DM

Diabetes care in Kilimanjaro region: clinical presentation and problems of patients of the diabetes clinic at the regional referral hospital—an inventory before structured intervention

H. F. Neuhann*, C. Warter-Neuhann†, I. Lyaruu and L. Msuya

Kilimanjaro Christian Medical Centre, Diabetes Working Group, Moshi, Tanzania, *Clinic of Gastroenterology, Hepatology and Infectious Diseases, Heinrich Heine-University, Düsseldorf and †Bezirksregierung Köln, Schulamt, Cologne, Germany

Accepted 2 October 2001

Abstract

Background In order to improve care for diabetic patients in a developing country at the regional referral hospital for the Northern zone of Tanzania, a specialized clinic was established in November 1996.

Aim The aim of this study was to provide a situational analysis about the problems of the diabetic patient population treated at the hospital. For all patients who registered at the clinic a questionnaire was completed about personal data, diabetes history, symptoms, treatment, eating habits and psycho-social aspects of the disease. Results from patients who registered between November 1996 and December 1998 were analysed.

Results Data from 474 diabetic patients (46% female) were obtained. Mean age was 53.75 (± 16; range 4–88 years), 15% were classified Type 1, 75% Type 2 and 10% remained unclassified. A body mass index of < 25 was recorded in > 80% of the Type 1 and approx. 50% of the Type 2 patients. Among complications, numbness of the legs was mentioned by 44%, hypertension was diagnosed in about 25%, retinopathy in 14%, foot ulcers in 10% and nephropathy in 7.5% of the patients. About 50% of the patients saw their disease as a big physical and psychological problem. Monthly cost for an average insulin-treated patient equalled around 25% of the minimal wage.

Conclusion Diabetes care in a developing country needs to address the specific background of the patient population, their needs, the medical problems and the social constraints. Active participation of the patients can help to overcome some of the difficulties.

Diabet. Med. 19, 509–513 (2002)

Keywords diabetes, clinical presentation, care, treatment options, Tanzania

Introduction

There are an estimated 1.0–1.5% (15 000–17 500) diabetic patients in Kilimanjaro Region, Northern Tanzania [1,2]. The benefit of structured management of diabetes has been widely proven in different populations [3–7]. To implement such an approach at the referral hospital for the Northern Zone of Tanzania, the Kilimanjaro Christian Medical Centre (KCMC), in November 1996 we established a diabetes clinic and analysed the problems of the diabetic patient population treated at KCMC. The clinic is run by a group of nurses and doctors, a laboratory technician and a teacher. It provides patient care and education on a weekly basis which specifically addresses the problems faced by diabetic patients in this half-urban half-rural environment. We analysed data of the period November 1996 to December 1998. All data presented reflect the findings and status of the patients before any intervention from the clinic.

Correspondence to: Dr H. F. Neuhann, Clinic for Gastroenterology, Hepatology and Infectious Diseases, Heinrich Heine University, Düsseldorf, Moorenstr. 5, 40225 Düsseldorf, Germany. E-mail: warter-neuhann@t-online.de

Patients and methods

For each newly registered patient who agreed to be enrolled a questionnaire was completed during a structured interview. It comprises items on personal data, general health status, diabetes history, symptoms and treatment, eating habits, lifestyle and psycho-social aspects of the disease. The interview of the patient was usually carried out by a nurse or the teacher in the local language as a part of the clinic registration process.

Patients were referred through the general out-patient clinic, other departments or the wards with a confirmed diagnosis of diabetes. During the study period 474 patients were registered and all agreed to the interview.

The interview was followed by a medical assessment (blood pressure, body weight and height, blood glucose testing, clinical examination including feet and injection sites). HbA_{1c}, microalbuminuria and blood lipids were not available for this survey. Blood glucose was determined by finger prick in the clinic using a glucometer (One Touch Basic, Lifescan, Johnson & Johnson, Neckargemünd, Germany [8,9]). Calibration was done according to the manufacturer's instructions. Weight (to the nearest 0.1 kg) and height (to the nearest 1 cm) were measured using the usual equipment of the out-patient clinic. Blood pressure was taken with standard sphygmomanometers (Boso, Jungingen, Germany) while the patient was sitting for at least 5 min with the arm rested on a table (to the nearest 5 mmHg) [1].

Types of diabetes were defined by age at diagnosis of less than 40 years, clinical presentation and judgement on insulin dependency, and the body mass index (BMI) as a supplementary criterion, e.g. for patients between 35 and 39 years of age.

Data analysis was generally descriptive. Distribution of BMI in Type 1 and Type 2 diabetic patients was analysed using the Wilcoxon rank test. The Epi Info system (version 6.04a; CDC, Atlanta, GA, USA) was used. The ethics and research committee of KCMC approved the study protocol.

Results

Apart from very few Asians, patients were African Tanzanians from different tribes. Most came from the nearby town or from the rural district within a radius of 40 km from the hospital. About 40% of the patients mainly live from subsistence farming, another 25% were without a paid job or too sick or too old to work on a regular basis. Patients had to travel for up to 4 h to get to the clinic. The number attending a clinic day averaged around 30.

Of the 474 patients, 15.8% were classified as Type 1, 74.6% Type 2 diabetes; 9.6% remained unclassified. A detailed description of the subjects is given in Tables 1 and 2.

The distribution of BMI differed significantly ($P < 0.0001$) between the groups of Type 1 and Type 2 diabetic patients (Fig. 1). A BMI of > 25 was more common in females than in males (53% vs. 35%).

Random testing for blood glucose at the first visit frequently resulted in high to very high concentrations (mean 12.1 ± 6.6 mmol/l). The initial blood glucose was > 16.7 mmol/l (300 mg/dl) in a quarter of the total ($n = 428$) readings and in

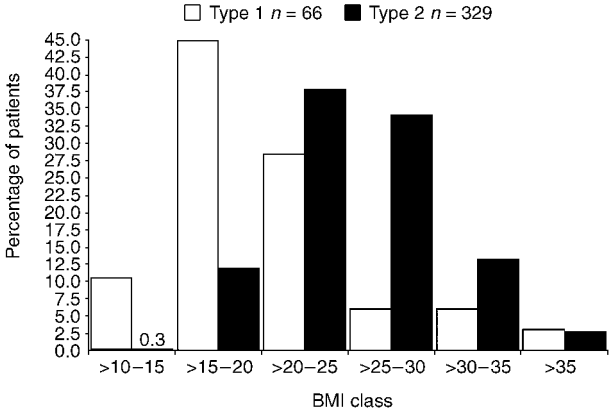

Figure 1 Body mass index (BMI) distribution among Type 1 and Type 2 diabetic patients.

a third of the Type 1 patients. No patient had performed any kind of blood or urine monitoring.

Out of 452 patients, 62.2% had received some kind of dietary instruction before, frequently having been told to avoid carbohydrates. In contrast to this recommendation, 95.8% said their usual and preferred food was stiff maize porridge, bananas and rice. Concerning frequency of meals (including bites) 1.8% reported two meals per day, 37.8% took three meals, 36.7% four and 23.5% more than four. Lunch and a late dinner were usually the main meals (89.6%) [10].

Insulin is listed as an essential drug for Tanzania [11] and is available for the hospital from the central Medical Store Department at a subsidized rate (1997–1999 approx. £1.40/400 units; Table 3). During the observation period a purified bovine preparation as 'regular' and a 'lente' type insulin (Bovine regular insulin and bovine zinc insulin, U40; Eli Lilly, Calzada de Tlalpan, Mexico) were regularly available. Within the hospital there were good facilities for appropriate storage of the insulin stock. The type and scale of the supplied syringes changed frequently (e.g. U 100 syringes for U 40 insulin) without adequate information passed on to medical staff and patients. Of the 196 patients treated with insulin, 60.2% were using only 'lente', 5% only 'regular', 29.6% both types and 4.6% did not know the type of insulin they were using. The amount of insulin used varied from 12 IU to a maximum of 125 IU (median of 36 IU; mean 40.5 ± 20.2 IU). About 27% injected only once per day, 65.5% twice and 6.9% three times. Supply of insulin and syringes was erratic in 22.5% and 15% of cases, respectively.

Chlorpropamide is widely used (41.2%) and cheaply available. Metformin is seldom used due to its cost and irregular supply compared with the subsidized insulin. Around 12% said that the supply of other drugs (oral hypoglycaemic or anti-hypertensive drugs) was irregular. Around 10% used traditional herbal remedies as additional treatment.

The distribution of symptoms was similar in both Type 1 and Type 2 patients. Most of the patients mentioned polyuria/polydysia as their first prominent symptom. Loss of libido and

Table 1 Study population

	Demographic and social data Total number of patients: 474	
Female/male ratio	Total	219 (46.2%)/255 (53.8%)
	Type 1	44.4%/55.6%
	Type 2	48.4%/51.6%
Mean age (years)	Total	53.75 (± 16.13)*
	Type 1	32.47 (± 15.70)*
	Type 2	59.32 (± 12.04)*
Family status (n = 454)	Single	71 (15.6%)
	Married	354 (78.0%)
	Widowed	23 (5.1%)
	Divorced	6 (1.3%)
Number of children	No children	15.1%
	1–2 children	11.1%
	3–5 children	3.1%
	> 5 children	50.7%
Education	No formal education	11.1%
	Primary school level	56.0%
	Secondary school level (any)	27.8%
	Any additional higher education	4.3%
	Unknown educational status	0.9%
Occupation (n = 458)	Peasant/subsistence farmer	37.2%
	Small scale business	9.2%
	Housewife	8.5%
	Teacher	7.0%
	Office clerk	6.1%
	Craftsman	5.5%
	Student/pupil	4.1%
	Retired officer	4.8%
	Medical personnel	2.8%
	Pastor	2.0%
	Driver	1.5%
	Others	5.9%
	Not working	5.0%

*(SD).

Table 2 Medical characteristics of the study population (n = 462)

Self-reported duration of diabetes (n = 445; years)			6.6 (± 6.4)*
Positive family history of diabetes			36.3%
Hypertension (systolic ≥ 140 and/or diastolic ≥ 90 mmHg)			25.2%
Systolic:	mean		132 (± 24.9)*
	median		130
Diastolic:	mean		83.7 (± 13.8)*
	median		80
Smoking:	total		9.7%
	males		13.8%
	females		5.1%
If smoking:	1–5 cigarettes		42%
	6–10 cigarettes		42%
	> 10 cigarettes		16%
Admitted regular alcohol consumption:		total	29.4%
		males	37.7%
		females	20.0%

*(SD).

skin infections were more frequent and important as second or third symptoms in the individual patients. Within the whole spectrum of symptoms, numbness of the legs, sweating, weight loss, visual disturbances were frequently, others rarely mentioned.

Retinopathy was already present in 14.5% of the patients, foot ulcers were seen in 10% and signs of nephropathy, e.g. elevated serum creatinine (> 176 mmol/l), frank proteinuria or oedema, were present in 7.5%.

Table 3 Cost for the patients (1998/1999)

Item*	Tanzanian Shillings	£
First medical consultation	1500	1.30
Consecutive consultation	500	0.43
Blood glucose, blood pressure, body weight and height	800	0.69
Extended history taking	500	0.43
Education (payable once)	500	0.43
Leaflets/piece	100	0.09
Ten syringes	600	0.52
Insulin 'lente' (400 IU)	1700	1.47
Insulin 'regular' (400 IU)	1600	1.37
Chlorpropamide (100 Tbs)	300	~0.28
Benedict solution (100 ml)	400	0.35
Test tube, pipette	600	0.52
Diabetes diary	200	0.17
Clinic identity card	100	0.09

*Most of the items were newly introduced with the clinic.

Concomitant diseases were reported by approximately half, namely hypertension (20.9%), peptic ulcer disease (8.8%), tuberculosis (2.2%), anaemia (2%).

Anti-hypertensive treatment consisted of α-methyldopa with or without diuretics for almost all patients. ACE-inhibitors were either unavailable or too expensive.

When registering at the clinic 34.6% of the patients had never been admitted to hospital for reasons associated with diabetes, another 34.6% once, 18.5% twice and 12.2% three times or more.

For an average patient treated with insulin (36 IU/day), the cost for the first visit adds up to approx. 8000 Tanzanian Shillings (TSh; equivalent to approx. £7), including the insulin prescription for 1 month but excluding all opportunity costs. The total direct cost (i.e. transport, clinic services, medication) for such a patient added up to around 25% of the then official minimum wage (Table 3). For 45.7% of the patients (n = 440), care of their disease caused a permanent financial problem and for another 13% this was occasionally the case. Approximately 20% stated that having diabetes caused a hindrance to their daily activities.

Discussion

The analysis of the questionnaire revealed important findings on the structure and the problems encountered by diabetic patients in this region which must be considered when trying to improve management and care.

Most patients had limited financial resources and depended on support of the extended family, while at the same time some had to care for a number of dependants themselves. Patients with financial constraints tended to minimize their clinic visits and needed to get the most out of every visit, e.g. education each time the patient comes to the clinic. Considering the level of formal education, an appropriate diabetes education programme will also have to address that most of the patients are unfamiliar with the theoretical, cognitive approaches to learning.

The central hospital can provide care at most for 3–5% of the diabetic patients of the region. There is a need to strengthen the expertise of the peripheral services. Nevertheless, the structure of services and links between central and peripheral hospital/health centre needs careful definition [12–15].

Among our patients the majority were physically active and consumed the traditional staple food. Aspray *et al.* [1] demonstrated the role of obesity as a risk factor for diabetes also in Tanzania. In our study, however, 50% of the Type 2 patients had a BMI of < 25, a finding that needs further explanation. It seems possible that 'being overweight' in Tanzanians starts at a lower BMI than 25 [16].

The composition and distribution of food treatment for the one-third of patients on insulin who injected only once per day in the morning are necessarily inadequate [10,17,18]. A relatively high proportion of Type 2 diabetic patients were treated with insulin. This may be because drug combination therapy, e.g. sulphonylurea plus metformin, is not established, more expensive, and might require repeated testing of renal function, which is not always accessible.

Glycaemic control was very poor and did not even achieve control of acute symptoms. Hypoglycaemia did not appear to be a frequent problem before intervention and needs to be carefully avoided when aiming for better glycaemic control [19,20]. Cheap and simple means for metabolic monitoring need to be introduced [21].

Hypertension and clinical symptoms suggestive of peripheral neuropathy were as frequent in this study as has been reported by others [1,22,23]. Notably, a high percentage of patients presented with an established diagnosis of retinopathy, but the number of patients with a diagnosis of nephropathy or overt signs of this was relatively low [24,25]. This might be due to lack of diagnostic facilities for early nephropathy. Alternatively, the relatively high prevalence of retinopathy may be explained by the diagnostic capacity of the ophthalmology department within the hospital. Foot ulcers are a big problem and foot care, especially for people who are used to walking barefoot or do not have appropriate shoes, is an issue that needs to be addressed carefully in the educational programme.

Patients with chronic disorders like diabetes face extreme problems in countries with limited resources. Estimated costs for insulin-dependent patients exceed the annual per capita expenditure for health by the factor of 20 [26]. There is an evident need for change (e.g. prices for insulin in developing countries [27]), but also in structural approaches within the regions of a country to improve diabetes care. Our data may help to identify the needs and organize the structures accordingly.

Acknowledgements

The authors thank Professor Ernst Chantelau, Düsseldorf, for his assistance with this paper. The authors are indebted to the

staff of the Diabetes Clinic at KCMC for their tireless work and dedication.

References

1 Aspray TJ, Mugusi F, Rashid S, Whiting D, Edwards R, Alberti KG *et al.* Rural and urban differences in diabetes prevalence in Tanzania: the role of obesity, physical inactivity and urban living. *Trans Royal Soc Trop Med Hyg* 2000; **94**: 637–644.

2 McLarty D, Pollitt C, Swai A, Alberti KGMM. Epidemiology of diabetes in Africa. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 1–17.

3 The Diabetes Control and Complications Trial Research Group. The effect of intense treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *NEJM* 1993; **329**: 977–986.

4 Bott U, Jörgens V, Grüsser M, Bender R, Mühlhauser I, Berger M. Predictors of glycaemic control in Type 1 diabetic patients after participation in an intensified treatment and teaching programme. *Diabet Med* 1994; **11**: 362–371.

5 Müller UA, Femerling M, Risse A, Schumann M, Use G, Jörgens V *et al.* Ausbildung der Patienten mit Typ-I-Diabetes zur Selbsttherapie. *Med Klin* 2000; **95**: 359–368.

6 Ridgeway NA, Harvill DR, Harvill LM, Falin TM, Forester GM, Gose OD. Improved control of type 2 diabetes mellitus: a practical education/behaviour modification program in a primary care clinic. *South Med J* 1999; **92**: 667–672.

7 Turner RC, Cull CA, Frighi V, Holman RR. Glycemic control with diet, sulfonyl urea, metformin, or insulin in patients with type 2 diabetes mellitus (UKPDS 49). *JAMA* 1999; **281**: 2005–2012.

8 Fanghanel G, Sanchez-Reyes L, Morales M, Torres E, Chavira J, Sotres D *et al.* Comparative accuracy of glucose monitors. *Arch Med Res* 1998; **29**: 325–329.

9 Naito HK, Kwak JS, Cottingham C. Accuracy of the One Touch II whole blood analyzer when used by analysts with diverse technical backgrounds. *J Family Practice* 1993; **37**: 153–157.

10 Hoffmeister M, Krahwinkel M, Lyaruu I. Nutrition of patients with diabetes mellitus from Kilimanjaro Region, Tanzania. A study on eating habits, nutritional status and metabolic adjustment. Report of the Institute of Nutritional Science. Giessen: Justus Liebig University, 2000: 44–50.

11 Anonymous. Metabolic and endocrine disease conditions. In *Standard Treatment Guidelines and The National Essential Drug List For Tanzania*, 2nd edn. Dar Es Salaam: Ministry of Health of the United Republic of Tanzania, 1997: 13–15.

12 Coleman R, Gill G, Wilkinson D. Noncommunicable disease management in resource-poor settings: a primary care model from rural South Africa. *Bull World Health Org* 1998; **78**: 633–640.

13 Famuyiwa OO. Important considerations in the care of diabetic patients in a developing country (Nigeria). *Diabet Med* 1990; **7**: 927–930.

14 Gill G. Delivery of diabetes care. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 51–64.

15 Gill GV. Practical management of diabetes in the tropics. *Trop Doctor* 1990; **20**: 4–10.

16 Deurenberg P, Yap M, van Staveren WA. Body mass index and percent body fat: a meta analysis among different ethnic groups. *Int J Obes Relat Metab Disord* 1998; **22**: 1164–1171.

17 Sherif IC, Beshyah SA. Diabetes and Ramadan. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 269–273.

18 Naidu R. Dietary management of diabetes in Africa. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 249–259.

19 Gill GV, Huddle KR. Patterns of insulin dependence in an African diabetes clinic. *Q J Med* 1991; **291** (New Series no. 294): 829–835.

20 Huddle KR, Gill GV. Reducing acute hyperglycaemic mortality in African diabetic patients. *Diabet Med* 1989; **6**: 64–66.

21 Van der Sande MA, Walraven GE, Bailey R, Rowley JT, Banya WA, Nyan OA *et al.* Is there a role for glycosuria testing in sub-Saharan Africa? *Trop Med Int Health* 1999; **4**: 506–513.

22 Mugusi F, Ramaiya KL, Chale S, Swai AB, McLarty DG, Alberti KG. Blood pressure changes in diabetes in urban Tanzania. *Acta Diabetologica* 1995; **32**: 28–31.

23 Edwards R, Unwin N, Mugusi F, Whiting D, Rashid S, Kissima J *et al.* Hypertension prevalence and care in an urban and rural area of Tanzania. *J Hypertension* 2000; **18**: 145–152.

24 Gill G. Outcome of diabetes in Africa. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 65–71.

25 Rolfe M. Chronic complications of diabetes. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 43–50.

26 Chale S. Economics of diabetes care. In Gill G, Mbanya JC, Alberti KGMM eds. *Diabetes in Africa*. Cambridge: FSG Communications Ltd, 1997: 199–214.

27 Yudkin JS. Insulin for the world's poorest countries—a proposal for the millenium. *Lancet* 2000; **355**: 919–21.