Section: General Surgery

Original Research Article

PATHOPHYSIOLOGY, MANAGEMENT AND FACTORS INFLUENCING DIABETIC FOOT ULCERS AMONG DIABETIC PATIENTS

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Abstract

Background: This research aim was to conduct a comparative examination of medication adherence in individuals with schizophrenia focusing on the influence of demographic, psychosocial as well as clinical factors on adherence. **Materials and Methods:** A cross-sectional approach was used including a sample of 124 patients who were diagnosed with schizophrenia at a tertiary care psychiatric centre. The data were collected through interviews as well as medical records which examined demographic factors, patient insight as well as severity of the symptom using PANSS scale. Medication adherence was assessed by combining self-reports with clinical records as well as family reports. Statistical analyses included of Chi-square tests along with independent sample t-tests. **Result:** Out of all patients 61.3% were compliant whereas 38.7% were non-compliant. Demographic variables including age, sex, marital status, education, employment, family income as well as type of family did not exhibit any significant association with medication adherence. Patient insight ($P < 0.001$) & symptom severity ($P < 0.001$) were significant with compliant patients had superior insight and lower PANSS scores. **Conclusion:** When it comes in predicting medication compliance among schizophrenic patients the Patient insight as well as symptom severity are crucial while the demographic factors has less influence.

INTRODUCTION

Diabetes is an endocrine disorder that has reached epidemic proportions worldwide. Overall 15 % of individuals with diabetes mellitus will have foot ulcer in their life time and the annual incidence of 2-5%. Diabetic foot is becoming a major concern of diabetic patients and those who treat them from quality of life, social and economic stand point. The word "Diabetic foot" means that the pathophysiological process of diabetes mellitus do something to foot, that puts at increased risk of tissue damage resulting to ulcer formation. (Payne & Florkowski, 1998). Foot damages such as ulceration, infection and gangrene are one of the important causes of hospital admission in patients with diabetic mellitus.[1]

Evidence that the pathological process of Diabetes have put the foot for more risk for tissue damage has happened and foot is at risk for end stage complications (amputation). Of all complications of diabetes, those occurring in the foot are considered most avoidable.

Epidemiology: 3-5% of those with diabetes have a foot ulcer.[2] 15% of all those with diabetes will, during their lifetime develops an ulcer. 4-5% of foot ulcers are increased by external trauma. Up to 20% undergo same side amputation within 12 months. Up to 50% undergo opposite side amputation within 1-3 yrs; 75% within 5 years. 3years increased death rate after complication is 20-50%.

Multidisciplinary Management: The plan in supervising diabetic foot is always to keep the patient at as low a phase possible. At each of the diabetic foot, it is essential to interfere early and to manage the foot to prevent further progression. No one person can manage the diabetic foot. Members of the team will include physician, general surgeon, orthopedic surgeon, radiologist, expert nurse and podiatrist.[3,4] It is helpful if the team works very much mutually, within the focal point of the diabetic foot clinic and also meets frequently to carry out ward rounds and x-rays conferences. Each team member should be available hastily in an emergency.[5-8]

MATERIALS AND METHODS

Study design: Observational Study
Sample size: 250

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A observational study was conducted on 250 diabetic foot ulcer patients attending surgical op/ emergency department over a period of 1 year from January 2024 to December 2024.

Inclusion criteria

Age > 13 years presenting to surgical OPD/ emergency department with diabetic foot ulcer.

Exclusion Criteria

Patients below 13 years, Pregnant females; Psychiatric patients; Diabetic patients who have ulcer other than diabetic ulcer for example traumatic ulcer, venous ulcer.

Data Collection: Clinical history includes the following points- Known case of diabetic or not, Duration of diabetes, regarding the treatment received if any, Family history of diabetes, any history of injury, Local symptoms such as swelling, pain, wound, discoloration andPersonal habits such as smoking and alcoholism. General examination of the patient includes all vitals and other system examination.

Clinical features of neuropathic foot are- Warm with intact pulses, Diminished sensations, callus, Ulceration, Sepsis, Local necrosis, Edema, Charcot's joints. Clinical features of ischaemic or neuro-ishaemic foot are Cold with absent pulse, diminished sensations, Ulceration and Necrosis or gangrene. In the examination of the feet, the following points are to be noted- Types of lesion and extent, evidence of any predisposing factors, any changes suggestive of neuropathy or vascular involvement. The neurological status of the lower limb assessed to rule out diabetic neuropathy. All the sensations, power, reflexes, and neurological deficit were noted. Vasculopathy of the limb was found by assessing Colour of limb: normal, pale, purpule, black, local temperature: normal or cold and the pulsations of the lower limb: dorsalis pedis, posterior tibial, popliteal and femoral artery.

Outcome: 1. Enhancing the importance of patient's knowledge in self-care practice and regular diabetic foot evaluation. 2. Reduce the morbidity of patients with diabetic foot ulcer and enhance early healing of ulcer. 3. Early rehabilitation of the patients with diabetic foot ulcer.

RESULTS

An analysis of 250 cases of diabetic foot was done. In our study 250 patients of diabetic foot lesions were studied. In 35 patients only incision and drainage and fasciotomy was done, healing of wound occurred without complications. In 125 patients debridement was done as the definite treatment, as a groundwork to amputation. Skin grafting was well thought-out in 40 patients once the wound was clean and granulating.

In our study amputation rate was 20%. Out of these, patients underwent Above Knee or Below Knee Amputations or minor amputations. In 40 patients major amputations like Below Knee and Above Knee amputations done. 15 Patients had wound infection and suturing gaping. For these patients with wound gaping secondary suturing was done. In 10 patients, Above Knee amputations was done, 5 patients stump was closed primarily and in 5 patients Guillotine amputation was carried out. A total of 10 patients died because of various complications of diabetes during the line of treatment.

Age distribution: Of 250 cases studied, youngest patient was 19 years and oldest was 84 years of age. Highest number of cases was found in the age group 51-60 years (31%) followed by 61- 70 years (27%). Maximum number of diabetic foot i.e 80% are between the age group of 41-70 years.

Sex Distribution: Of the 250 cases studied in this series, 160 (64%) cases were male and 90(36%)

Occupation: In this study maximum patients were farmers (54%) and minimum patients were drivers and office employee (4%).

Type of Diabetes: In this study 35 patients had type I diabetes, remaining 215 patients had type II diabetes.

Incidence of Trauma: In this study 64 cases exposed a history of some kind of trauma before the onset of lesion.

Mode of presentation: The different types of lesions seen including ulcer, cellulitis, abscess and gangrene. Most of the patients present with more than one lesions. Only major lesion is considered here. Ulcer was the major lesion seen and is present in 120 patients. 15 patients presents as a abscess was the least common lesion.

In above patients x-ray of 30 cases showed changes of Osteomyelitis. 15 patients present with Charcot's joint.

Doppler studied in 10 patient showed atherosclerotic changes with low volume flow in anterior and posterior tibial arteries.

%	Bacterial	No. of cases
40	Staphylococcal aureus	100
12	Pseudomonas	30
18	Klebsiella	45
14	E- coli	35
10	Proteus	25
6	Non-hemolytic streptococci	15

Antibiotics	% of patients
Imipenem	45
Ceftazidime	25
Amoxycillin and Clavulanate	45
Amikacin	25
Cefotaxime	10
Ciprofloxacin	25
Ampicillin	5
Vancomycin	30

Duration of Diabetes: In our study 18% presented with duration less than or equal to 1 year. Most of these patients were diagnosed post admission. Only 20 patients had diabetes of more than 20 years. Maximum 80 patients in our study were diabetes of 6- 10 years. In the present series 10 patients were detected as a diabetic at the time of admission.

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Culture and Sensitivity: In our study majority of septic lesions yielded Staphylococcus aureus in about 40% on culture of pus. Other organisms were isolated are Pseudomonas 12%, Klebsiella 18%, E-coli 14%, Proteus 10%.

Imipenem and Amoxicillin & Clavulanic acid were sensitive against most of the organisms as they cover a wide range of organisms.

Neuropathic lesions: In the present study 130 cases were found to have neuropathy. Patients with neuropathy varied from 35-80 years. Majority had history of diabetes more than 5 years. This shows that peripheral neuropathy is common in long standing diabetic patients. 50 patients had gangrene.

Duration of hospitalisation: In this study minimum stay in hospital was 1 week and maximum was 12 weeks (84 days). Most of patients stayed in hospital form 4-6 weeks (155).

Treatment: In this series 125 cases were managed by daily dressing and wound debridement, and slough excision. 40 patients were treated with SSG, 35 patients under went Incision & Drainage for abscess and some of them fasciotomy. Minor amputation was done in 10 cases. BKA was done in 30 cases and AKA in 10 cases. In most of the cases, limb was salvaged by conservative treatment and minor amputation.

Outcome: In the present study 240 patients recovered from their lesion after treatment while remaining 10 patients died due to various complications.

Atherosclerotic changes: Out of 250 patients with diabetic ulcers 160 patients showed atherosclerotic changes in major arteries of lower limb which was proven categorically by an arterial Doppler color examination.

DISCUSSION

Diabetes is a common problem. It affects about 16 million people of all ages and is a major cause of end stage renal disease, blindness and peripheral neuropathies. The disease is chronic and affects the metabolism of carbohydrate, protein, fat, water and electrolytes.[9,10]

Many diabetic ulcers are ignored because they may produce few symptoms and their importance is not valued by patients and secondly it falls between specialities. Not being entirely in the surgeon or physician domain. Reduction in the occurrence and prompt treatment of foot ulceration would ultimately lead to drop in the amputation rate in diabetic patients.[11,12]

Without doubt, the problem of foot infection in diabetic patient population is costly to both the patient and society. As a result, health care expenditure and medical hard work must be directed education and prevention, early detection and prompt therapy of food infection.[13-15]

Total 250 cases of diabetic foot were included in this study. Following is the result of my study conducted at our hospital from (duration of study)

The analysis of this study is as follows.

AGE: Prevalence of diabetes is greater in persons over the age of 50 years. Pedal infection is a devastating and severe complication of diabetes seen often is elderly patients.

In our study of 250 patients age was ranging from 19 years to 84 years. It was found that age group 51-60 years, had the highest number of 80 patients.

SEX: Most of the diseases have the male predominance, this is same with diabetic foot also. In our series 64% patients were males and 36% patients were females.

The following may be the reason for the male predominance are exposed to the external environment more than females hence they are likely candidates for injury leading to ulcer formation. Alcoholism and smoking habits are more common in males and this may be an important factor. Barefoot walking is more common in India this also contributes to the foot ulceration.

Occupation: As seen in our study, farmers had more incidence of diabetic foot lesions because of unawareness of having Diabetes, lack of foot care and poor management of diabetes. It is evident that the surgical complications of patients whose profession exposes them to the risk of trauma and injuries making the vulnerable to the complications of diabetic foot.

Type of Diabetes: As per literature foot ulcers have been more in the patient with NIDDM (86%) as per our study. NIDDM age group is being elder and foot complications are more in these patients.

History of trauma: 64 cases in this series had history of trauma, before the onset of foot lesion.

In majority of the cases of surgical complications of diabetes, some kind of trauma is the beginning of the problem. This is because of three factors, they are ischemia:- due to ischemia the parts, which are traumatized will be underperfused, thus impairing the healing process.

Neuropathy: Result in loss of sensation and the patient will be unaware of the injury and neglects it.

Hyperglycemia: acts as a perfect medium for the multiplying organisms.

Neuropathy which is seen more than 50% of diabetes of long standing duration is considered at to be the single most major course of ulceration.

In present study neuropathy changes seen in 52 cases, ischemic complications was noted in 20 cases and infective complication of foot noted in all cases.

Type of Lesion: In our study of foot lesions are Cellulitis, Abscess, Ulcer and Gangrene. In some patients there was more than one lesion. Ulcer (48%), Cellulitis (26%), Gangrene (20%), Abscess (6%). Ulcer was the commonest presentation.

Diabetic Status: In our study 96% patients were known diabetics. Other 10 patients were diagnosed after hospital admission to hospital.

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Duration of Diabetes: In our study mean duration of diabetes mellitus is 12 years.

Culture & Sensitivity: In our study pus was sent for culture and sensitivity in 120 patients. In most of patient's more than one organism were grown on culture. In our study staphylococcus aureus (40%), E Coli (14%), Klebsiella (18%), Proteus (10%), Pseudomonas species (12%) were commonly isolated organisms.

Imipenem, Meropenem and Cefepime were the most effective agents against gram negative organisms. Vancomycin was the most efficient against gram positive organisms.

Neuropathy

Neuropathy foot has got three main complications neuropathic ulcer, neuropathic joint (Charcot's) and neuropathic edema. Neuropathy consists of three main components – sensory, motor and autonomic. In our series 52% patients had neuropathy. It was diagnosed by weakness of small muscles, foot deformity, loss of sensation, loss of sweating, formation of new pressure points, callosities and eventually ulcer.

In autonomic neuropathy skin becomes dry as a result of loss of sweating. There will be cracking of skin and impaired defense against infection. In case of sensory neuropathy there will be loss of sensation which predispose to the trauma and ulcer formation. After trauma there will be devitilisation of the tissue, if the infection supervenes there is rapid formation of inflammatory exudates, especially in the deeper underlying tissue which leads increased pressure in the compartment resulting in obstruction to the blood supply, eventually resulting in gangrene and uncontrolled infection.

Due to vasculopathy and neuropathy, foot infections are deserted, there is spread of the infection from distal to the proximal part.

Co- relation of atherosclerosis and diabetic ulcers: As seen in various studies. Diabetes leads to microangiopathy and macroangiopathy with resultant atherosclerosis of blood vessels leading to decreased vascularity to the distal lower limb causing ulcerations, gangrenes etc.

Our study also corroborates these findings by showing high incidence and atherosclerosis in the patients with diabetic ulcers which can be considered as one of the causes.

Duration of Hospitalization

In this study minimum duration in hospital was 7 days (1week) and maximum was 84 days (12 weeks). Most of patients stay in hospital for 4-6 week.

This long duration of hospitalization can be explained by the refractory to patients diminished resistance of body due to uncontrolled sugar level, resistance of the organism to the antibiotic therapy, poor nutrition, advanced age.

Investigations

The study indicated that at the time of admission in hospital, RBS level of 70 patients were above the normal level and FBS level of patients done that showed 155 patients had more than normal range. It is recommended that diabetic patients present with diabetic foot lesions in uncontrollable blood sugar level. 75 patients showing normal blood sugar level because they are regularly taking anti-diabetic treatment.

Treatment

Most of the cases in our study were referred to us in a difficult stage with serious infection and associated complications.

Before starting treatment every patient must be assessed to decide the relative importance of predisposing factors – neuropathy or vascular disease. In absence of severe ischemia, conservative medical and surgical management give good results. In presence of ischemia unless the limb is salvaged by direct arterial surgery, we may have to consider major amputations.

Medical Management

All our patients were advised diabetic diet with low cholesterol and high PUFA. All patients were shifted to crystalline insulin therapy. According to the blood sugar level dosage of the insulin was adjusted. In case of Ketoacidosis, planned aggressive treatment was necessary because this is life threatening complication, where severity of infection is more and there is defective neutrophil function.

Dosage of insulin was required more in cases of ketoacidosis, severe infection. After correction of ketoacidosis and control of infection, the dosage of insulin required was reduced.

At the time of discharge 100 patients were shifted to oral hypoglycemic, 115 patients to Lente insulin and the rest were continued with the crystalline insulin.

Control of infection: Control of infection was done by careful debridement and antibiotic therapy. The role of antibiotics in foot infection is to limit the spread of infection.

In our study most of the patients were treated with multidrug regime. Staphylococcus was the commonest organism grown, which was sensitive to Cefotaxime, Ampicillin and Gentamycin in 80-90% of cases. We have used combination antibiotic therapy. Combination antibiotic therapy is advised by Brodsky J.W.et al & L.Bhasker Reddy et al .

Brodsky J.W. Advised the following combinations:

-Ticarcillin + Clavulanic acid

-Vancomycin + Metronidazole

-Third generation cephalosporin + Metronidazole

L. Bhasker Reddy et al advised the following combination: Cefotaxime + Metronidazole

According to the availability of drugs we could use broad spectrum antibiotics like Ciprofloxacin, Cefotaxime, in combination with Metronidazole and Gentamycin. Ampicillin, penicillin, erythromycin, tetracycline were used in some of the patients. In the present series, 125 cases were treated by slough excision, 40 with skin graft, 35 by fasciotomy and I&D. Below Knee Amputation was done in 30 patients and Above Knee Amputation were done in 10 cases. Minor amputations are done in 10 cases. Proper control of diabetes is very important in

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diabetic foot management. Fasting and PPBS estimations were well under control. Urine sugar estimation was done thrice daily. Infection was treated with broad spectrum antibiotics. Patients were educated about care of foot and Pentoxyphylline was administered to in patients with ischemic lesions. In our study amputation rate is 20%, that is lower when compared to standard studies. This could be due to better education of patient, better glycemic control, proper care of foot, proper use of antibiotics, extensive debridement and regular dressing. After amputation, wound healed well. The patients were referred to rehabilitation center for prosthesis.

CONCLUSION

This study comprised of 250 cases of diabetic foot patients with emphasis on surgical management and its complications. After analysis of the data the following are the conclusions. The highest number of patients was seen in the age group of 51-60 years (32%). Males are almost two times more affected than females. Males are more at risk to trauma. Farmers had more incidence of diabetic foot lesions. Diabetic foot ulcers have seen more in NIDDM Duration of diabetes varied from just diagnosed to 25 years. In study 240 patients were known diabetic and 10 patients diagnosed at the time of presentation. Insignificant trauma of some kind was the initiating factor in nearly one- third of the cases. Minimum stay in hospital was 1 week and maximum 12 weeks, most of patients stay for 4-6 weeks. Commonest presenting lesion was ulcer 48%, followed by Cellulitis 26% and gangrene 20%. After 5 to 6 years of diabetes most of patients present with neuropathic lesions and they are in 35-80 years age group some of them develops gangrene. Staphylococcus aureus is a commonest organism causing infection. Atherosclerotic changes may lead to formation of ulceration of foot in diabetic patients. Conservative treatment consisting of control of diabetes with plain / Lente insulin along with appropriate oral /IV antibiotics was effective in some cases. Wound debridement, slough excision followed by dressing with Povidine iodine/ Magnesium sulphate/ Metrogyl/ Collagenase dressing resulted in healing in some cases. Split skin graft, disarticulations, Transmetatarsal amputation, Below Knee Amputation and Above Knee Amputation were other modes of treatment. 240 patients cured and 10 patients died during course of treatment.

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