ORIGINAL ARTICLE

Surgical Complications Involving Lower Limb in Diabetic Patients - A Cohort Study at Allama Iqbal Teaching Hospital Sialkot

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ABSTRACT

Aim: To evaluate and treat the surgical complications encountered in lower limbs of patients diagnosed with Diabetes Mellitus; being treated in the Department of Surgery, Allama Iqbal Memorial Teaching Hospital, Sialkot.
Study Design: Prospective Study
Place and Duration of Study: Department of Surgery, Khawaja Muhammad Safdar Medical college, Sialkot from June 2016 to May 2020.
Methodology: The diabetic patients included in this study were treated and followed in Surgical Outpatient Department as well as some of them were admitted in Surgical Ward. Written consent was taken from the patients before including them in the study conducted. The patients having their lower limb affected by Diabetes Mellitus were followed from the time of presentation until 3 months after their treatment was over or their associated complications were managed. Patients of both Type 1 and 2 Diabetes Mellitus were included. The data was entered on a proforma which consisted of history, examination, investigations which included metabolic profile and blood glucose monitoring, diagnosis and treatment record.
Results: In this study, 1859 (100%) patients were enrolled, out of which 345 (18.56%) were lost to follow up and 1514 (83.23%) were included in the study.The presenting symptoms data shows that out of 811 (100%) OPD patients, 406 (50.1%) had inflammatory conditions of soft tissues, 197 (24.3%) had inflammatory conditions of musculoskeletal system, 164 (20.2%) had bone and joint pathologies, 3 (0.36%) had skeletal deformities and 41 (5.05%) had peripheral vascular disease/limb ischemia. Out of 703 (100%) patients admitted in surgical ward, 335 (47.7%) had inflammatory conditions of soft tissue, 187 (26.6%) had inflammatory conditions of musculoskeletal system, 121 (17.2%) had bone and joint pathologies, 7 (0.99%) had skeletal deformities and 53 (7.54%) had peripheral vascular disease/limb ischemia.
Conclusion: The diabetic patients suffer from a vast range of pathologies which effect lower limbs and it shares a main bulk in general surgical wards. Most of these problems need to be treated by surgical procedures while majority of such patients in outpatients department are usually managed conservatively.
Keywords: lower limb, skeletal , amputations, conservative, management

INTRODUCTION

Diabetes mellitus (DM) is considered asthe epidemic of the century. Morbidity and mortality rate due to this disease is significantly high. Microvascular complications have a huge impact in morbidity and mortality due to this disease and is a burden on public health system especially in Sub-continent nations. There are multiple diabetic complications in lower extremities. These complications result from complex interactions between peripheral vasculopathy, peripheral neuropathy, structural deformity and decreased immunity. An early and accurate recognition of these abnormalities is crucial which initiates prompt treatment, therefore avoiding or minimizing life-long deformity, dysfunction and amputation in worst case scenarios. Radiological investigations after a thorough clinical assessment are most important in prompt diagnosis and treatment of the patient. Unfortunately, most radiologists fail to give their quality clinical opinion as they are relatively unfamiliar with the complex interactions of this disease in the patients. Furthermore, in a country like Pakistan, we lack an experienced and dedicated multidisciplinary team of an endocrinologist, a vascular surgeon and a podiatrist[1,2].

Diabetes Mellitus contributes significantly and independently to the development of peripheral arterial disease and is associated with an increased likelihood of critical limb ischemia and lower limb amputation. Despite having high prevalence worldwide, most cases of diabetic peripheral vasculopathy remain undiagnosed due to lack of reporting by the patients or altered pain perception due to diabetic neuropathy. Vascular changes delay ulcer healing, predisposing it to gangrene formation, as the diminished arterial supply is incapable of meeting the increased metabolic demand of an infected foot.The diabetic lower limb is classified into two types: a) Neuropathic limb with palpable pulses and b) Ischemic limb without pulses along with a variable degree of neuropathy[3].Lower limb atherosclerosis in diabetic patients tend to occur more distally and is associated with arterialcalcification and occlusion of the arteries. Arteries below the knee joint are preferentially affected, particularly the peroneal and

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posterior tibial arteries[4]. Diabetic foot ulcer (DFU)involves a multifactorial pathogenesis including peripheral neuropathy, which is the primary causal factor, together with peripheral vascular disease (PVD), repetitive trauma, and superimposing foot infection. Infected DFU is a major cause of prolonged hospital admission among diabetic patients and contributes over 90% of non-traumatic lower limb amputations (LLAs), which is more than a million amputations per year[5]. Diabetic neuropathy plays a vital role in the initiation and pathogenesis of diabetic foot complications. It is usually diagnosed clinically which is further enhanced by electrophysiological studies.It typically presents in a slowly progressive primary sensory deficit in a diagonal fashion, with symptoms starting in the feet and then spreading upwards giving rise to “stocking-glove distribution”. Patients who present with diabetic amyotrophy mostly have freshly diagnosed diabetes, short period of hyperglycemia, better glycemic control, less micro or macro vascular complications and a lower basal metabolic index[6].

Fat atrophyis common in Diabetes Mellitus. Ultrasonography shows thinning of plantar soft tissue within the region of the metatarsal heads, and correlative MRI has confirmed the fibrous replacement of fat in the affected area.Atrophied and displaced plantar fat pads provide less protection against microtrauma, resulting in ulcerations. Callus and ulcerationis seen on areas vulnerable to increased pressure and friction. The typical sites are over the distal hallux, heads of first and fifth metatarsals, posterior calcaneus, medial and lateral malleoli.Callus predisposes to ulceration, which further leads to cellulitis and osteomyelitis.Cellulitisresults from contiguous spread of microorganisms through skin ulcerations and sinus tracts. Plain radiograph and CT scan may show swelling, loss of fascial planes, and often gas within soft tissues. Gas is observed in cellulitis secondary to gas-forming organisms such as Clostridium perfringens or air tracking from skin ulceration to deeper tissues.MRI features of cellulitis include thickened skin, septation of the subcutaneous fat and thickening of underlying fascia[7].

Necrotizing fasciitisis a life-threatening rapidly progressive inflammatory infection of the superficial and deep fascia with secondary necrosis of subcutaneous tissues. Clinical findings include purplish discoloration of skin, edema, erythema, skin vesicles and crepitus. Sonography may aid in diagnosis but CT scan pinpoints the site of involvement by indicating necrosis with asymmetrical fascial thickening and presence of. gas in subcutaneous tissues. Soft-tissue hypo perfusion/ ischemia/ gangrene can be qualitatively evaluated using contrast-enhanced MR angiography. MRI is also used to quantify loss of tissue perfusion, showing tissue affected by gas gangrene as dark or blank space. Gas gangrene is an emergency and needs to be differentiated from gas tracking from superficial ulcers to deeper tissues through sinus tracts.Bursitis in Diabetes Mellitus is due to immunosuppression.Prepatellar bursitis is most common in the lower limb.Ultrasound is valuable tool in the evaluation of bursitis of the superficial bursae in patients who cannot undergo MRI. It demonstrates increased synovial fluid with thickening. Color Doppler shows distension of the synovial membrane and synovial hyperemia. MRI shows increased synovial fluid with contrast enhancing the synovial membrane but not the bursal fluid[8,9].

Foreign bodies are found in neuropathic foot owing to loss of sensation anddiminished protective reflexes. Ultrasonography is useful in detecting radiolucent foreign bodies whereas CT scan and MRI are best radiological techniques available in this case.Osteomyelitisin a diabetic foot or ankle is mostly the consequence of contiguous spread from an adjacent ulcer or soft-tissue infection, involving cortex first and then bone marrow.Forefoot is most commonly affected by osteomyelitis. The risk of above ankle amputation is higher in hindfoot. Osteomyelitis of forefoot has better prognosis. The two specific signs for clinical diagnosis of osteomyelitis are: a) Width and depth of the foot ulcer, b) Probe-to-bone test[10].

Scintigraphy is more sensitive than plain radiography. Plain radiograph show periosteal reaction, cortical destruction, loss of normal trabecular pattern and bone lysis with or without osteosclerosis. MRI is the modality of choice that shows calcified periosteum separated from underlying bone by fluid or pus.Pathological fracturesoccur in Diabetes Mellitus because of neuropathy, vasculopathy and weak bony structure.Bone stress fractures are rarely diagnosed in patients with diabetic neuropathy because of their atypical presentation with foot edema rather than pain, exacerbated by loadbearing. Fractures, which are often difficult to observe on plain radiograph, are well appreciated on CT or MRI.Cuboid and atraumatic calcaneal avulsion fractures are common.

Septic arthritis results from direct inoculation from adjacent skin ulceration. Joints of the foot and ankle that are close to the sites of ulceration are most frequently involved, with the interphalangeal and metatarsophalangeal joints being the most common sites. MRI shows large joint effusions, intense synovial enhancement and perisynovial edema demonstrate a septic joint.Muscleatrophyin diabetic patients, initially affects the distal pedal muscles. Diagnosis is madeon CTscan or MRI by analyzing the bulk of muscle and morphology, with atrophic muscle replaced by fat tissue in advanced cases.Diabeticmyopathyusually occurs due to poor diabetic control followed by extensive atherosclerosis, microangiopathy and possibly underlying coagulopathy. Typical presentation is acute onset of pain along with swelling in affected muscles, which is often bilateral and occasionally associated with a palpable mass. The thigh muscles are commonly involved, followed by calf muscles and short rotators of the hip. MRI is useful in the diagnosis of this condition and aids in avoidance of unnecessary biopsies and surgical intervention[11,12,13].

Tendinopathyis due to increased pedal tensile force and altered gait biomechanics. Achilles and plantar fascia thickenings have been clinically observed on CT scan, MRI and ultrasonography along with loss of fiber continuity with hyper intense gaps in ruptured or completely torn tendons.Septic tenosynovitiscan occur in the presence of skin ulceration, cellulitis or osteomyelitis. Peroneal, Achilles and plantar flexor tendons are commonly involved. It is usually diagnosed on MRI that indicate presence of peritendinous fluid, thickened tendon and post-contrast synovial enhancement. When MRI is not readily available, high-resolution ultrasonography and power Doppler are used[14].

Despite stressing on the importance of early detection and management in different studies, workshops or seminars and public health awareness programs, prevention practices remain poor, with inconsistent patient follow-up, management and compliance. As a result, patients with DFU maintain poor quality of life, with higher baseline depression rate, and 5-year mortality rate up to 74%[15].

No data collection and analysis of such complications have been published in our region; so we wanted to analyse our spectrum of patients and their management.

PATIENTS AND METHODOLOGY

The diabetic patients included in this study were treated and followed in Surgical Outpatient Department as well as some of them were admitted in Surgical Ward. Written consent was documented from the patients before including them in the study conducted. The patients having their lower limb affected by Diabetes Mellitus were followed from the time of presentation until 3 months after their treatment was over or their associated complications were managed. Patients of both Type 1 and 2 Diabetes Mellitus were included. The data was entered on a proforma which consisted of history, examination, investigations which included metabolic profile and blood glucose monitoring, diagnosis and treatment record. The patients were distributed in two groups: Group I included patients being treated and followed in Surgical Outpatient Department and Group II included patients admitted and treated in surgical ward. The symptoms of these patients were thoroughly assessed and diagnosis was made. The complications in patients admitted in surgical ward were treated by appropriate surgical procedures and were followed in Outpatient Department after discharge. All patients having lower limb complications were included. Other comorbidities alongside Diabetes were also noted and managed concomitantly with the assistance of Department of Medicine. The patients of acute trauma received in emergency department who require immediate management were not included in this study.

The patients who refused to give consent or not completed their 3 month follow up were excluded from the data. Data was entered and analyzed using SPSS v 22.0.

RESULTS

The inflammatory conditions of soft tissues include all spectrum i.e., cellulitis, abscess formation, necrotizing fasciitis, and gangrene of parts involving lower limb in varying proportions. Inflammatory conditions (musculoskeletal) including bursitis, osteomyelitis, and septicarthritis were recorded. Bone and joint affections and pathologies presenting in orthopedic department were collective shown in the table; these include pathological fractures, muscular atrophy, myopathy, tendinopathy and septic tenosynovitis.Category of skeletal deformities include different arthrodesis and Charcot's foot. Table III shows management. Presentation of patients is shown in Table II.

Table I - Demographic data

Total patients enrolled	1859 (100%)	
Lost to follow up	345 (18.56%)	
Patients in study	1514 (83.23%)	
Age	24- 89	Mean 32± 7.9 years
Gender (M: F)	591(39%): 923(61%)	
Duration of diabetes	35 years	Mean 10.69 years
Group I	811 (53.6%)	
Group II	703 (46.4%)	

Table II - Presentation/Diagnosis in groups. n=1514 (100%)

	Group I	**Group II**	**n**
Inflammatory conditions (soft tissue)	406 (50.1%)	335 (47.7%)	741(48.9%)
Inflammatory conditions (musculoskeletal)	197 (24.3%)	187 (26.6%)	384(25.4%)
Bone and joint pathologies	164 (20.2%)	121 (17.2%)	285(18.8%)
Skeletal Deformities (Charcot Foot)	3 (0.36%)	7 (0.99%)	10 (0.66%)
Peripheral vascular disease/ limb ischemia	41 (5.05%)	53 (7.54%)	94 (6.21%)

Table -III- Management and surgical procedures n= 2221 (100%)

Minor amputation	267 (12%)
Major amputation	63 (2.84%)
Debridements	396 (17.8%)
Fasciotomies	73 (3.29%)
Rehabilitation/ physiotherapy department referral/ prosthesis	890 (40.1%)
Conservative management	532 (23.95%)

DISCUSSION

The data in our study shows that 48.9% of diabetic patients had inflammatory conditions of soft tissue, 25.4% had inflammatory conditions of skeletal tissue, 18.8% had bone and joint pathologies, 0.66% had skeletal deformities and 6.21% had peripheral vascular disease/limb ischemia. While the study by Shatnaviet al[16] shows that 76.9% of the diabetic patients had inflammatory conditions of soft tissue and skeletal tissue, 43.8% had bone and joint pathologies and skeletal deformities and 52.9% had peripheral vascular disease. The vast difference in the data of both studies can be explained by the latter study conducted on large number of patients. The study conducted by Nulukurthi et al[17]shows that 56% had inflammatory conditions of soft and skeletal tissue, 26% had bone and joint pathologies, 10% had skeletal deformities and 86% had peripheral vascular disease. This vast difference can be explained by small sample size, late presentation of the disease and the latter study being conducted in rural area where there is lack of awareness regarding Diabetes Mellitus.

The data in our study also shows that 12% of the patients underwent minor amputation, 2.84% underwent major amputation, 17.8% underwent debridement, 3.29%

underwent fasciotomies, 40.1% were referred to rehabilitation/ physiotherapy/ prosthesis and 23.95% had conservative management. While the study by Shatnavi et al[16]shows that 64.7% underwentdebridement, 8.9% underwent conservative management, 16.6% underwent minor amputation and 11.6% underwent major amputation. The slight difference in both studies can be explained by the stage of disease in the patients in both studies and large number of patients included in the latter study. The study conducted by Nulukurthi et al[17]showed that 72% of the patients underwent debridement, 48% underwent minor and major amputations and 2% of the patients were managed conservatively. This vast difference between both studies can be explained by small sample size, late presentation of the disease and the latter study being conducted in rural area where there is lack of awareness regarding Diabetes Mellitus.

A multidisciplinary approach to the “high-risk diabetic foot”, in our experience, has proven to be very effective in managing complications in this ever increasing cohort of patients specifically in reducing morbidity, including limb loss, as well as length of stay in hospital. As discussed, diabetes has broad spectrum of manifestations in the lower limb. Timely, combined expert input from dedicated podiatrists, endocrinologists, vascular surgeons and radiologists in this forum has proven to be a very successful model, resulting in early diagnosis of complications and the subsequent ability to expedite aggressive treatment.

Multiple imaging modalities are employed as appropriate, with increased reliance on high-resolution MRI, specifically to confirm or exclude the presence of early neuropathic osteoarthropathy, devitalized soft tissue or bone, septic arthritis, osteomyelitis and soft-tissue abscesses. The role of the radiologist is central in terms of providing accurate and early diagnosis of complications, as well as monitoring the progress of complications and treatment. Radiologists are also uniquely placed to advise on, and perform specific image-guided interventions such as lower limb arterial revascularization procedures for ischaemia, joint aspiration for suspected septic arthritis, bone biopsy for suspected osteomyelitis, as well as percutaneous drainage of soft-tissue abscesses.

CONCLUSION

The diabetic patients suffer from a vast range of pathologies which effect lower limbs and it shares a main bulk in general surgical wards. Most of these problems need to be treated by surgical procedures while majority of such patients in outpatients department are usually managed conservatively.

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