



## Diabetic Foot in India

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### INTRODUCTION

Diabetes mellitus is recognised to be common in Indians of Asian subcontinent. Currently 25 million Indians have diabetes. The projections indicate that India will have the largest number of diabetic patients by the year 2025 A.D.

The loss of a limb or foot is one of the most feared complications of diabetes and yet foot problems remain the commonest reason for diabetic patients to be hospitalized.

Diabetic foot ulcers are common and estimated to affect 15% of all diabetic individuals during their lifetime.<sup>1</sup> Diabetic foot ulcers precede almost 85% of amputations.

There are two main reasons for the foot complication.

Some diabetic patients develop a diabetic peripheral neuropathy characterised by loss of sensation in the feet. Such patients have a high risk of injuries which often go unnoticed. Diabetic patients particularly those with neuropathy have abnormal pressure points under the feet. In these areas, the skin gets thickened (called callus) which then becomes an ulcer. Chronic infection in the ulcer ultimately leads to amputation of a toe or the whole foot.

These two groups of patients are considered to have “High Risk Feet”.

### EPIDEMIOLOGY

In India, the prevalence of diabetic foot ulcers in the clinic population is 3.6%.<sup>2</sup> Sociocultural practices such as barefoot walking, religious practices like walking on fire, use of improper footwear and lack of knowledge regarding foot-care attributes towards increase in the prevalence of foot complications in India.<sup>3</sup> A retrospective study to evaluate the clinical profile of diabetic foot infection showed that the recurrence of foot infection was common among South Indian type 2 diabetic patients and was related to the presence of PVD and neuropathy. This study also showed a need for improvement in footwear and foot care education.<sup>4</sup>

In a study from Southern India, it was found that patients without foot problems spent 9.3% of the total income, while patients with foot problem had to spend 32.3% of the total income towards treatment.<sup>5</sup> This huge challenge imposed by diabetic foot problem calls for prevention and effective management at initial stages of the complication.

### PATHOGENESIS OF DIABETIC FOOT ULCER

If we are to succeed in reducing the incidence of foot ulceration and amputation in diabetes, then a clear understanding of the various factors that interact resulting in ulceration is essential. It is important to understand that the diabetic neuropathic foot does not spontaneously ulcerate. Neuropathy is simply a component cause and it is the addition of trauma that results in tissue destruction and ulceration.<sup>6</sup>

#### Neuropathy

Diabetic neuropathy is defined as “peripheral, somatic or autonomic nerve damage attributable solely to diabetes mellitus”.<sup>7</sup>

Clinical diabetic neuropathy requires the presence of an abnormal neurologic exam done by a physician skilled in the proper examination technique. Abnormal neurologic exam can be consistent with nerve damage from diabetes.

#### Autonomic neuropathy

Sympathetic autonomic neuropathy in the lower limb results not only in reduced sweating and therefore dry skin that is prone to crack and fissures, but also to increased blood flow, in the absence of large-vessel peripheral vascular disease. This latter abnormality is a consequence of an increase in arteriovenous shunting and results from a warm foot, with distended dorsal foot veins, both useful physical signs of an “at risk” foot. In a recent study assessing pathways to ulceration, neuropathy was the single most important component cause.<sup>8</sup>

#### Peripheral vascular disease (PVD)

In addition to the influences of age and duration of diabetes, several studies have indicated that hypertension and cigarette smoking, two important risk factors for coronary artery disease, are also associated with peripheral vascular disease.<sup>9</sup>

A prospective study among 613 type 2 diabetic patients from Tanzania, Germany and India was conducted to determine the differences in underlying risk factors and clinical presentation of foot problems. The study concluded that a lesser prevalence of PVD and yet higher prevalence of amputation rate among Indians was noted when compared with those in Western countries due to progressive infection.<sup>10</sup>

## Plantar pressure

Based on many studies linking high barefoot pressure to ulceration, it is beneficial to measure barefoot plantar pressure in all patients with loss of protective sensation. It was suggested that a pressure of 750 Kpa provides the best level of discrimination between low-risk and high-risk patients.<sup>11</sup> They do point out, however, that the higher the pressure, the higher the risk, and that there is no clearly safe pressure. Therapeutic footwear is of course an option that can be utilized to deal with all the abnormalities that cause high pressure.

## Limited joint mobility

Glycosylation of collagen in tendons and ligaments results in limited motion of joints found in feet. Limited joint mobility (LJM) contributes to the abnormal mechanics in the diabetic foot. Diabetic subjects often have limitations in the range of motion of feet that are rigid, firm and dry. LJM is associated with an increased foot pressure and greater chances of foot ulceration. In the presence of LJM, the foot is unable to provide its shock absorbing mechanism and may lose its ability to maintain normal foot pressures. LJM and plantar pressures have been reported to be higher in European patients than in Asian patients.<sup>12,13</sup> However, a prospective study of 345 type 2 diabetic patients showed that LJM and high plantar pressure appear to be important determinants of foot ulceration irrespective of the duration of diabetes in South Indian diabetic patients.<sup>14</sup>

There are some initial indications that pharmacologic interventions may have some impact on LJM. It was shown that the use of N-phenacylthiazolium bromide in diabetic rats resulted in increased joint mobility.<sup>15</sup> There is now preliminary evidence that passive range of motion and other exercises may be effective in increasing the range of motion at the joints of the foot and perhaps also reducing plantar pressure during walking.<sup>16</sup>

## Footwear

Compliance with the wearing of prescription footwear is obviously a key to successful treatment. A prospective study was conducted among patients with previous ulceration.<sup>17</sup> Patients were randomly assigned to wear either their own shoes or an extra-depth shoe with custom moulded insoles. After 1 year, reulceration in the two groups was 58.3% and 27% for the group wearing their own shoes and the extra-depth shoe group respectively. In a recent study in South India, it was found that the use of therapeutic footwear which is scientifically designed to redistribute load and pressures effectively, prevent pressures from acting on the affected ulcerated regions.<sup>18</sup> Use of this footwear is recommended in order to reduce ulceration and consequently the amputation rate in the diabetic population.

## THE COMPONENTS OF GOOD PATIENT EDUCATION

Findings from several studies help determine effective components of patient education that contribute to successful patient outcomes. These include giving detailed footcare recommendations, requesting patient commitment to self-care, demonstrating and practicing footcare procedures and

communicating a persistent message that foot complications can be avoided by self-care. In comparing the effectiveness of intensive versus conventional education, researchers found that patients in the intensive group showed greater improvement in foot-care knowledge, better compliance with the recommended foot-care routine and greater reduction in the number of foot problems requiring treatment.<sup>19</sup> Recognition of risk factors, preventive foot maintenance and regular foot examinations are essential in preventing foot ulcers in patients with diabetes. When foot ulcers develop despite preventive measures, a systematically applied regimen of diagnosis and classification, coupled with early and appropriate treatment, should help to reduce the tremendous personal and social burden of diabetes-related amputations.

## CONCLUSION

The staggering human and economic costs of diabetes foot disease may be reduced significantly with increased practice of several simple preventive measures designed to prevent foot ulcers and lower extremity amputations. Routine annual foot screening facilitates early interventions to reduce the incidence of the most common precipitating events including injury and foot-related trauma to the insensitive foot. The key elements of preventive care include: annual examination of the feet by healthcare providers to determine risk factors for ulceration, subsequent examination of high risk feet at each patient visit, patient education about daily self-care of the feet and careful glucose management.

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