LIMB SALVAGE IN DIABETIC FOOT INFECTION

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ABSTRACT

BACKGROUND

Diabetic foot infections are a frequent clinical problem. About 50% of patients with diabetic foot infections who have foot amputations die within five years. Properly managed most can be cured, but many patients needlessly undergo amputations because of improper diagnostic and therapeutic approaches. Limb salvage procedures may prevent eventual limb loss, the need of a major limb amputation, decrease total cost and may restore full ambulation earlier.

MATERIALS AND METHODS

Seventy five septic diabetic feet were treated with NPWT between 2014 and 2016. Debridement with or without partial foot amputation was followed. Wound progress was measured using a digital scanner. A limb was considered salvaged if complete healing was achieved without any or with minor amputation through or below the ankle.

RESULTS

In this series, 33 cases were managed initially by debridement and slough excision, 11 patients underwent incision and drainage for abscess and three patients underwent fasciotomy. Seven cases who presented with gangrene of toes were treated with ray amputation. Below-knee amputation was done in 21 cases. In most of the cases, limb salvage was possible.

CONCLUSION

A comprehensive treatment approach incorporating surgical and nonsurgical therapies are required to avoid major limb amputations in severe diabetic foot infections.

KEYWORDS

Diabetic Foot; Infection; Amputation; Limb Salvage.

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BACKGROUND

The prevalence of diabetes mellitus is growing at epidemic proportions worldwide. Most alarming is the steady increase in type 2 diabetes, especially among young and obese people.[1] Foot ulcerations, infections, Charcot neuroarthropathy and peripheral arterial disease are more common in diabetics frequently resulting in gangrene and lower limb amputation.[2] The main predisposing factors for the development of diabetic foot infections are macroangiopathy, microangiopathy, peripheral neuropathy and the altered immunological response of diabetic patients. Although, not all foot complications can be prevented, dramatic reductions in frequency can be achieved by taking a multidisciplinary approach to patient management and limb salvage rate can be improved.

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Foot infections in patients with diabetes cause substantial morbidity and frequent visits to healthcare professionals and may lead to amputation of a lower extremity.[3] The major predisposing factor to these infections is foot ulceration, which is usually related to peripheral neuropathy. Peripheral vascular disease and various immunological disturbances play a secondary role. Diabetic foot infections require attention to local (foot) and systemic (metabolic) factors. Providing optimal wound care in addition to appropriate antibiotic treatment of the infection is crucial for healing. Although, many patients with severe infections are hospitalised and treated with Intravenous Antibiotics (IA), the role of early surgical management is often underrated and severe diabetic foot infections can become limb- or life-threatening events. Because systemic signs of infection are frequently absent or late, all infections must be treated aggressively. Limb salvage procedures may prevent eventual limb loss, the need of a major limb amputation, decreased total cost and may restore full ambulation earlier.

Optimal management of diabetic foot infections can potentially reduce the burdens (medical, financial and ecological) associated with inappropriate practices, including those related to antibiotic prescribing, wound care,

hospitalisation decisions, diagnostic testing, surgical procedures and adjunctive treatments.

MATERIALS AND METHODS

This prospective study comprised of 75 patients of severe diabetic foot infection who presented to the surgical unit at the Department of General Surgery, RIMS Hospital, Kadapa, over a period of two years from December 2014 to October 2016.

Several foot ulcer classification methods have been proposed in order to organise the proposed appropriate treatment plan, but none have been universally accepted. The Wagner-Meggitt classification is based mainly on wound depth and consists of six wound grades (Table 1).[4] The University of Texas system grades the ulcers by depth, then stages them by the presence or absence of infection and ischaemia.[4,5] As there is the need for rapid and more appropriate therapy to facilitate healing, the international working group on the diabetic foot proposed the PEDIS classification, which grades the wound on a 5-feature basis-perfusion (arterial supply), extent (area), depth, infection and sensation.[6] They also classified diabetic foot infections into four grades- Grade 1 (no infection); Grade 2 (mild) in subcutaneous tissue only; Grade 3 (moderate) with extensive erythema and infection of deeper tissue and Grade 4 (severe) with systemic inflammatory response indicating severe infection[5,6] (Table 3). Most diabetic foot infections require some surgical intervention ranging from minor (debridement) to major interventions including amputation. The main emphasis of the current international guidelines on the management of the diabetic foot is prevention, early recognition and treatment. Prevention of the diabetic foot entails controlling diabetes, smoking, obesity, daily foot checks, removing callosity (neuropathic foot), daily moisturising, regular toenail cutting and well-fitted footwear.[7]

The study is that if the guidelines on the management of the diabetic foot are followed, primary amputation is only necessary for the unsalvageable diabetic foot (Table 4). Endovascular procedures are the future in the treatment of diabetic arterial disease and hence the diabetic foot.

Grade 1	Grade 2	Grade 3	Grade 4
No infection	Mild	Moderate	Severe
No signs or symptoms of infection	Superficial, limited in size and depth	Deeper or more extensive	Systemic signs or metabolic perturbation

Table 1. PEDIS Classification[6]

Debridement/minor amputation	Primary amputation
Good blood supply to limb	Wet gangrene (infection+ischaemia) foot, but infected
Small vessel disease and gangrenous toe	Life-threatening sepsis
Successful surgical bypass	Extensive muscle necrosis
Neuropathic foot with little arterial disease	Revascularisation technically impossible, bed-ridden patients/functionally
Useless limb osteomyelitis with little arterial disease	

Table 2. Indications for Conservative Surgical Approach or Primary Amputation[8,9,10,11]

OBSERVATIONS AND ANALYSIS

An analysis of 75 cases of severe diabetic foot infection was done. These cases were admitted and treated in surgical unit at the Department of General Surgery at RIMS Hospital, Kadapa, over a period of two years from December 2014 to October 2016. Out of the 75 cases, 40 cases presented with an infected ulcer, 23 cases with gangrene of toe or foot, eight cases with a deep abscess and four cases with osteomyelitis.

Mode of Presentation	Number of Patients	Percentage
Infected ulcer	40	54
Gangrene	23	30
Deep abscess	08	10
Osteomyelitis	04	06

Table 3. Mode of Presentation in Diabetic Foot

In this series, 35 cases were managed initially by debridement and slough excision, 11 patients underwent incision and drainage for abscess and three patients underwent fasciotomy. Seven cases who presented with gangrene of toes were treated with ray amputation. Below knee amputation was done in 19 cases. In most of the cases, limb salvage was possible.

Surgical Intervention Done	Number of Patients
Debridement	35
Incision and drainage	11
Ray amputation	07
Fasciotomy	03
Below knee amputation	19

Table 4. Surgical Procedures Performed in Diabetic Foot

Secondary reconstruction with split skin grafts was done in 17 patients. Of these, two cases had minimal graft uptake.

DISCUSSION

Diabetic foot infection is one of the most common complication of chronic hyperglycaemia and a major source of chronic morbidity and mortality. More than 60% of traumatic amputations are attributed to diabetes, 80% of which are presided by a foot ulcer, peripheral neuropathy, peripheral vascular disease, ipsilateral foot ulcer, previous amputations, male gender and insulin therapy have been reported as risk factors for lower limb amputations. Limb salvage in patients with diabetes mellitus is a challenging

process that aims to prevent major limb loss in a population often plagued by multiple comorbidities. Employing a multidisciplinary approach has proved advantageous in improving limb salvage rates in diabetes population.

Prevention of diabetic foot disease through glycaemic control, periodic foot examination, callus debridement shoe gear recommendations, deformity prevention and accommodation and patient education is the first line of defence against amputation, however, surgical intervention frequently become necessary to eradicate infection, remove necrotic tissue, close chronic wounds eliminate structural causes of tissue breakdown and reconstruct deformities.

For a myriad of reasons, limb salvage should be considered a first line approach in treating most patients with an at risk limb. It has been demonstrated that five-year mortality rates are higher in those with a diabetes-related lower extremity amputation than those afflicted with breast cancer or prostate cancer.

Following below and above-knee amputations, 30-day mortality rates of 6.3% and 13.3%, respectively, have been reported long-term survival rates have been documented as low as 62% at one year 50% at two years and 29% at five years. Conversely, significantly better mortality rates have been reported following partial foot amputations, which also spare the need for intensive rehabilitation further more major limb loss in older, diabetic patients have been associated with major morbidity. They experience considerably more problems than age and sex matched controls with performing household chores and hobbies and with maintaining social relationships due to their inability to be effectively rehabilitated into the community, psychological effects as well as moderate risk for loss of the contralateral limb are also concerns following amputation. Similarly, diabetic foot ulcers can have a profound effect on quality of life if not treated appropriately.

Study	Number of Cases	Number of Major Amputations	%
Collen's series (1962)[12]	215	83	38.6
Osaka Kosainekin Hospital (2005)[13]	210	110	52
Ozkara et al[14] (2005)	84	32	38.1
Strbova et al[15] (2011)	124	38	30.6
Aziz et al[16] (2011)	100	28	28
Diabetes Research Centre, Chennai Study (2011)[17]	1985	377	29.1
Present study	75	19 (below knee)	26

Table 5. Major Amputations

The incidence of major amputation in our study is 26%. This is lesser compared to other studies. Limb salvage can be a time consuming process fraught with complications and costs. A comprehensive discussion between the surgeons and patients is critical for aligning realistic expectation in terms of postoperative function healing potential and progressive nature of underlying disease. The patient must understand the continued risk of tissue breakdown, healing complications and recurrent infections that could require additional hospitalisation and surgical procedure. Advanced wound closure techniques and subsequent pedal amputation maybe necessary to achieve a successful outcome.

Four pertinent issues must be addressed with the limb salvage candidate prior to surgical intervention-

1. Definition of a realistic expectation corresponding to the average functional outcome in medically similar patients with the same amputation level.
2. Comparison of the functional outcomes of a salvaged limb versus an amputation and fitting of prosthesis.
3. Costs, including consumption, time off work and the patient's ability to afford multiple surgeries.
4. Risk, particularly risk of recurrent infections and need for further surgery when limb salvage is chosen.

A thorough vascular examination including Doppler ultrasound is essential for determining perfusion adequacy of the corresponding segment. When perfusion is impaired, patients should have a formal consultation with a vascular surgeon to determine the extent of vascular disease and the need for vascular reconstruction.

In addition to critical limb ischaemia in a non-perfusable foot, there are number of other scenarios in which a below knee or above-knee amputation becomes the best option for the patients. A non-salvageable foot secondary to extensive tissue loss, unstable deformity in a poor surgical candidate and non-ambulatory bedridden patients who likely suffer from extensive comorbid conditions are indications for a primary major lower limb amputation where the benefit of a more definitive surgery outweighs the risks of attempted limb salvage, its potential complication and a poor prognosis.

CONCLUSION

Many diabetic foot problems are avoidable. Good glycaemic control and patient's education are essential. The main determinant of which patients with a diabetic foot infection need to be hospitalised is the clinical severity of the infection. With minimal surgical trauma and certain curative effect, endovascular procedures is the future in the treatment of diabetic peripheral arterial disease and hence the diabetic foot. It is desirable that a vascular surgeon should assess the diabetic foot as the possibility of revascularisation, must always be considered and the correct subgroup selected for amputation. Guideline-based care for diabetic foot infections and the employment of multidisciplinary teams would help improve outcome and minimise amputations.

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