AN OVERVIEW OF DIABETIC FOOT ULCER DISEASE AT COLOMBO SOUTH TEACHING HOSPITAL: A PRELIMINARY STUDY

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INTRODUCTION

A rapid growth of the prevalence of diabetes mellitus (DM) has been reported in Sri Lanka in the past decades with one in five adults having either diabetes or pre diabetes and one third of those with diabetes remaining under diagnosed (Katulanda *et al.* 2008). DM eventually leads to chronic complications and a significant proportion of patients with type 2 diabetes have complications by the time of diagnosis.Whilst various factors are known to contribute to chronic complications of DM, the duration of DM, the degree of hyperglycaemia, hypertension, dyslipidemia and smoking have being identified as the strongest risk factors.

Among complications, diabetic ulcer disease is a major source of morbidity and the commonest cause of hospital admissions in diabetic patients in the western world as well and in the South Asian region. Ulceration, infection, gangrene and amputation are important complications of the disease which leads to long hospital stay imposing a significant burden on the health budget of the country. Various factors such as prolonged hyperglycemia, distal peripheral neuropathy (DPN), peripheral vascular disease (PVD), foot trauma, walking barefoot and inappropriate footwear have been documented to be associated with foot ulceration.

Ulcer healing is influenced by various factors such as the overall glyceamic control, the presence or absence of infection and/or ischemia, and proper wound care management. Optimum glycemic control is achieved through proper control of diet and the use of oral hypoglycemic drugs and /or insulin. Appropriate wound care management which involves wound debridement, antibiotic therapy and the use of various types of dressings also enables ulcer healing, preventing possible limb amputations. . However, we have observed that current practices on managing patients with diabetic ulcers vary widely in our hospitals and available local literature is very limited regarding this aspect. Hence, our aim was to study a cohort of patients attending the out patients' department (OPD) of a teaching hospital to identify the socio demographic characteristics, life style factors, ulcer characteristics and, diabetic and ulcer management practices of local patients with a view to obtain baseline data required to plan a larger study.

METHODOLOGY

This cross sectional descriptive study examined 88 DM patients with foot and leg ulcers presenting consecutively to the OPD of the Colombo South Teaching Hospital. Previously diagnosed DM patients were identified and the diagnosis was confirmed by medical records. Subjects were recruited on a voluntary basis and written consent was obtained. The study was approved by the Ethics review committees of the University of Sri Jayewardenepura and Colombo South Teaching Hospital. Type 2 DM patients with leg and foot ulcers, with ulcer size not less than 2.5cm^2 and ulcer duration not less than one week and not more than 6

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months were included in the study. Subjects with cognitive impairment were excluded. Data on socio demographic factors and diabetic and life style factors (duration of DM, type of DM treatment, history of smoking and alcohol consumption, walking habits and type of footwear, cause of ulcer and presence of co-morbidities) were collected by an interviewer administered questionnaire. Data on fasting blood glucose level, hemoglobin percentage and type of materials used for wound dressing were obtained from medical records. Systolic and diastolic blood pressure measurements were recorded. The foot was examined for the site of ulcer, presence or absence of foot pulses and the presence of varicose veins. Presence ofDPN was assessed by 5.7/10g Semmes-Weinstein (SW) monofilament test. The results were analyzed by descriptive statistical methods including frequency percentages, means and standard deviations using statistical package for social sciences (SPSS) software (Version 19).

RESULTS AND DISCUSSION

Table 1: Co- morbidities of patients with diabetic ulcers

Category	Yes (%)	No (%)
Hypertension	35 (39.8%)	53 (60.2%)
Visual impairment	41 (46.6%)	47 (53.4%)
Heart disease	8 (9.1%)	80 (90.9%)
Stroke	6(6.8%)	82 (93.2%)
Kidney disease	7 (8.0%)	81 (92.0%)
Joint disease	4 (4.5%)	84 (95.5%)
Others	9 (10.2%)	79 (89.8%)

Foot ulceration is a costly but preventable complication of DM. A total of 88 subjects were studied. There were 43 males and 45 females. The mean age of the patients was 56.5±10.2 years. The mean duration since diagnosis of DM in our study sample was 8.5±6.9 years while developed countries reported longer durations (USA - 13.2 years, McNelly*et al*, 1995). This variation might be due to the difference in quality of diabetic care available for the people in developed settings which have led to the possible delay in the onset of ulcer formation. Poor glycaemiccontrol is a well-documented factor which not only triggers diabetic foot problems (Nyamu*et al.* 2003; 2012; Edo *et al.* 2013) but impair healing of existing ulcers. The mean fastingplasma glucose in our cohort of patients was 137.4 ± 41.9 mg/dl with most showing values higher than the WHO defined normal cutoff of 110mg/dl. Although estimation of glycosylated haemoglobin (HbA_1C) is a better indicator to assess the glycaemic control, we had to rely on fasting plasma glucose levels as HbA1C values were not available in all patients.

Cigarette smoking is another associated factor reported for ulcer formation in DM patients **(**Shahi*et al.* 2012). Smoking is a known cause of PVD which reduces the arterial blood flow to the lower extremities which in turn increases the risk of foot ulceration and delay in wound healing. All females in this study (n=45) have not smoked nor consumed alcohol. Majority of males have smoked (76.7%) and consumed alcohol (80%). However surprisingly, male to female ratio in the diabetic ulcer population studied was almost 1:1 indicating that the ulcer risk should be thought about even in non-smokers. Foot trauma accounted for the formation of ulcers in 76.1% patients we studied, while remaining had developed ulcers spontaneously. In most instances, the history of trauma was related to walking barefoot. Ill-fitting and un-protective shoes, occupational injuries and dog bites were the common causes for traumatic ulcers. Although present study found relatively low occurrence of spontaneous ulcers, other recent studies (Shahi*et al.* 2012; Edo *et al.* 2013) have documented about 50% evolving as spontaneous blisters. Uncontrolled hyperglycaemia was thought to be the main factor leading to formation of blisters that subsequently progressed to ulcers. When walking habits were assessed in our study sample we found that although majority of patients used footwear (96.6%, n=85), only 9.4% (8/85) wore appropriate footwear to protect the feet from trauma.

Also, it was found that the majority in the group used footwear only for outdoor activities. Since walking barefoot (Jayasinghe*et al*, 2007) and use of ill-fitting and inappropriate foot wear (Nyamu*et al*, 2003) increase the risk of foot ulceration, use of appropriate footwear and wearing them indoors as well as outdoors should be recommended in patients with DM to prevent foot ulcers.

In our study sample, ulcers were commoner in the foot (86.4%) than in the leg (13.6%). The most predominant ulcer site was forefoot (46.6%), followed by mid foot (21.6%), ankle (10.2%) and hind foot (8%). This finding is consistent with the findings of a Tanzanian study (Chalya*et al*, 2011) that reported a high occurrence of forefoot ulcers (60.3%). DPN and PVD are the two most important aetiological factors for ulcer formation in DM patients. Previous studies have shown thatneuropathic ulcers were common in plantar surface of the foot especially in metatarsal heads while ischemic ulcers were common in extremities of the toes, heels, and between the toes (Bruttocoa, 2010). Leg ulcers are mainly caused by venous stasis and primarily found on the inner part of the leg, just above the ankle. PVD mainly affects the tibial and peroneal arteries of the lower limb. PVD caused by prolonged hyperglycemia, contributes to decrease in endothelium-derived vasodilators resulting in constricting arterial lumen leading to diminished blood flow to the foot. It may cause ischemia of the skin and subcutaneous tissues which might lead to ulceration and delay in ulcer healing. Though Doppler ultrasound is the gold standard to assess blood flow in arteries, we had to limit our examination to palpation of foot pulses. Posterior tibial and dorsalispedis pulses were absent in 9.4% and 10.5% subjects respectively. Nerve damage in DPN occurs in diabetes when blood sugar is poorly controlled for a prolonged period of time. Absence of pressure sensation detected by abnormal SW monofilament test (criterion ≥1 insensate site) were reported in 67 %(n=59) of subjects indicating that majority of our patients have insensate feet. When the sensation of the foot is impaired, the patient becomes unaware of the beginning of an ulcer or progression of an ulcer. It also alters the microcirculation of the foot, resulting in reduced blood flow to the foot which delays wound healing.

Table 1 shows the presence of co-morbidities in patients with leg and foot ulcers. The most predominant co-morbidities in our study population were visual impairment 46.6 % (n=41) and hypertension 39.8 % (n=35). Visual impairment may be due to the normal aging process, cataract or retinopathy which may possibly increase the likelihood for foot trauma. High prevalence of hypertension shown in the present study is consistent with other similar studies. It is recognized as a contributory factor for foot ulceration due to its effect on the increased occurrence of PVD in patients with DM. PVD resulting in ischemia in the lower extremities may increase the ulcer risk and impediment in healing the ulcers.

Management of diabetic ulcers requires achieving good glycaemic control and the local treatment of the ulcer pay. Majority of subjects in this study were treated with oral hypoglycemic agents (OHA) alone (n= 52, 59.1 %). OHA and insulin were used in 27.3% while insulin was administered in 5.5% of the subjects. DM was controlled with diet alone in 8.0%. Combination of both OHA and insulin has been reported to have favorable outcomes on glycemic control when compared to treatment with oral drugs alone (Rafiq*et al*, 2008). Various types of dressing material were used for management of ulcers with the common wound dressing material being providone iodine (Betadine) 51.1 % (n=45) followed by Metronidazole (Metrogel) 25% (n=22) and iodosorb powder 8% (n=7). Povidoneiodine is bactericidalwith maximal activity at 0.1% - 1%. Although some studies have shown inconclusive evidences for usingpovidone-iodine solution for managing wounds (Burks, 1998), a recent study has observed it being less advantageous over superoxidised solution (Kapur&Marwaha, 2011). However, conventional wound dressing materials seem to be still popular in our government hospital setting probably due to less cost. Certain iodine preparations (eg: iodosorbpowder)are useful in absorbing exudates of ulcers and preventing skin excoriation (Hilton *et al.* 2004) and hence preferable for chronic wounds. Unripe *Carica papaya* was another topical application used for treatment of chronic ulcers in our population.

Even though it is not wildly used, topical application of papaya is found to be useful in promoting desloughing, granulation, healing and reducing the odor of the wound (Hewittet, *et al*, 2001).

CONCLUSIONS/RECOMMENDATIONS

Diabetic foot ulceration was seen equally in both sexes with ulcers occurring about 8 years after the diagnosis of DM. The important associations of diabetic ulcers identified in this study are poor glycemic control, impaired foot sensations, reduced foot pulses, impaired vision and hypertension. Foot trauma contributed to ulceration in majority of patients. Although the use of insulin is recommended for good glycemic control which is a prerequisite for ulcer healing, only a minority of patients were treated with insulin. Povidone iodine was found to be the most used wound dressing material in the OPD.

Diabetic foot ulceration has to be thought about in all diabetic patients irrespective of their sex. Optimum glycemic control should be ensured in DM patients to prevent complications. Regular screening for DPN, PVD, vision etc. and patient education regarding appropriate footwearis mandatory to reduce the burden of diabetic ulcers on the health care system of the country and to improve the quality of life of people with diabetes. The suitability of new evidence based ulcer management strategies should be researched in our population.

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