28	37
Dorsum	28	14	11
Toes	24	51	52

Site Of Lesion

This was comparable only in the sole lesions with the other studies. It was also observed in the present study that 60% of Diabetic foot occurred among those who walked bare foot and 35% in those wearing only slippers or chappals while only 5% prevalence was observed in those wearing shoes.

Duration Of Diabetes Mellitus

Most of the patients presented between 1-5 years and mean duration was 3.12 years. It was 14.8 and 11.6 in Manchester, Seatle series [22] and 8.2 in John Hopkins study [23] respectively. This shows that foot complications occured early in our study most probably due to lack of strict glycemic control.

Incidence Of Pvd And Neuropathy

Incidence of PVD and neuropathy in present study were 14% and 22% and both in 36% of patients. When only neuropathy is taken in to consideration 58% of patient in present series had neuropathy. The incidence of neuropathy in other series were Walter OP *et al* [24] -39.4% and in Meral *et al* [25] -53.8%. When only PVD is taken in to consideration 50% of patients in present study had PVD. In Manchester series -39% and Walter dp *et al* [24] -24.2%.

The most common lesion is atherosclerosis of tibial arteries leading to decreased blood flow resulting in decreased delivery of oxygen, nutrients and antibiotics to foot hampering the chance of healing. The increased incidence of these complications in the present study was probably due to lack of strict glycemic control.

Osteomyelitis

In the present study 20% of the patients had osteomyelitis in the x-ray. Demineralization, periosteal reaction and bony destruction are classic radiographic triad of osteomyelitis appear only after 30-50% of bone destruction .It was the nidus for infection unless it is controlled wound never going to heal. It is comparable to JOS university study [14] (14%) and Manchester series (20%).

Causative Organism

In the present study most common organism isolated was S. Aureus (66%), next is pseudomonas (12%), and Str. Pyogenic (8%). These results were comparable with JOS university study [17].

Distribution Of Cases According To Occupation

Among 50 patients with diabetic foot 54% were farmers and 22% were coolie workers. The incidence is high in farmers in our study as these patients are more prone to injury during their occupational activities and also lack of strict glycemic control in these patients.

Surgical Treatement

In the present study single stage surgical approach with total excision of ulcer, broad exposure,

correction of underlying osseous deformity and wound coverage using SSG in 29 patients reduced healing time, with no need for additional surgical procedures, resulting in decreased hospital stay and cost. I&D done in 8, surgical tarsal tunnel release in 2 patients, disarticulation in 2 patients, transmetatarsal amputation in 1 patient, below knee ampuatation in 1 patient. This was comparable with Khyber Teaching Hospital, Peshawar and Department of Surgery, study.

HbAIC Level, Hospital Stay And Necessity Of Strict Glycemic Control:

In the present study only 8 patients had HbA1C level <7 mg% and they had shorter hospital stay compared to the other patients. It indicates that both short and long term strict glycemic control was necessary for the faster wound healing. Insulin requirement was more initially and as the infection is under control the requirement became less and less.

Hospital Stay

Hospital stay was related to type, extent, severity of disease and effective short and long term glycemic control. In the present study average duration of hospital stay was 34.64 days. Stay for non healing wounds were 28.4 days and for neuropathy it was 16 days. Causes for long hospital stay were uncontrolled diabetes, life threatening infections, malnutrition and multiple medical co morbidities.

Foot Care

Patient education in foot care, prophylactic skin and nail care, and footwear reduces the risk for foot ulcers and lower extremity amputation by 25% in those patients with no specific risk factor.

CONCLUSIONS

- Males are more vulnerable to trauma and almost three times more affected
  than females because of their occupation and recreational activities.
- History of trivial trauma of some kind was the most common initiating
  factor in nearly half of the cases.
- Strict glycemic control is necessary for faster healing of wounds and decrease the incidence of amputation.
- Conservative treatment consisting of control of diabetes with Plain/Lente insulin along with appropriate oral / IV antibiotics.
- Wound debridement, slough excision followed by dressing with Povidone/magnesium sulphate/ saline resulted in healing in some cases.
- Tarsal tunnel release in selected neuropathic patients resulted in improved neuropathic symptoms.
- Split skin grafts, Disarticulation, Transmetatarsal amputation, below knee amputation were the other modes of treatment.

REFERENCES

1. Powers AC. Diabetes Mellitus. In: Longo DL, Fauci AS Kasper DL, Hauser SL. Harrison‟s Principles of Internal Medicine. 19th ed. Philadelphia: Mc Graw Hill. 2015;3179 – 3210.
2. Purushottam PS. Diabetic Foot. In: Munjal YP, Sharma SK, Agarwal AK, Gupta P. API Textbook of Medicine. 10th ed. Mumbai: Dr. Yash Pal Munjal for and on behaIf of the association of physicians of India. 2015;387- 392.
3. Park's Text Book of Preventive and Social Medicine. 23rd edition. Jabalpur, India: M/S Banarsidas Bhanot 2015; 341-343.
4. Levin, O'Neal's the diabetic foot. — 7th ed. / [edited by] John H. Bowker, Michael Pfeifer. RC951.D53 2008 page no 307-308.
5. Powers AC. Diabetes mellitus, Eugene Braunwald, Anthony S Fanci, Dennis L, Kasper, Stephen L, Hauser, Don L, Longon J Lorry Jameson. Harrison's Principles of Internal Medicine. 19th edition. Vol. 2. McGraw-Hill. 2166-2178.
6. Stanley JC, Collier AM. The diabetic foot and ankle Original Research Article Orthopaedics and Trauma. 2009;23(1).
7. Kandemir O, Akbay E, Şahin E, Milcan A, Gen R. Risk factors for infection of the diabetic foot with multi-antibiotic resistant microorganisms Original Research Article Journal of Infection. 2007;54(5):439-445.
8. Howard IM. The prevention of foot ulceration in diabetic patients. Physical medicine and rehabilitation clinics of North America. 2009 Nov 30;20(4):595-609.
9. Curchural GJJR, Tally FP, Jacobus NV. Susceptibility of the bacteroids fragilisgroups in the United State, analysis by site of isolation. Antimicrob Ag Chem Other. 1988;32:717.
10. Moore RD, Smith CR, Lipsky JJ. Risk factors for nephrotoxicity in patient treated with aminoglycosides. Ann Internal Medicine. 1984;100:352.
11. F. Charles Brunicardio Dana K Andreson, Biller TR, David .l. dunn. John G Hunter , Jeffrey B Mathew, SHWARTZ'S principle of surgery page no. 424-425.
12. Lavery LA, Armstrong DG, Wunderlich RP, Mohler MJ, Wendel CS, Lipsky BA. Risk factors for foot infections in individuals with diabetes. Diabetes Care. 2006 Jun;29(6):1288-93.
13. Kimberlee B. Hobizal, Dane K. Wukich. Diabetic foot infections: current concept review. Diabet Foot Ankle. 2012;3:10.
14. Uçkay I, Aragón-Sánchez J, Lew D, Lipsky BA. Diabetic foot infections: what have we learned in

the last 30 years?. International Journal of Infectious Diseases. 2015;40:81–91.
15. Ramanujam CL, Stapleton JJ, Zgonis T. Diabetic charcot neuroarthropathy of the foot and ankle with osteomyelitis. Clin Podiatr Med Surg. 2014 Oct;31(4):487-92.
16. Capobianco CM, Stapleton J. Diabetic foot infections: A team-oriented review of medical and surgical Management. 2010;1:1-10.
17. Studies on diabetic foot ulcer in patients at JOS university, department of microbiology and surgery. July 2003;4(2).
18. Boyko EJ, Ahroni JH, Cohen V. Prediction of diabetic foot ulcer occurrence using commonly available clinical information: The Seattle Diabetic Foot Study. Diabetes Care. 2006;29(6):1202–1207.
19. Grayson ML. Diabetic foot infection. Antimicrobial therapy, Infact Dis Clinics North Am. 1995 March;9(1):143-161.
20. Viswanathan V. Profile of diabetic foot complications and its associated complications – a multicentric study from India. Journal of Association of Physicians of India. 2005 Nov;53:933-6.
21. Reiber Ge, Vileikyte L, Boyko EJ, Aguila MD, Smith DG, Lavery LA. Causal pathways for incidence of lower extremity ulcer in diabetics . diabetic care. 1999;22:157-62.
22. Boyko EJ, Ahroni JH, Cohen V. Prediction of diabetic foot ulcer occurrence using commonly available clinical information: The Seattle Diabetic Foot Study. Diabetes Care. 2006;29(6):1202–1207.
23. Tan JS. Johns Hopkins Advanced Studies in Medicine Diagnosis and treatment of diabetic foot infections. Clin Infect Dis. 2004;39:885-910.
24. Walter DP, Gathing W, Muller MA, Hill RD. The distribution and severity of diabetic foot disease: A community study, diabetic med. 1992;(4):354-8.
25. Kiziltan ME, Gunduz A, Kiziltan G, Akalin MA, Uzun N. Peripheral neuropathy in patients with diabetic foot ulcers: Clinical and nerve conduction study Original Research Article Journal of the Neurological Sciences. 2007;258(1-2):75-79.