Turkish Journal of Endocrinology and Metabolism, (2002) 2 : 77-80 **ORIGINAL ARTICLE**

Decreased Lower Extremity Amputation Rate in Patients with Diabetes Mellitus : A Comparative and Retrospective Study

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Foot lesions are common cause of morbidity and mortality in patients with diabetes mellitus. They also present some economic problems. The gold standard for selecting the appropriate therapy for a diabetic foot patient is the diabetic foot team conference, ideally supported by all relevant specialities. Far too often, this ideal is not achieved.

The aim of this study is to evaluate clinical, epidemiological and economic characteristics of diabetic patients with 75 foot problems hospitalised in our Department, Internal Medicine and Endocrinology, Atatürk University during the last 10 years. We divided our practice into two stages: 1 from 1990 to 1997, in which a single discipline approach was used; 2 from 1997 to 2000, in which a multidisciplinary approach was selected.

Our results suggest that a multidisciplinary approach will decrease amputation rate.

Key words: Diabetes mellitus, chronic complications, diabetic foot, multidisciplinary approach

Introduction

Diabetes remains the world's leading cause of amputation. Prevention of amputation requires a diligent approach to the minimisation of risk factors, rigorous control of both blood glucose levels and blood pressure to avoid both microvascular and macrovascular complications, and careful attention to foot-care. Patient education efforts (tight glycemic control, smoking cessation and foot-care) coupled with a team approach of aggressive early management represent the optimum current strategy (1). Fifteen percent of all diabetic patients suffer at one time or another from a foot ulcer. This condition accounts for 20% of all admissions of diabetic patients and for 50% of corresponding hospitalisation stays. Fifteen to 25% of diabetic foot ulcers lead to an amputation. Fifty percent of the amputated patients will have a contralateral amputation within the next 5 years (2).

Careful observation and assessment of ulcers and monitoring of foot pulses, peripheral vascular disease and/or neuropathy is essential to ensure that the integrity of the limb is not threatened, which could result in amputation. A multidisciplinary team approach is the key to successful management of diabetic foot ulceration (1). Preventive measures are known to lower the risk of amputation by 50% (3).

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The present study was designed to evaluate characteristics of clinical, epidemiological and economic aspects of diabetic patients with foot problem. In addition, we aimed to analyse the reason for the decrease in amputation rate in the patients treated between 1990-1997 and 1997-2000 in our unit.

Materials and Methods

The study patients consisted of hospitalised diabetes mellitus (type 1; 3, type 2; 72) patients in our University Hospital from 1990 to 2000 years. The total number of the hospitalised diabetic patients during this period was 862. Among them 75 patients had foot problems. We divided our patients into two groups according to their treatment modality. Group-1 included the patients (n: 49) treated from 1990 to 1997 under a non-multidiscipline approach. Group-2 included the patients (n: 26) treated from 1997 to 2000 under a multidisciplinary approach. Endocrinologists, diabetes nurses, a dietician, orthopedists, a plastic and reconstructive surgeon, a vascular surgeon, and neurologists were included in the team.

Data concerning demographic, clinical and economic characteristics were recorded from files for each patient. Retinopathy, neuropathy, nephropathy and coronary artery disease were diagnosed from examination notes and consultation reports in the patient files. Diabetic foot ulcers were classified according to Wagner stage. The total cost of diabetic foot was counted by taking into consideration the bills on discharge day as USA dollars. The cost of medicine was excluded from the total cost.

Statistical Analysi s

Information about patients was evaluated by SPSS 6.1 statistical program. Data are n(%) or means ± SD. Logistic regression model was used to compare different groups. P values <0.05 were statistically significant.

Results

The diabetic foot accounted for 8.7%(75/862) of all admissions of our diabetic patients. Table 1 shows characteristics of the study population. Twenty-seven patients (36%) underwent amputation due to diabetic foot. The number of patients who smoked was 24(32%) and all of them were male. There was a significant relationship between smoking, nephropathy, retinopathy, neuropathy, coronary artery disease (CAD) and foot amputation (p<0.01). While amputation was performed in 40.8% (20/49) of the patients in period-1, their duration of hospitalisation was determined to be 25 days. Amputation was performed on 26.9% (7/26) of the patients in period-2, and their hospitalisation time was determined to be 29 days. The cost was 125 dollars more for the patients who underwent amputation. The decrease in amputation rate was statistically significant (p<0.01).

Table 1. Characteristics of study population hospitalised.

n	75
Type I	3(4%)
Type II	72(96%)
Males	50(66.6%)
Females	25(33.4%)
Age (years)	56.9±10.8
Diabetes duration	11.5±7.2
Wagner Grade	
I	5(6%)
II	10(12%)
III	33(44%)
IV	18(24%)
V	9(12%)
Prior ulcer	25(33%)
Neuropathy	51(68%)
Retinopathy	55(73%)
Nephropathy	27(23%)
Coronary artery disease	10(13%)
Arterial hypertension	38(50%)
Smoking habit	24(32%)
Major amputation (above the knee)	3(4%)
Minor Amputation (below the knee)	24(32%)
Hospitalisation duration	27.7±20.5
Costs ($)	1095±1420 (43-8500)

Discussion

The incidence of foot problems in diabetic patients varies between 2 to 20%. This ratio is higher in people actively working because they are frequently exposed to trauma (4). In our study, patients that were hospitalised due to diabetic foot problem accounted for 8.7% of all hospitalised diabetic patients (5,6). Two thirds of them were male (66.6%).

It has been suggested that patients with diabetes having previous foot ulcers have a high risk of new ulcerations and further amputations (7). That rate

has been presented as 56% in Hekimsoy at al's report and 14% in Ersoy et al's study (8,9). This is also the case in our study and 25(33%) of our patients have prior ulcers.

The role of neuropathy in the development of foot ulcerations in diabetic patients is well established. Diabetic neuropathy was found in 68% of our patients. When we looked at the national studies on this aspect of the problem, we realised that there were different rates varying between 55%-90% in different reports (8-12).

Some diabetic foot ulcers lead to amputation. Hamalainen et al found amputation ratios to be 3.4% for diabetic patients (13) during the median follow-up 7 years, Pinzur et al 74/224 (33%) for diabetic foot ulcers during the median follow-up 4 years (14), and Challetton et al 69%, though only 4 major amputations were done, during the median follow-up 16 months (15). Gürlek et al found (36.7%) (16), Ersoy et al 29% (9), Demirbaş et al 28% (11), Hekimsoy et al 16% (8) and Azal et al 40% (12). The amputation ratio was found to be 36% (27/75) in our patients; above the knee amputation was performed in 13% of these, below the knee amputation in 26%, metatarsal amputation in 21%, and amputation of the finger in 39%.

A multidisciplinary approach including preventive strategy, patient and staff education has been reported to reduce the amputation rate by more than 50% (3). Debridement is an essential part of the management of diabetic foot lesions. The Endocrinology and Metabolism Department in our University was founded in 1997. From that year on, we started to treat our patients with a multidisciplinary approach. We removed necrotic tissue and dressed two times a day. We trained the patients and their relatives about diabetes mellitus disease. From 1997 to 2000, 26 diabetic patients were consecutively hospitalised in our diabetes unit for foot ulcer and 7 (26.9%) amputations were carried out. The amputation rate of this series of cases was compared with that occurring in diabetic subjects taken into our hospital for foot ulcer in seven previous periods: 1990-1997 (20 amputations in 49 inpatients or 40.8%). The comparison shows a progressive reduction in amputation rate. But, during this period the average stay of the patients in hospital increased from 25 to 29 days. The probable reason for this may be an increase in the number of dressings.

One of the most important steps to reduce cost in the management of the diabetic foot is to avoid amputations (3). The cost of amputation is generally above 20 000 dollars. Ashry et al of Texas University found the cost of amputation to be 27 930 dollars and their hospitalisation duration to be 15.9 days (17). Tennvall et al found that all costs for diabetic foot ulcers were 26.000 dollars (18). On the other hand in the studies which were conducted in our country duration of hospitalisation and cost for diabetic foot ulcers were between 22-56 days and 1292- 3610 Dollars, respectively (10,19). In our hospital, hospitalisation time for diabetic patients was 27.7 days and total cost was 1095 dollars. This cost did not include the cost of drugs because our patients came from various social security organisations and their drug expenses were met by their organisations. The reason why our cost of treatment was relatively low was a result of cost politics in health services. But we still note that to reduce the amputation ratio of patients is more important than cost.

Foot ulcer and especially amputation are related to increased re-ulceration rate and lifelong disability. We believe that a multidisciplinary approach including preventive strategy such as tight glycemic control, smoking cessation, proper footwear, avoidance of trauma, patient and staff education, and multifactorial treatment of foot ulcers will reduce the amputation rate and foot ulcers.

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