Implementation of Guidelines for the Prevention of Diabetic Nephropathy

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Effective treatment of hyperglycemia, cessation of smoking, and treatment of elevated blood pressure are important means to prevent and retard the progression of diabetic kidney disease in type 1 diabetes (1–4). Guidelines regarding management of these risk factors have become increasingly common, but little is known about how efficiently they are implemented in clinical practice.

The national guidelines for the prevention of diabetic nephropathy published in 1991 by the Finnish Diabetes Association state the following: *1*) aim for strict glycemic control (HbA_{1c} 7.0–7.5%); *2*) encourage the patient to stop smoking; *3*) in patients with elevated albuminuria, initiate antihypertensive therapy with ACE inhibitors as first-line agents if blood pressure exceeds 140/90 mmHg, with the target for treatment <130/80–85 mmHg. The aim of the present study was to examine to what extent these guidelines are implemented in a large cohort of adult type 1 diabetic patients.

RESEARCH DESIGN AND METHODS

— The Finnish Diabetic Nephropathy (FinnDiane) study is a nation-wide, prospective, multicenter study initiated in November 1997 with the primary aim to identify genetic and environmental risk factors for diabetic nephropathy in type 1 diabetes (5,6). The patients were recruited from 20 university and central hospitals, 23 local hospitals, and 16 primary health care centers. After approval of the study protocol by the local ethics committee, all patients with a diagnosis of type 1 diabetes attending the diabetic and renal outpatient clinics and dialysis units were asked to participate. The response rate was 78%. Data on diabetic micro- and macrovascular late complications, insulin therapy, and other regular medication were given by the attending physician, whereas data on smoking habits, alcohol intake, educational level, and social class were obtained with a questionnaire. HbA_{1c} was locally determined, and the nondiabetic reference range was between 4.0 ± 0.2 and 6.0 ± 0.2% in 65% of the laboratories. Blood pressure was measured auscultatorily by a nurse after 5 min of rest with the subject in a sitting position. Current smoking was defined as daily use of tobacco during the year before participation in the study. Renal disease was defined according to prevailing recommendations (7).

The present analysis was made in 3,115 patients (mean age 38 years, duration of diabetes 22 years, BMI 25.0 kg/m^2, and proportion of men 52%) with their data entered into the FinnDiane database by 31 October 2002. Patients with an age at onset of diabetes >35 years or who had not had insulin therapy initiated within 1 year after diagnosis were excluded.

RESULTS

— Good glycemic control was found in every fourth patient (Table 1). The proportion of patients with good glycemic control was smaller in patients with microalbuminuria and overt nephropathy than in patients with normoalbuminuria. Similarly, every fourth patient was a current smoker. The proportion of current smokers was higher in patients with microalbuminuria and overt nephropathy than in those with normoalbuminuria or end-stage renal disease.

Hypertension, defined as antihypertensive therapy and/or a blood pressure >140/90 mmHg, was present in 52% of the patients, and the prevalence increased steeply with degree of renal involvement. Untreated hypertension, defined as a blood pressure >140/90 mmHg without antihypertensive therapy, was rare, especially in patients with microalbuminuria or overt nephropathy. However, controlled hypertension, defined as a blood pressure <130/85 mmHg in patients receiving antihypertensive therapy, was found in only 33 and 19% of patients with microalbuminuria and overt nephropathy, respectively. ACE inhibitors and angiotensin receptor blockers were used in almost all patients with microalbuminuria or diabetic nephropathy on antihypertensive therapy.

CONCLUSIONS

— The mean HbA_{1c} was 8.5%. When accounting for the different normal ranges of assays used, this mean value is quite comparable to that of other studies, such as the EDIC (Epidemiology of Diabetes Interventions and Complications) study (8), the EURODIAB study (9) (after transformation into values of the Diabetes Control and Complications Trial method [10]), or the recent Swedish National Diabetes Register study (11). Thus, despite the proven efficiency of strict glycemic control in the prevention of diabetic microvascular complications in type 1 diabetes, the target for treatment is still achieved in only a minority of patients. Of the studied type 1 diabetic patients, 24% were current smokers, a prevalence similar to that of the Finnish background population (12). Moreover, this proportion was even higher in the high-risk individuals with microalbuminuria and overt nephropathy. The guidelines for initiation of blood pressure treatment and the use of ACE inhibitors were successfully implemented in patients with microalbuminuria and overt nephropathy. However, regarding blood pressure control, only every fifth patient with overt nephropathy reached

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Received for publication 4 December 2003 and accepted in revised form 10 December 2003.

Table 1—*Adherence to national guidelines for prevention of diabetic nephropathy in Finland*

	Normoalbuminuria	Microalbuminuria	Overt nephropathy	End-stage renal disease*	Not classifiable	All
n	1,422	366	482	271	574	3,115
Good glycemic control†	28	18‡	12‡	23	29	24
Current smokers	22	30§	29§	18	26§	24
Untreated hypertension‖	17	12¶	3‡	7‡	11§	12
Antihypertensive therapy	15	66‡	95‡	90‡	27‡	42
Controlled hypertension#	22	33¶	19	8‡	26	21
ACE inhibitor/angiotensin receptor blocker**	65/12	81‡/12	78‡/12	23‡/5‡	71/18	66/11

Data are percentages. *Kidney transplant ($n = 202$) and dialysis ($n = 69$); †HbA_{1c} <7.5%; ‡$P < 0.001$ vs. normoalbuminuric patients; §$P < 0.01$ vs. normoalbuminuric patients; ‖blood pressure >140/90 mmHg, no antihypertensive treatment; ¶$P < 0.05$ vs. normoalbuminuric patients; #antihypertensive treatment, blood pressure <130/85 mmHg; **the proportion of patients on antihypertensive therapy receiving ACE inhibitors or angiotensin receptor blockers.

the target for treatment. We measured blood pressure on a single occasion, and thereby, the prevalence of controlled hypertension was most likely underestimated (13). Nevertheless, adequate blood pressure control seems difficult to achieve in this group, where aggressive antihypertensive therapy is mandatory in preserving kidney function. Similar or slightly higher prevalences of controlled hypertension have been reported by others (14,15).

Recent clinic-based studies have indicated a decline in the cumulative incidence of diabetic microvascular complications (16,17), most likely as a result of improved glycemic control, aggressive antihypertensive therapy, and a decreasing proportion of smokers. However, the therapeutic goals for these key variables are still achieved in only a subgroup of patients. Additional efforts are needed to implement prevailing recommendations in clinical practice.

Acknowledgments— The skillful assistance of the members of the Finnish Diabetic Nephropathy Study Group (previously presented in detail [5]) is acknowledged.

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