Profile of Diabetic Foot Complications and its Associated Complications - A Multicentric Study from India

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Abstract

Aim : The aims of this study were to determine. The prevalence of foot complications such as neuropathy, peripheral vascular disease (PVD), amputations and infections and the associated diabetic complications and practice of foot care among these subjects.

Methods : A total of 1319 type 2 diabetic patients, were selected from four different centres across India. The centres were Diabetes Research Centre (DRC), Chennai, Government Rajaji Hospital (GRH), Madurai, Christian Medical College (CMC), Vellore and All India Institute of Medical Science (AIIMS), Delhi. Details were collected regarding foot problems and associated complications.

Results : The prevalence of neuropathy was 15% (n=193) and PVD was 5% (n=64). Infections were present in 7.6% (n=100) of patients. The infection rate varied from 6–11% in the different centres. Nearly 3% of subjects had undergone a minor or major amputation.

Discussion : This study found that the prevalence of infection was 6-11% and prevalence of amputation was 3% in type 2 diabetic patients. Neuropathy (15%) was found to be an important risk factor for diabetic foot infections. Effective foot care advice should be propagated to reduce the burden imposed by diabetic foot complication particularly in developing countries like India. ©

INTRODUCTION

Diabetes and its complications pose a major threat to future public health resources throughout the world.[1] Based on a compilation of studies from different parts of the world, the World Health Organisation (WHO) has projected that the maximum increase in diabetes would occur in India.[2] Considering the large population and the high prevalence of diabetes, the burden of diabetes in India would become enormous. Diabetic foot infection is a common cause for the hospital admissions of the diabetic patients in India.[1] This could be attributed to several sociocultural practices such as barefoot walking; inadequate facilities for diabetic care low education and poor socio-economic conditions.[1] Diabetic foot amputations are the most frequent of diabetic complications in developing countries. Patients with foot complications spend higher percentage of their income (32.3%) for treatment when compared with those without foot infections.[3]

Considering the immense burden superimposed by foot complications, aggressive management becomes imperative. Indian data regarding various aspects of foot complications such as percentage prevalence of foot deformity, infections and amputations and level of foot care among patients are very scarce. This study was done to evaluate the prevalence of various diabetic foot complications and associated complications in type 2 diabetic subjects from various parts of India. The aims of this study were to determine. The prevalence of foot complications such as neuropathy, peripheral vascular disease (PVD), amputations and infections and associated diabetic complications and practice of foot care among these subjects

METHODS AND MATERIAL

A total of 1319 type 2 diabetic patients, according to the WHO criteria, were selected from four different centres across India. The centres were Diabetes Research

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Centre (DRC), Chennai, Government Rajaji Hospital (GRH), Madurai, Christian Medical College (CMC), Vellore and All India Institute of Medical Science (AIIMS), Delhi. Among these centres, DRC is a private speciality centre for diabetes, GRH and AIIMS are Government general hospitals and CMC is a private charitable medical college. Hospital based diabetes team in each of the above centres except DRC were invited to participate in this project. Every third type 2 diabetic subjects of outpatient department of the different centres attending the centres was recruited into this study.

Medical history was taken for all subjects. Details regarding duration, treatment of diabetes, patient's social history and habit of smoking were noted. Blood pressure was measured in all subjects in sitting position on the right arm with a standard mercury sphygmomanometer. Mean values were determined from two independent measurements taken at 5 min intervals. Hypertension (HTN) was defined as the presence of systolic blood pressure (SBP) of $\geq$ 140 mmHg and/or diastolic blood pressure (DBP) of $\geq$ 90 mmHg or when antihypertensive treatment was being taken.

Peripheral vascular disease was assessed using Doppler studies. Cutaneous pressure perception was assessed using 10g Semmes Weinstein monofilaments at five plantar sites (1st, 3rd and 5th metatarsal heads, mid foot and the heel) on each foot. With eyes closed, the patients were required to elicit a 'yes / no' response to monofilament pressure and correctly identify the site of contact. Each filament was placed against the plantar surface of the foot in a perpendicular fashion so that it bent with a constant force, with the 10g filament. Insensitivity to 10g monofilament at any one site on either foot indicated abnormal sensation.[1,2] Data regarding myocardial infarction and ischaemic heart disease were collected from the patient's case sheets. A detailed examination of the feet for the presence of foot deformity, infections and amputations was done.

A questionnaire was given to all the patients and the details regarding their day to day practice of footcare, types of footwear used, frequency of using the footwear and the aetiology of foot infection were noted. These details however could not be collected from AIIMS, Delhi.

Statistical Analysis

Statistical analysis was performed using SPSS, version 4.0.1 (SPSS, USA) and EPI INFO V 5.01a program (CDC of Atlanta, USA and the WHO, Geneva, Switzerland). Data with normal distribution were expressed as mean $\pm$ SD. ANOVA was used to determine the differences between the groups. Chi square test was performed for categorical variables. A 2-tailed p value < 0.05 was considered as statistically significant.

RESULTS

Among the 1319 patients, 462 (35%) were selected

from DRC, Chennai, 640 (46%) were included from the Government general hospitals, Madurai and Delhi, and 253 (19%) were recruited from CMC, Vellore. All the subjects from the four centres were age and sex matched. The mean age of the total cohort was 53 ± 11 yrs and the mean duration of diabetes was 6.9 ± 5.9 yrs. The mean SBP was 133 ± 19 mmHg and DBP was 84 ± 10 mmHg. The mean blood urea, creatinine and cholesterol values were found to be within normal limits (Urea : 26 ± 12 mg/dl , Creatinine : 0.95 ± 0.5 mg/dl, Cholesterol : 192 ± 47 mg/dl). Hypertension was found in 34% (n=443) subjects and retinopathy in 15% (n=198). Among the study subjects, 11% (n = 148) were smokers.

The prevalence of neuropathy was 15% (n=193) and PVD was 5% (n=64). Infections were present in 7.6% (n=100) of patients. The infection rate varied from 6 – 11% in the different centres. Nearly 3% of subjects had undergone a minor or major amputation.

The characteristics of the subjects from the four centres are shown in Table 1 and Table 2. The prevalence of hypertension and retinopathy was found to be the highest among the AIIMS group. The prevalence of neuropathy was however lowest in this group. Prevalence of myocardial infarction was found to be the highest in CMC (5.5%). No difference in the prevalence of PVD was noted across the four centres. The infection rate varied from 6-11%in the different centres.

Foot care practices among study subjects:

Foot care practice was done by 36% (n = 400) patients by themselves. Family members were involved in 2% (n=20) of patients and professional help was sought by nearly 2% (n=15) of subjects. Nearly, 65% of the study subjects did not follow any footcare procedures.

While 90 % of the study subjects wore footwear outside the house only 3% of them did so inside the house. Hawaii slippers were the most commonly used footwear (49%) followed by sandals (14%). Special diabetic footwear and shoes were used by only 8% of the study population. Bare foot walking was practiced by 7% of the study population. Improper footwear use, injury while doing a foot care procedure and unknown causes equally contributed to the development of foot complications.

DISCUSSION

This study found that the prevalence of infection was 6-11% and prevalence of amputation was 3% in type 2 diabetic patients. Neuropathy (15%) was found to be an important risk factor for diabetic foot infections.

In a study by Chaturvedi *et al*,[4] it was found that South Asians had higher prevalence of neuropathy (30%) compared with PVD (9%) and this prevalence was lesser when compared to the Caucasians. It has also been shown that most of the foot problems associated with diabetes in India are neuropathic and infective rather

Table 1 : Clinical and biochemical profile of the study subjects

	DRC, Chennai	GRH, Madurai	CMC, Vellore	AIIMS, Delhi
No. of patients	462	387	253	217
M / F	313 / 149	188 / 199	169 / 84	131/86
Mean age (years)	52.9 ± 9.3	53.9 ± 11.1	53 ± 11.8	53.7 ± 9.9
Mean duration of DM (years)	6.2 ± 5.3	5.0 ± 6 #	7.0 ± 5.8 $	9.1 ± 6.7 #,$,*
Body Mass Index (BMI) kg/ m²	25.2 ± 4.9	23.2 ± 4 #	25 ± 3.3 $	24.7 ± 4.9$
Systolic blood pressure (mmHg)	132 ± 22	134 ± 20	130.2 ± 17.8	136.9 ± 17.9
Diastolic blood pressure (mmHg)	85.1 ± 11.5	85 ± 10.4	80.4 ± 8.8 #,$	85.5 ± 8.5 *
Mean PPBS (mg/dl)	278 ± 91	290.6 ± 73.2	228 ± 75 #,$	225 ± 91 #,$
Urea (mg%)	22.4 ± 8.5	26.9 ± 10.5 #	—	30.7 ± 19.3 #,$
Creatinine (mg%)	0.8 ± 0.3	0.9 ± 0.4 #	1.0 ± 0.6 #	1.2 ± 0.6 #,$
Cholesterol (mg%)	194 ± 48.0	205 ± 45 #	183 ± 42.3 #,$	**175 ± 51 #,$**

Differences between groups tested using ANOVA

\# - vs DRC
\$ - vs GRH } Statistically significant p<0.05
* - vs CMC

Table 2 : Associated complications of the study subjects

	DRC, Chennai	GRH, Madurai	CMC, Vellore	AIIMS, Delhi
n	462	387	253	217
Hypertension (n,%)	96 (21)	169 (44) #	56 (22)$	122 (56) #$*
Retinopathy (n,%)	78 (16)	41 (11) #	31 (12)	48 (22)$*
Smoking (n,%)	59 (13)	26 (7) #	44 (17)$	19 (9)*
Myocardial infarction (n,%)	3 (1)	9 (2)	14 (5.5)#	0
Ischemic Heart Disease (n,%)	8 (2)	18 (5) #	8 (3.2)	0
Neuropathy (n,%)	80 (17)	53 (14)	40 (16)	20 (9) #*
PVD (n,%)	21 (4)	24 (6)	8 (3.2)	11 (5)
Foot deformity (n,%)	2 (0.5)	7 (2)	19 (7.5) #	0
Infection (n,%)	26 (6)	35 (9)	16 (6.3)	23 (11)
Amputation (n,%)	6 (1)	4 (1)	11(4.4) #$	9 (4)$#
Minor amp	5	3	4	
Major amp	2	1	7	

Differences between groups tested using χ2

\# - vs DRC
\$ - vs GRH } Statistically significant p<0.05
* - vs CMC

than vascular in origin as in developed countries.[5] The prevalence of PVD has been found to be 3.9% in another cross-sectional population–based study conducted in south Indians subjects which is similar to the findings of this study.[6]

The higher prevalence of hypertension and retinopathy in the AIIMS group of patients could be attributed to the fact that AIIMS is a large secondary referral centre.

In this study, subjects with age >50 years had higher prevalence of all complications when compared with those lesser than 50 years of age. Particularly the prevalence of neuropathy (72%) and PVD (80%) was very high. This finding is similar to the findings of Premalatha *et al*[7] who had shown that prevalence of PVD increased with age. Age >50 yrs was found to be associated with PVD (OR 6.3%), thereby identifying age as a most significant risk factor for PVD.

It is of clinical importance that nearly 65% of the study population did not follow any footcare procedures, which could be one of the major reasons for increased prevalence of infections.

In a study by Vijay *et al*, it was shown that strategies such as intensive management and foot care education are helpful in preventing newer problems and surgery in diabetic foot disease. In the study of 4872 type 2 diabetic patients, it was shown that patients who followed strict control developed lesser complication when compared to those who did not follow the advice.[8]

Effective foot care advice should be propagated to reduce the burden imposed by diabetic foot complication particularly in developing countries like India.

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