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Impact of Multidisciplinary Team Approach in the Management of Diabetic Foot for a Favourable Outcome

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Abstract: Lower extremity amputation is performed to remove ischemic, infected, necrotic tissue or locally unresectable tumor, and at times, is a life-saving procedure. Peripheral artery disease, alone or in combination with diabetes mellitus, contributes more than half of all amputations; trauma is the second leading cause. Lower extremity amputations are common debilitating complications in patients with diabetes mellitus. Our aim was to analyse the various causes for lower extremity amputations, assess the complications and amputation rates in patients with diabetes mellitus and to identify risk groups for lower extremity amputations that can be focussed for preventive treatment at Vydehi Institute of Medical Sciences and research centre, Bangalore. This retrospective audit was conducted jointly in the Dept of General Surgery & Dept of Medicine, VIMS&RC, a super speciality teaching hospital in south India, between Jan 2011 and Dec 2014. Case files of patients who underwent lower extremity amputations were retrieved from the institution medical records section and data analysed for demography, clinical presentation of diabetics, other causes for amputation such as vascular disorders, kidney disorders, malignancy and diabetic ulcer/ infections of the foot, and post-operative morbidity and mortality. 137 patients were amputated, of which 120(87.59%) males and 17(12.40%) females (table-1, fig-1). 82(59.85%) patients were diabetic and 55(40.14%) non diabetic patients which included twenty three peripheral vascular disease (16.78%), osteosarcoma 16(11.67%), crush injuries 9(6.56%) and elephantiasis 3(2.18%) (fig-3). Of the 82 diabetics males were 65(79.26%) and females 17(20.73%) (Table-2). Foot infections and chronic renal disease preceded amputation in patients with diabetes. Diabetic women were older than the men when amputated, diabetic men underwent multiple amputations both minor and major, had severe foot infections compared to the women. 90 % of all diabetes-related amputations were preceded by foot ulcers leading to ischaemic gangrene. Various interventions the patient underwent ranged from wound debridement to revision amputation (table-3,fig-4)The number of diabetics attending the diabetic foot clinic increased over the years showing the impact of awareness programmers and counselling about the disease (fig-2).The complications of diabetic foot infections ranged from cellulitis to gangrene (table-4,fig-5) There was 50% reduction in the rate of amputations performed above the ankle in patients with diabetes during the year 2014(table-6)) as most of them were referred to the multidisciplinary foot team in our diabetic clinic prior to the decision of amputation. There was no mortality in the study. The gradual decrease in rate of major amputations is due to an active implementation of the consensus guidelines of foot care in the diabetic clinic and awareness of the patients to get themselves examined and treated for foot problems early. Diabetic foot complications and diabetic nephropathy when identified early in diabetics can prevent major lower extremity amputations.

Keywords: Lower extremity amputations; Diabetic Foot ulcer; Diabetic foot complications.

INTRODUCTION

Foot ulcers are common complications of diabetes and the most common risk factor of lower extremity amputations in diabetic patients [1, 2] .The rate of lower extremity amputation is an excellent indicator of the quality of diabetic foot care. Diabetic complications such as peripheral neuropathy and peripheral vascular disease contribute to the formation of foot ulcers, causing ischemia, and gangrene and impaired wound healing. In 2000 the International

Working Group on the Diabetic Foot published the "International Consensus on the Diabetic Foot and Practical Guidelines on the Management and the Prevention of the Diabetic Foot", which contained guidelines for quality care and prevention of the diabetic foot, stressing the importance of a multidisciplinary approach in order to ensure the most effective treatment. Multidisciplinary teams consisted of physicians cum dialectologists, general surgeons/orthopaedicians [3,4]. The aim of this study was to retrospectively audit the various causes for lower extremity amputation, clinical presentations of diabetic patients and to evaluate the impact of the national and international guidelines on the diabetic foot by correlating the amputation rate at Vydehi institute of medical sciences and research centre for a period of 4 years (Jan 2011-Dec2014)

MATERIALS AND METHODS

A retrospective audit was carried out in the Department of surgery/diabetic foot clinic and Dept of General Medicine. The aim of this study was to audit the various causes for lower extremity amputation, clinical presentations of diabetic patients and to evaluate the impact of the national and international guidelines on the diabetic foot care by correlating the amputation rate at Vydehi institute of medical sciences and research centre a super speciality centre in south India, for a period of 4 years (Jan 2011-Dec2014). Relevant data pertaining to demography, duration of diabetes, details of foot complications, microbiological culture report, and management of complications and reasons for lower extremity amputations were obtained from the hospital medical records section. Non-diabetic patients with foot infections were excluded from the study.

RESULTS

A total of 137 patients underwent lower extremity amputation. 120 (%) were males and 77 (27.7%) were females. (table1, fig-1). 82 patients were diabetics who underwent amputations male 65(79.2%) and females 17(20.73%) (Table-2). Year wise distribution of amputated patients were as follows in 2011- 30(21.89%), 2012- 25(18.24%), 2013-30(21.89%) and 2014-52(37.95%) (Fig -2).The age ranged between 20 and 80years and the mean age was found to be 46.6 years. All the patients in the diabetic group were detected of diabetes for at least 5-7.

Years and 50% of the patients had diabetic nephropathy. Fifty five amputated patients without a known history of diabetes were defined as nondiabetic.Peripheral vascular disease was present in 23(16.78%), malignancy16 (11.6%), crush injury9 (6.56%) elephantiasis3 (2.18%) (Fig-3). Eighty two patients case reports was analysed for the event of an amputation preceded by a known history of diabetes mellitus of which males 65(79.26%) and females 17(20.73%) (Table-2). The case files of the 137 patients were scrutinized for diagnoses of diabetes, diabetic nephropathy, vascular disorders and ulcer infections of the foot that were present before an amputation. Renal disease was defined as acute renal failure, chronic kidney disease, known diabetes nephropathy, serum creatinine levels > 100 μmol/l. Infections were positive culture for polymicrobial organisms in osteomyelitis and infected foot ulcers or residual limb. Peripheral vascular disorders 23(16.78%) included atherosclerosis, ischemia. Peripheral neuropathy 25(30.48%) callus/ non-healing ulcers 5(6.09%) charcot arthropathy 15(18.29%), gangrene 39(47.56%), cellulitis 13(15.8%), fungal infections10 (2.19%), osteomyelitis10 (12.19%), and necrotizing fasciitis4 (4.8%) (Table 4, fig-5). Amputations performed below the ankle were defined as minor amputations such as toe disarticulation20(14.59%),wound debridement21(15.32%),forefoot amputation10(7.29%) were performed. whereas amputations above the ankle were defined as major above knee amputation40(29%), below knee amputation41(29.92%), revision amputation3(2.18%),bilateral below knee amputation2(1.45%) were performed(table-3,fig-4). The rate of major amputations in diabetic patients decreased with approximately 50% between 2011-27(32.92%), 2012-22(26.82%), 2013-21(25.60%) and 2014-12(14.62%) (Table-5, fig-2). There was no mortality during the study period.

Table-1: Showing Gender distribution of total number of amputated patients.

No of male patients	No of female patients
120 (87.59%)	17 (12.40%)

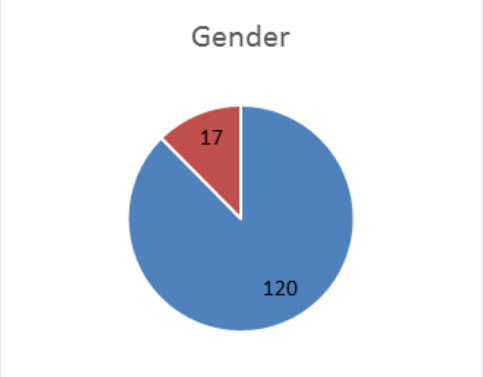

Fig-1: Pie chart showing gender distribution of total number of amputated patients

Table-2: showing distribution of diabetic patients who underwent amputation.

No: of male patients& %	No: of female patients& %
65(79.26)	17(20.73)

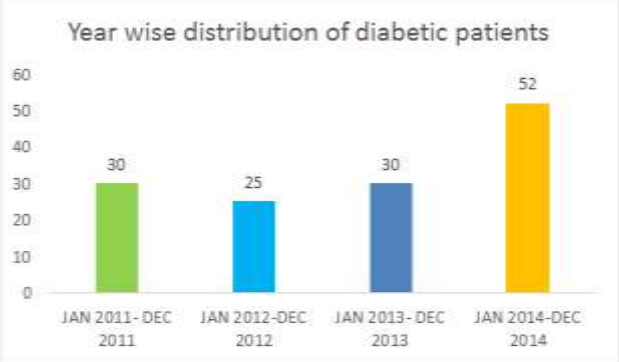

Fig -2: Showing year wise distribution of diabetic patients

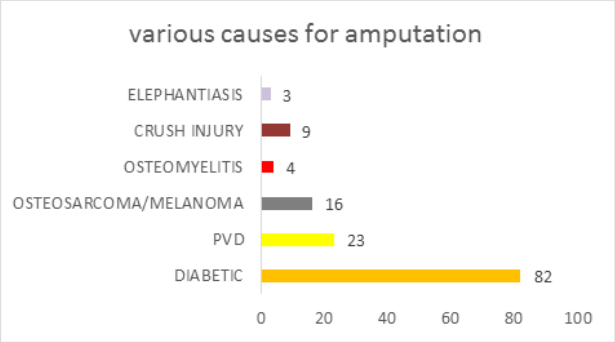

Fig-3: Showing various causes for lower extremity amputation

Table-3: Table showing various types of surgical procedures performed for diabetic foot

Surgical procedure	**No of patients & %**
Wound debridement	21 (15.32%)
Toe disarticulation	20 (14.59%)
Fore foot amputation	10 (7.29%)
Above knee amputation	40 (29.19%)
Below knee amputation	41 (29.92%)
Revision amputation	3 (2.18%)
B/L below knee amputation	2 (1.45%)

Fig-4: showing various surgical procedures performed in diabetic patients

Table -4: Table showing various foot complications in diabetic patients

complications	Number of patients & %
Peripheral neuropathy	25 (30.48%)
Charcot arthropathy	15 (18.29%)
Callus	5 (6.09%)
Fungal infection	10 (12.19%)
gangrene	39 (47.56%)
cellulitis	13 (15.8%)
Spreading cellulitis	6 (7.31%)
osteomyelitis	10 (12.19%)
Necrotizing fasciitis	4 (4.87%)

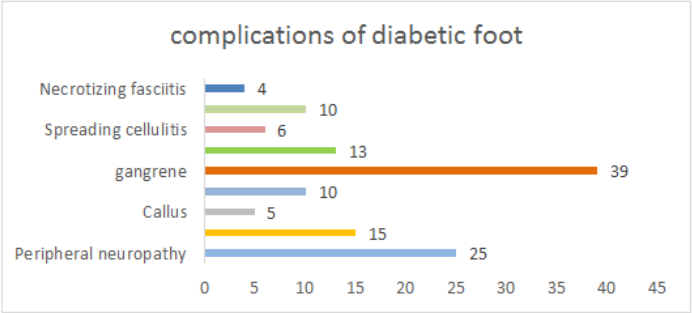

Fig-5: showing various diabetic foot complications

Table-5: showing year wise distribution of amputated patients with application of consensus guidelines

year	Number of patients
2011	27(32.92%)
2012	22(26.82%)
2013	21(25.60%)
2014	12(14.63%)

DISCUSSION

Prevalence rate of diabetes in Indians is 2.4% in rural and 12-17% in urban population ranks second in the world with 65.1 million diabetic patients. The complications in diabetic patients are peripheral neuropathy, charcot arthropathy, foot ulcers, infections, and lower extremity amputations leading to disability [5]. Risk of developing foot ulcer is as high as 25%. In India prevalence of foot ulcers in diabetes patients is 3%, which is lower compared to western population Diabetic foot infections include paronychia, cellulitis, myositis, abscesses, necrotizing fasciitis, septic arthritis, tendonitis, and osteomyelitis. It is estimated that diabetes accounts for more than 50% of amputation, of which 85% of lower amputation in diabetes patients are preceded by foot ulcers [6,7].

The number of major amputations decreased by 50% in patients during the time period between 2011 to 2014, while the number of minor amputations remained unchanged, favouring that diabetic patients underwent less disabling amputations at the end of the study period. Reductions in the total and major amputation rates are consistent with recent studies of

trends in the amputation rate and indicate an improved effectiveness in the diabetes care, possibly due to multidisciplinary actions [8,9]. The patients amputated in this study were predominantly male, a finding which is similar with other studies. Male patients also underwent repeated surgeries and reamputations.

Many patients with type 1 diabetes had diabetes duration of ten years or more at the time of complications and amputation. Diabetic nephropathy is a major diabetic complication leading to end-stage renal disease. Renal disorders are associated with an increased risk of neuropathy and peripheral vascular disease [10,11]. There was no gender difference in the presence of foot ulcers prior to amputation in patients with diabetes, pointing that once a foot ulcer is present the risk of Lower Extremity Amputation is same. Delayed wound healing in male patients, vulnerability to ulcer infections contributed to the higher number of male patients undergoing redo surgeries.

Autonomic neuropathy increases the risk of ulceration by causing anhidrosis and oedema of the foot, and peripheral sensory polyneuropathy reduce the protective sensation of the distal limbs due to altered vascular function and endoneural hypoxia [12]. According to the consensus guidelines of foot care, better treatment outcomes are expected if all patients with problems related to the diabetic foot are treated by multidisciplinary treatment teams. Patients at risk of Lower extremity amputations should receive preventive foot care in time, and specialist treatment as soon as a foot ulcer is noticed which can prevent major amputations in diabetic patients [13,14]. Amputees with diabetes are more likely to be severely disabled hence counselling and rehabilitation and provision for prosthesis could go a long way. Amputation performed without an attempt at limb salvage (revascularization, bony repair, soft tissue coverage) is termed primary amputation, whereas amputation following a failed attempt at revascularization is termed secondary amputation. Traumatic amputation refers to limb loss that occurs in the field at the time of injury [10-14].

CONCLUSIONS

The rate of major amputations in diabetic patients decreased with approximately 50% between 2011 and 2014. Diabetic patients who were amputated preceded foot infections and kidney disorders. Diabetic patients also underwent more redo surgeries and amputations. Female diabetic patients were older at the time of amputation, while male diabetics were younger and underwent re-amputations with higher prevalence of infected foot ulcers compared to female diabetic patients. The patients who had been treated with the multidisciplinary foot team early showed reduced major amputations. The amputation rate could be further reduced if all patients at risk of lower extremity amputations were referred to the multidisciplinary foot team in order to reduce the disability rate.

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