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Diabetes teaching — outcome analysis

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Abstract

A comprehensive database has been maintained on patients attending the St. Paul's Hospital Diabetes Teaching and Treatment Centre (DTTC) since 1984. In November 1995, four sets of patients, all of whom had returned to the Centre, were identified for an outcome study. The sets were: insulin-dependent diabetes mellitus (IDDM), diet-treated non-insulin-dependent diabetes mellitus (NIDDM), oral agent-treated NIDDM, insulin-treated NIDDM. Data on glycosylated hemoglobin (A1c) values, percent ideal body weight (%IBW), home blood glucose monitoring (HBGM)/week were analysed for all sets; data on hypoglycemic events/month were analysed only for the group with IDDM. Results demonstrated that patients in all groups performed significantly more HBGM over time. Downward change in %IBW in the diet-treated and oral agent groups was significant. Upward change in %IBW was significant in the IDDM group. Hypoglycemic events did not significantly increase in IDDM patients even though A1c improved. Most notably, the A1c values improved in all four groups up to 8 years after the first DTTC visit. Implications for practice are suggested.

Keywords: Diabetes education; NIDDM; IDDM; Diabetes outcomes; Hgb A1c

1. Introduction

Diabetes teaching and treatment have assumed greater importance since the Diabetes Control and Complications Trial (DCCT) [1] results

showed that long-term improvement in diabetes control is possible and beneficial. Intervention through diabetes education programs has been shown to improve diabetes control but only on a short term and variable basis [2–4]. Offering a program modelled after the DCCT would be prohibitive both in cost and patient selection since the DCCT provided intensive monitoring, an always available multidisciplinary team and ac-

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cepted only highly motivated patients. Knowing that long-term improvement in diabetes control is possible and beneficial and that cost effective, accessible care is essential, we have reviewed outcome data on 5823 patients who have returned to St Paul's Diabetes Teaching and Treatment Centre for up to 8 years.

The following is a description of the Diabetes Teaching and Treatment Centre at St. Paul's Hospital, a report on the outcome data collected, and a discussion of practical implications.

2. Description

The DTTC at St. Paul's is managed by a multi-disciplinary team consisting of dietitians, nurses, clerical staff, dining room staff, physicians and a social worker. A 'core' program is available over four consecutive days or evenings. All patients are seen by a dietitian for initial individual counseling. During the core program all meals are eaten at the Centre so that staff can oversee meal choices and provide on-the-spot feedback. Dietary information is shared in a group setting to provide information on basic dietary concepts, the use of alcohol, dining out, handling illnesses, and travelling. Specialized diets for Punjabi and Japanese patients are available. Staff fluent in Cantonese work with the large proportion of Cantonese attendees.

Each person attending the Centre is taught self blood glucose monitoring (SBGM) by a nurse-educator and tests are taken before meals and before departure each of the 4 days or evenings. Course content taught by nurses includes basic information about diabetes, effects and timing of diabetes medications, recognition and treatment of hypoglycemia, tips for comfortable travelling, and day to day coping skills. Materials used for teaching have been reviewed and scored equivalent to a grade IV reading level. The staff is experienced in teaching through visual aids for those people who are not literate or whose first language is not English.

The majority of patients (90%) are seen by an attending endocrinologist; all have an attending family medical doctor (MD). During the core program patients are seen daily by the en-

docrinologist. Family MDs are encouraged to see their patients personally; most are in telephone contact. Information compiled throughout each day is reviewed with the patient and treatment decisions are made in a collaborative manner. At the end of the 4-day course patients are provided with discharge details including contact phone numbers, prescriptions as necessary, and an appointment for followup.

The Centre protocol is to have newly diagnosed patients return 3 months after their initial 4-day course for a 1-day followup course. Followup is encouraged thereafter at 3 months, 6 months, or yearly intervals, dependent on the staff and patient perceptions of need having regard to A1c levels. On occasion patients are asked to return to the 4-day course. These returnees usually need to start on insulin treatment or have A1c values which remain persistently high for unexplained reasons.

The 1-day followup course is a condensed version of the core program. Again, meals are eaten in a supervised manner and each patient's SBGM is reviewed on three samples. At the beginning of the course, participants are asked to supply questions about diabetes and to share experiences with the group. Each patient is seen by an MD, a nurse-educator and a dietitian during the review. As in the core program, the clerical and dining room staff are vital in the smooth running of the followup program. The social worker sees patients in the Centre on a referral basis.

At the end of each core or followup visit, patients are asked to complete a questionnaire evaluating the program content and staff. Data collected during the clinical assessment are recorded by the staff on the chart flowsheet. A standardized report is sent to the family MD. Weekly meetings are held in the Centre to review daily problems of running the courses, to work on program development, and to adjust availability of types of programs according to demand.

3. Methods

Hemoglobin A1c was measured using two techniques. From February 1985 to April 1990 a cation exchange resin in a disposable column was used

(Bio-Rad hemoglobin A1c microcolumn test). Since May 1990, an ion exchange high pressure liquid chromatography technique was used (Bio-Rad Diamet analyzer). Specimens were collected into vacutainer tubes (Bectin-Dickinson) containing EDTA as the anti-coagulant. Comparability of the two methods was tested using 226 samples from patients attending the Diabetes Centre. For the purpose of this report, the microcolumn test results were adjusted according to the derived linear regression model: Diamet result = 1.13 (microcolumn results) + (0.001) ($R = 0.95$).

%Ideal body weights were calculated using 1983 Metropolitan Life Insurance values for desirable weights for heights of adults [5].

Home blood glucose monitoring/week was the number of times per week the patient performed HBGM.

Hypoglycemia episodes/month was the number of times per month the patient felt or another noticed symptoms of hypoglycemia.

Data were analyzed on all patients who attended the Centre and returned for followup. To verify the accuracy of data input, 2000 fields in the data base were randomly compared to source document data. Sixteen errors, representing an error rate of less than 1%, were identified thus validating the data base. Data is represented as means \pm standard deviation. Student *T*-test for paired samples was used to determine statistical significance of changes from initial assessment.

IDDM: Patients were categorized as having IDDM when (a) onset of insulin requiring diabetes mellitus was at age less than 30 years, or (b) there was proven ketoacidosis in an insulin requiring person, or (c) C-peptide challenge was negative (Table 1 describes the IDDM patients).

Table 1
Description of patients with IDDM

<i>N</i>	1067
Age (years)	37 \pm 12.8
Duration D.M.	16 \pm 13.2
% Males	54
Average insulin units/day	
Initial	39
Follow-up	42

Table 2
Description of patients with NIDDM

Diet	
<i>N</i>	1192
Age (years)	56 \pm 12
Duration	4 \pm 4
% Males	56
Oral agents	
<i>N</i>	2269
Age (years)	60 \pm 12
Duration	8 \pm 6
% Males	59
Insulin	
<i>N</i>	1295
Age (years)	60 \pm 11
Duration	15 \pm 8
% Males	52

Patients not fulfilling these criteria were categorized as having NIDDM unless an oral glucose tolerance test documented impaired glucose tolerance (Table 2 describes the NIDDM patients).

4. Results discussion

A comprehensive database has been maintained on patients attending the St. Paul's Hospital DTTC since 1984. In November 1995, four sets of patients, all of whom had returned to the Centre for followup, were identified for an outcome study. The sets were: IDDM, diet-treated NIDDM, oral agent-treated NIDDM, insulin-treated NIDDM. Data on A1c values, %IBW, HBGM/week were analysed for all sets; data on hypoglycemia events/month were analysed only for the IDDM group.

The results of our outcome study show that in those patients who attend the comprehensive diabetes teaching and treatment program at St. Paul's Hospital and return to the Centre for follow-up, long-term improvement in diabetes control is possible (Figs. 1–4). In patients with IDDM, significant improvement in diabetes control was observed without a significant increase in hypoglycemia (Table 3). This observation differs from that seen by the DCCT [1], but was in agreement with Pieber et al. [6]. A significant increase in

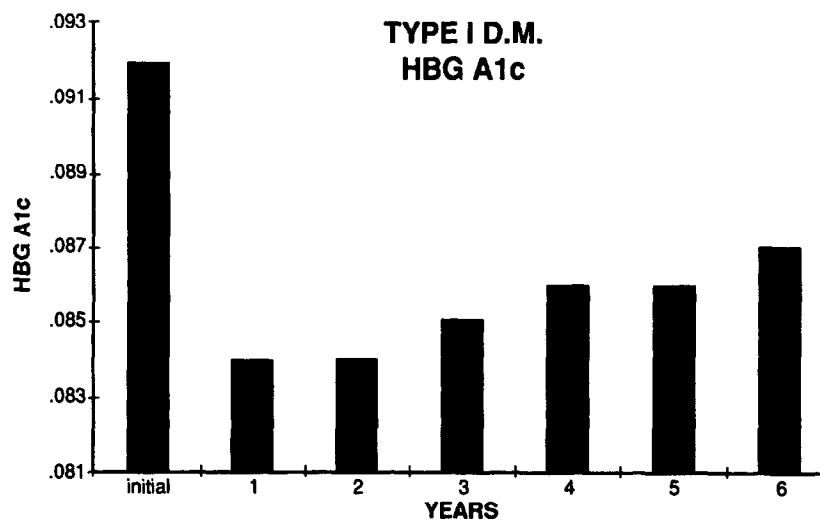


Fig. 1. Type I D.M. HBG A1c.

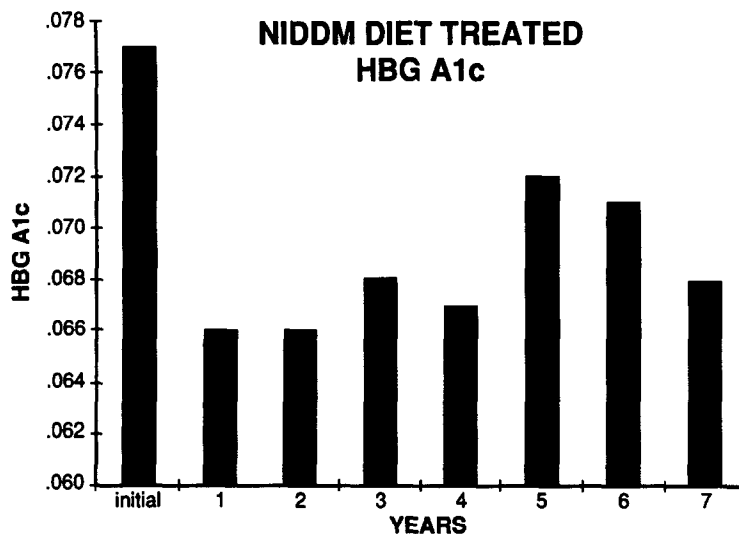


Fig. 2. NIDDM diet-treated HBG A1c.

weight was seen in this group. The DCCT documented a similar finding. The diet-treated group showed significant weight reduction of approximately 7% from baseline (Table 4). This demonstrates the efficacy of diet and weight reduction (however modest) in improving diabetes control in these patients. The oral agent-treated group showed a modest but significant weight loss (Table 5). The insulin-treated group did not demonstrate a significant weight gain (Table 6). In all three groups of patients with non-insulin-de-

pendent diabetes mellitus (NIDDM), significant and long lasting improvement in glucose control was found. In all four sets of patients, there was a significant increase in HBGM/week.

Although it is intuitive that increased knowledge about diabetes mellitus is important for patients, not all studies have shown a positive correlation of knowledge with outcome [7]. It is encouraging that our outcomes study showed that on average patients performed significantly more HBGM/week and gained significantly improved

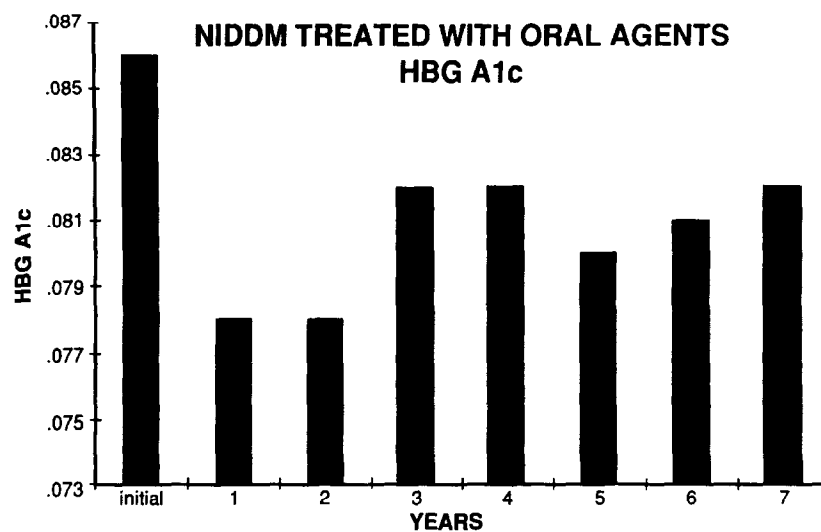


Fig. 3. NIDDM treated with oral agents HbG A1c.

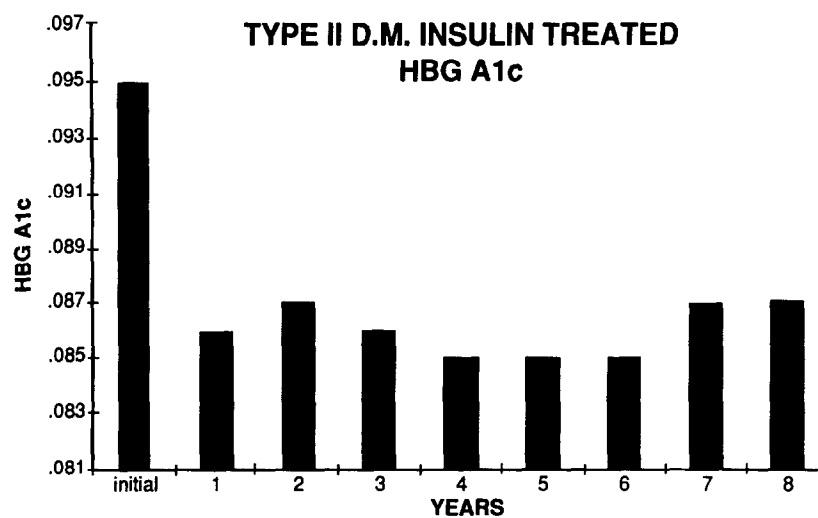


Fig. 4. Type II D.M. insulin-treated HbG A1c.

Table 3
Outcome data on patients with IDDM

	Years						
	Initial	1	2	3	4	5	6
Hgb A1c	0.092	0.084	0.084	0.085	0.086	0.086	0.087
% IBW	1.04	1.06	1.07	1.07	1.06	1.08	1.08
Hypoglycemia (episodes/month)	6.7	5.5	6.9	6.5	5.9	6.2	5.8
# HBGM/week	12.7	16.6	15.2	15.3	15.2	15.4	14.8

glucose control. These findings support the observation that the frequency of self blood glucose monitoring and knowledge of Hgb A1c are important determinants of outcome [8].

5. Practice implications

The 4-day program encourages patients to adjust behavior in a supervised and supportive surrounding. Patients are provided with information gradually and appropriate repetition is possible. Self blood glucose monitoring provides immediate feedback on behavior changes.

Unfortunately, we do not have information on patients who never attend our Centre or who do not return. Our follow-up rate for patients with IDDM is approximately 70% which is a good deal

higher than others studies report [3]. The follow-up rate for patients with NIDDM is greater at 85%. We think that the higher NIDDM return rate is at least partially because the NIDDM patients are an older group who tend to focus more on their health.

The total operating budget for the DTTC is \$975 000 (Can.) per annum. This represents 9200 visits or \$106 (Can.) per visit. In St. Paul's Hospital, the current cost for one hospital day is approximately \$800 (Can.). Substantial savings are realized by utilizing the DTTC for historically in-hospital activities such as management of patients with newly diagnosed diabetes, management of patients new-to-insulin and management of patients with diabetes control problems. There has been a significant decrease in the number of cases of diabetic ketoacidosis since the inception

Table 4
Outcome data on NIDDM patients diet-treated ($n = 1192$)

	Years							
	Initial	1	2	3	4	5	6	7
Hgb A1c	0.077	0.066	0.066	0.068	0.067	0.072	0.071	0.071
% IBW	1.23	1.18	1.16	1.15	1.15	1.16	1.16	1.16
# HBGM/week	1.6	2.4	2.3	2.4	2.2	3.1	4.7	4.7

Table 5
Outcome data on NIDDM patients treated with oral agents ($n = 2269$)

	Years							
	Initial	1	2	3	4	5	6	7
Hgb A1c	0.086	0.078	0.078	0.082	0.082	0.080	0.081	0.082
% IBW	1.20	1.19	1.18	1.19	1.17	1.15	1.17	1.18
# HBGM/week	3.3	5.3	5.21	5.4	5.4	5.2	5.8	5.8

Table 6
Outcome data on NIDDM patients treated with insulin ($n = 1295$)

	Years								
	Initial	1	2	3	4	5	6	7	8
Hgb A1c	0.095	0.086	0.087	0.086	0.085	0.085	0.085	0.087	0.087
% IBW	1.19	1.18	1.21	1.2	1.18	1.18	1.18	1.18	1.17
# HBGM/week	6.3	10.5	10.3	10.2	10.5	10.5	10.6	10.0	9.3

of the DTTC. The physician services to patients who have attended the DTTC have been shown to decline [9].

Our data point out that it is possible to provide diabetes education and care for a large number of patients in a community-based outpatient setting with modest resources and achieve lasting improvement in diabetes control. Long-term benefits should be realized by sustained improvement in A1c levels thus minimizing or delaying the complications of diabetes.

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