



A Study Of Risk Factors Leading To Major Amputations In Diabetic Foot Ulcers

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Abstract

Introduction:

Diabetes mellitus is the most significant cause of non-traumatic amputations worldwide. The most common form of neuropathy is the symmetrical sensory motor neuropathy. The aim of this study is to determine the risk factors causing major amputations in diabetic foot infections and to emphasize the actions that are needed to prevent the progression of the disease.

Materials And Methods:

This prospective descriptive study included 66 patients (amputees) admitted in general surgical wards in Government Karur Medical College And Hospital during the period of 12 months from June 2021 To May 2022.

Result:

The majority of the amputees were males. The number of the being 38 males and 28 females. Amputations were more commonly done in the age group of 50 to 60 years. There seems to be apparent reduction in the rate of amputation in the older age groups. Longer the patient with diabetes, the more chance of landing up with amputation. In this study, patients underwent major amputation , having diabetes for more than 10 years duration. In this study, All patients had previous history of minor amputations, with around 56.6% had > 3 wound debridement.

Conclusion:

Early recognition and treatment of psychological morbidity seem to be important in preventing long-term disabilities in an amputee. Intervention in the form of counseling both pre and post operative period addresses the psychological side of injury and healing which is paramount to physical rehabilitation.

Keywords: Diabetic foot ulcer, Risk factors, Amputation

Introduction

Diabetes is a chronic disease causing lower extremity amputation all over the world, mostly in india, the diabetic capital of the world. Diabetes mellitus is the most significant cause of non-traumatic amputations worldwide. In a neuropathy mechanism, the loss of any protective sensation may predispose the foot to a much higher risk of

complications and ulcers directly or with an increase in plantar pressure. The most common form of neuropathy is the symmetrical sensory motor neuropathy. Sensory neuropathy is found to be caused by the abnormal metabolic pathways, including the sorbitol via polyol pathway. The loss of protective sensation could lead to the foot problems going undetected by the patients thus resulting in

repetitive trauma and also tissue breakdown with autolytic enzyme activities further causing foot ulcerations. Motor neuropathy could further add to structural and muscular changes which ultimately lead to the shedding of plantar tissues with repetitive and excessive external stress. The aim of this study is to determine the risk factors causing major amputations in diabetic foot infections and to emphasize the actions that are needed to prevent the progression of the disease.

Materials And Methods:

This prospective descriptive study included 66 patients (amputees) admitted in general surgical wards in government karur medical college and hospital during the period of 12 months from june 2021 to may 2022. All cases of diabetic foot undergoing major amputation at the department of general surgery, Govt. Karur medical college and hospital during the study period included in the study. Major amputation is defined as below knee (transtibial) or higher levels of amputation. Patients with diabetes mellitus undergoing major amputation following trauma & patients with peripheral vascular disease like TAO, patients who had undergone prior major amputation, patients not willing to participate in the study were excluded from the study. The patients included in the study were evaluated clinically, biochemically and radiologically. The study factors were demographic details of all patients including age, sex, duration of diabetes, smoking history and use of foot ware were noted as a part of demographic data. The diagnosis of diabetes was made by measuring random blood sugar value on admission. The following details were collected by a questionnaire; duration of diabetes, previous history of minor amputation, whether the habit of smoking present or not, whether patient is using footwear or not. As a protocol, patients treated in the ward with diabetic ulcer foot underwent a standardized evaluation for assessment of peripheral vascular disease and peripheral neuropathy. Sensory

neuropathy was evaluated with Michigan neuropathy scale. Nutritional assessment was done by measuring hemoglobin and serum albumin. The diagnosis of peripheral arterial diseases were evaluated by arterial Doppler. Wounds with frank purulence or with signs of inflammation such as warmth, erythema, lymphadenopathy, edema, loss of function and pain were used for the diagnosis of infection. Patients with infected wounds, pus culture and sensitivity were done. To assess the renal function, blood serum creatinine values were taken. To assess the features of osteomyelitis, x-ray of the local part was taken. To assess the level of major amputation, we stratified all the lower extremity major amputation in the following levels; transtibial or below knee amputation and trans femoral or above knee amputation. All 66 patients included in the study were followed up till the time of discharge and followed for a minimum 2 months regarding rehabilitation. Details regarding hospital deaths were also noted to correlate above mentioned risk factors leading to mortality among patients.

Results:

The majority of the amputees were males. The number of cases being 38 males and 28 females (figure 1). Amputations were more commonly done in the age group of 50 to 60 years (figure 2). Patients having diabetes for more than 10 years as a risk of major amputation, the more the durations of diabetes positively correlates with mortality among amputees with highest mortality among >20 years duration (figure 3). 55 patients were below knee amputees and 11 patients were above knee amputees (figure 4). 54.5% of participants were smokers (36) indirectly correlating with decreased wound healing and immune response (figure 5). Vast majority of subjects had peripheral neuropathy (57) 86.5% leading to diabetic foot ulcer ultimately ending up in major amputations. The presence of neuropathy was assessed by tuning fork testing (figure 6).

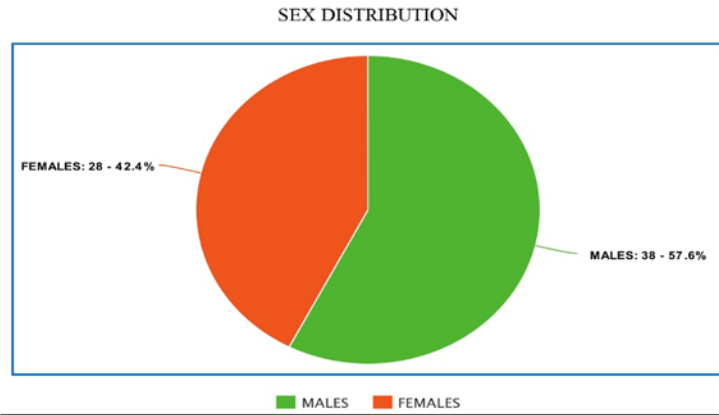


FIGURE 1 Sex Wise Distribution

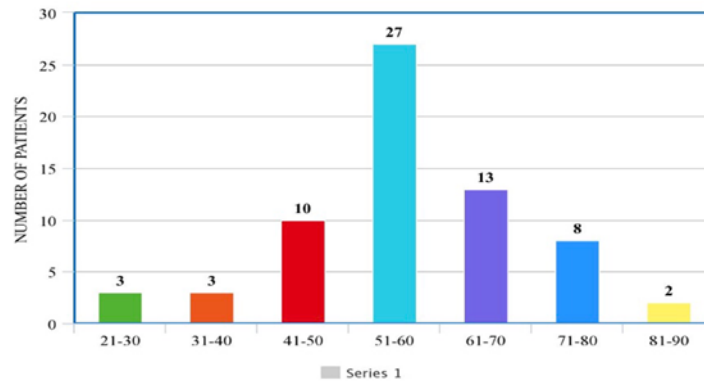


FIGURE 2 Age Wise Distribution

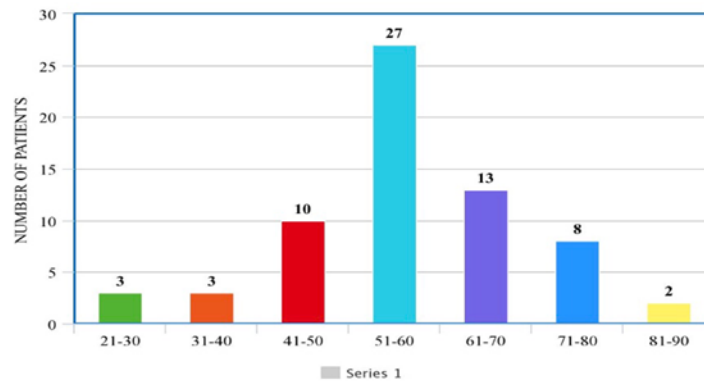


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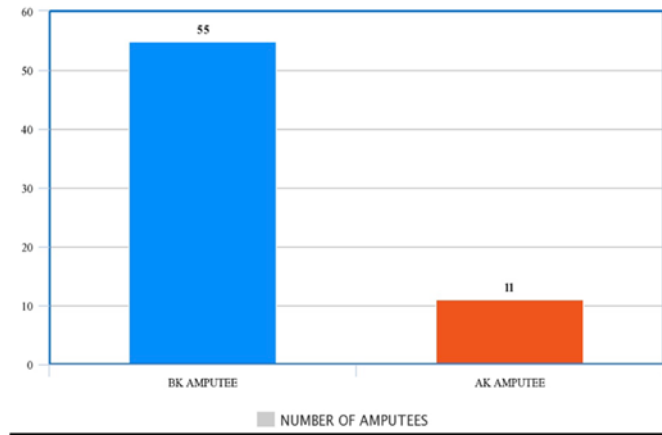


FIGURE 4 Distribution Of Amputees

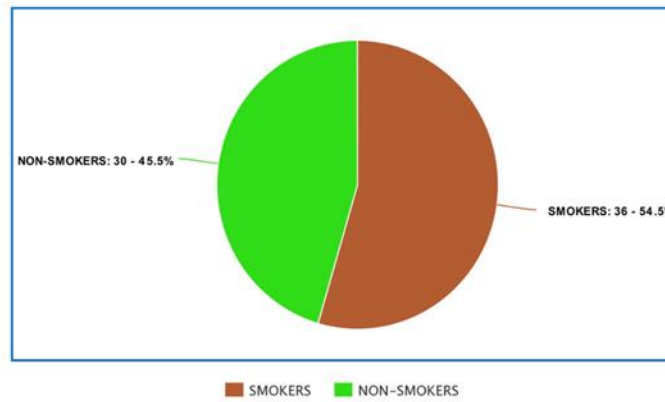


FIGURE 5 Distribution Of Smokers

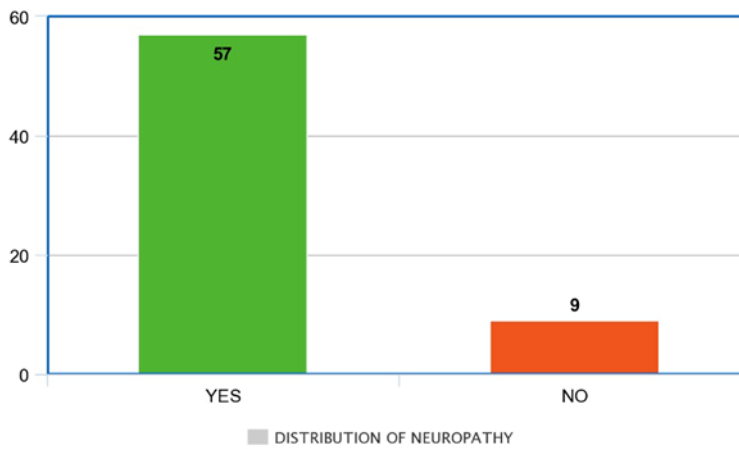


FIGURE 6 Distribution Of Neuropathy

Around 47 patients had Hb<10 (anemia) -71 % , leading to decreased wound healing and increases the progression of foot ulcer, 15 patients with Hb< 10g/dl expired after amputation of respective limbs which positively correlates anemia and mortality among diabetic foot ulcer patients (figure 7). 42 patients had RBS > 200mg/dl (70.2%) ,as a risk factor for lower limb amputation (figure 8). Above 42 patients had multiple wound debridement (>3) and increased creatinine values and anemia , leading to multifactorial causation. The more the number of wound debridement , there is increased chances of mortality among study patients. Patients with 7 times wound debridement went for 100 % mortality indicating poor wound status , ascending sepsis leading to multi-organ failure(figure 8) . Among the study subjects 34 (54.5%) had radiological evidence of osteomyelitis(figure 9) . Out of 66 patients ,most common organism cultured was proteus mirabilis followed by E.coli and Klebsiella oxytoca (figure 10). 36 patients had dyslipidemia , 17 % of patients showed atherosclerotic changes in Doppler.

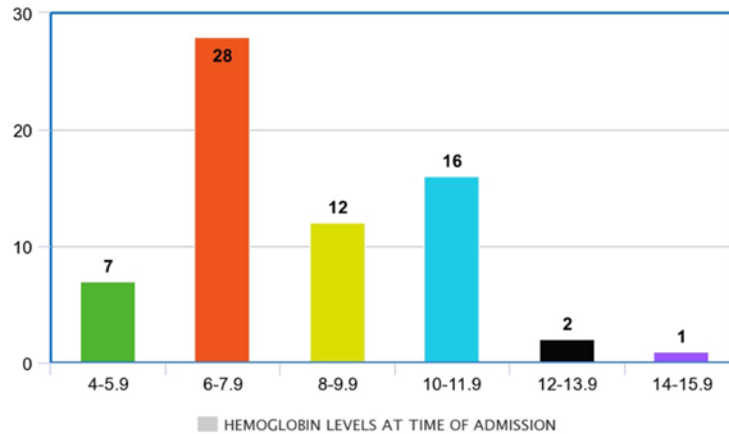


FIGURE 7 Distribution of Hemoglobin

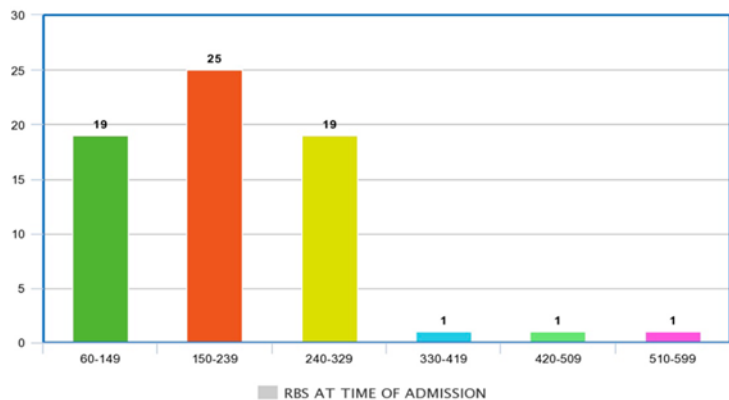


FIGURE 8 Distribution Of Random Blood Glucose

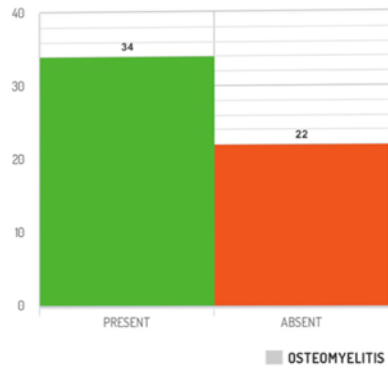


FIGURE 9 Distribution Of Osteomyelitis

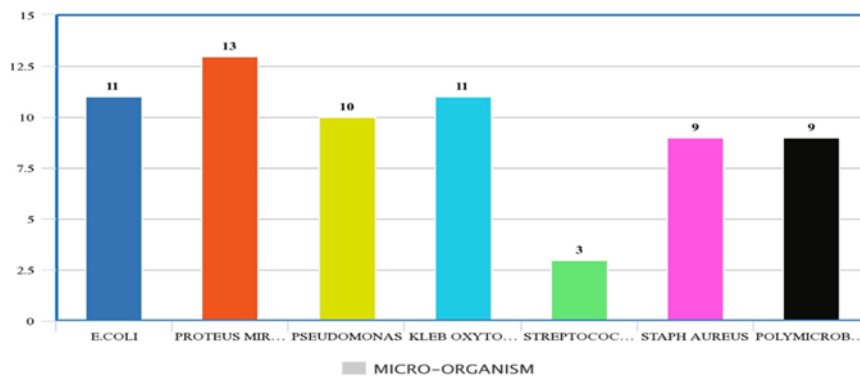


FIGURE 10 Distribution Of Microorganism

Discussion:

Vascular changes lead to ischemic ulcers which are different from the neuropathic ulcers. Neuropathy assessment done by Michigan neuropathy screening instrument (MNSI), the Leeds assessment of neuropathic symptoms and signs (LANSS) pain scale. Ankle-brachial index (ABI) test is done to demonstrate arterial wall insufficiency. The testing of muscular power can be achieved as per manual muscle testing (MMT) procedure and medical research council scoring system 0–5. Neuroquick, useful for testing cold sensation, pus culture and sensitivity, x-ray of local parts. Management and treatment of diabetic foot infection includes, topical wound care treatment and indications for their use, surgical treatment of the ulcerated foot, lower extremity arterial reconstruction in patients with diabetes soft tissue reconstructive options for the ulcerated or gangrenous diabetic foot, amputations and rehabilitation, organization and preventive care.

Aggressive mechanical debridement, systemic antibiotic therapy, and strict non-weight bearing are the cornerstones for effective wound care. Management of foot ulcers involves recognition and correction of the underlying etiology, as well as appropriate wound care and prevention of recurrence.

Treatment differs according to the nature of the wound. It can be either ‘conservative’ therapy or surgical intervention. Before planning for surgical intervention care should be given in the form of antibiotics, adequate care of the foot. Debridement of wound should be given. If necessary offloading techniques may be used for the wound to heal. Patient should be advised to maintain good glycemic control.

All the devitalized tissues should be removed. If there is involvement of the bone, it should be removed. If there is presence of pus, incision and through drainage should be done. These prompt measures may provide healing of the wound.

Samples for cultures are acquired by curettage of the infected ulcer. Oral antibiotic therapy is initially given. MRSA should be covered under the spectrum. The ulcer should be debrided as often as necessary. Only clearance of infected tissue will improve the internal milieu of the patient. Most of such cases have poly-microbial infections requiring intravenous antibiotics initially rather than oral medication. Osteomyelitis should be evaluated by x-ray and CT. Debridement of the infected bone and even minor amputations may be needed. Bone cement containing antibiotics are available for use after adequate debridement, provided adequate soft tissue cover is available. Advances in wound debridement includes versajet system. After bacterial contamination has been controlled, small ulcers can usually be excised and closed immediately, use of local rotation flap helps in primary closure of the excised wounds without any undue tension. Large open wounds, however, are treated with a staged approach, with frequent debridement and creation of a granulation base with the use of local or free- flap coverage and soft-tissue repair. The endpoint for chronic diabetic foot wounds should include reduction in the number of major amputations, prevention of infection, decreased probability of ulceration, maintenance of skin integrity, and improvement of function. Vac therapy has been shown to activate angiogenesis, increase rate of granulation tissue, and decrease bacterial colonization while decreasing edema and increasing blood flow. Bioengineered alternative tissues and adjunctive therapies for diabetic foot wounds includes recombinant PDGF, hyperbaric oxygen, substitutes of skin (e.g., apligraf, dermagraft). amputations are last resort of the diabetic foot. It can be either curative or emergent. Amputation level selection aims at providing balance between preservation of limb length and function with the ability of the wound to heal properly.

In this study 66 patients admitted in general surgical ward in Govt. Karur Medical College – which inferred age of presentation (5th decade), smoking status, associated co-morbidities, duration of diabetes, osteomyelitis on imaging, anemia, nephropathy and neuropathy.

The studies by most rs et al, siitonen oi et al, armstrong dj et al (1993) group tg, have shown increasing age and male gender are unavoidable risk factors for amputation. In this study amputations

were more common in the fourth & fifth decade and there is increased male preponderance. Kumar et al, walters et al (1994), have quoted that increasing duration of the diabetes is a risk factor for amputation. In this study, majority of the patients had long duration of diabetes.

wright et al(2014) found the prevalence of anemia in patients with severe DFU. Their description was due to systemic inflammation, frequent superficial, deep tissue infection, osteomyelitis, and antibiotic use which may delay healing of foot ulcer. In this study 47 patients (71%) had anemia (hb <10g/dl) at the time of admission, as a risk factor leading to major amputations among diabetic foot ulcer. Studies by litzel man et al, Kumar et al, Carrington et al] (1999) boyko et al], Abbott et al, kasten Bauer et al, have found previous history of amputation is a risk factor for amputation. In this study, almost all subjects has a previous history of minor amputation, with around 56.6% had > 3 wound debridement's

Studies by chantelau e et al(1999) have found the use of footwear in diabetes mellitus prevents the development of the initial ulcer and prevents recurrence of ulcer at the same site or different site. In this study, all subjects used foot wear, still ended up with ulcer foot leading to major amputations, this is mostly due to lack of knowledge regarding proper and adequate foot care.

Studies by moss et al (1992), concluded smokers of younger age were more likely to ulcerate in diabetic patients. In wisconsin study, there was a borderline significance between smoking and ulceration in diabetic patients. In this study, 45.5 % of study subjects were smokers. kastenbauer (2003) have found neuropathy is a risk factor for amputation in diabetic ulcer. In this study 86.5% of subjects had neuropathy detected by tuning fork test and biothesiometer. Studies by carrington et al(1999), show that strict glycemic control can prevent amputation in diabetic foot. Ashu rastogi et all, described hyperglycemia in diabetes affects the DFU closure by impairing all phases of wound healing including decrease in neutrophilic phagocytosis, chemotaxis and bactericidal activity, abnormal migration of keratinocytes, and impaired collagen synthesis. In this study, 70.2 % of subjects had a blood glucose level of more than 200mg/dl. Fernando et al (1991), have found diabetic

nephropathy is a factor for foot ulceration sometimes leading to amputation. In this study, 69.3 % had diabetic nephropathy. Serum albumin level more than 3gms% is necessary for adequate wound healing to occur (dickhaut sc et al(1984). In this study, 83.9% of subjects had a serum albumin level less than 3gms%. Osteomyelitis can present with the failure of the local part to heal. Usually bone is infected by the way of blood spread. Due to infection in diabetic foot, spread form without inwards, from the overlying soft tissue to the deeper bone (berendt ar, lipsky ba et al(1997).

Lazaro martínez et al describes, osteomyelitis (om) is the most frequent infection of DFU, occurs in >20% of moderate infections and 50%– 60% of severe infections, and is associated with high rates of amputation, in this study 54.5 % of subjects had radiological evidence of osteomyelitis Studies by lipsky ba et al], borrero e, goldstein ej, viswanathan v et al(2005) shows that staphylococcus aureus is the most important pathogen followed by coagulase negative staphylococcus. Seyed et al] (2007), pseudomonas spp., & proteus spp. Carry a special role and are responsible for continuing and extensive tissue destruction with the poor blood circulation of the foot, with optimal microbiological techniques, most of these infections are noted to be polymicrobial. In this study, 21% of subjects had proteus mirabilis infection, and 16 % of subjects had infection with klebsiella oxytoca. Studies by cunha ba et al(2005), have found organisms like enterococci, and pseudomonas aeruginosa, are often colonizers rather than pathogen, and antimicrobial therapy specifically targeted against them may not be required. Patient education should emphasize; vigilant selection of footwear, regular inspection of the feet to detect early signs of poor- fitting footwear or minor trauma, everyday foot hygiene to keep the skin clean and moist, avoid of self-treatment of foot abnormalities and high-risk behavior (e.g., walking barefoot). Quick consultation with a health care provider if an abnormality arises.

The vital elements of preventive care are: yearly checkup by health care providers to determine risk factors, examination of at-risk feet at every visit, patient mindfulness on daily foot care and diabetes management, formation of specialized clinics to concentrate exclusively on diabetic patients. 60% patients with ulcer will have reappearance of ulcer in

the same region. Despite wide-spread availability of newer therapeutics and diagnostics, the effective prevention of reulceration is paramount in reducing the social and economic burden caused by diabetic foot ulcers. Therapeutic foot wear plays a key role in this context. The Achilles heel in attaining this elusive target still remains the patients lack of knowledge and non-compliance with advice of expert health-care personnel.

Conclusion:

Amputation of a limb, even though a life saving palliative procedure affects almost all aspects of an individual's life. Amputees in addition to their physical disability suffer from myriads of psychological as well as psychosocial problems. Early recognition and treatment of psychological morbidity seem to be important in preventing long-term disabilities in an amputee. Intervention in the form of counseling both pre and post operative period addresses the psychological side of injury and healing which is paramount to physical rehabilitation.

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