Brief Communication

Limited Joint Mobility of the Hand in Type I Diabetes Mellitus

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Limited joint mobility (LJM) of the hand was present in 32 of 100 subjects, aged 3–22 yr, with type I diabetes mellitus. Prevalence of LJM was independent of age and sex, but increased with duration of diabetes, with peak occurrence in individuals who had diabetes for more than 5 yr ($P < 0.005$). In age- and duration-matched pairs of control and LJM subjects ($N = 31$), there was no significant correlation of LJM with insulin type, insulin allergy, family history of arthritis, or growth retardation. There was also no correlation with "control parameters" including number of episodes of hypoglycemia and ketoacidosis, degree of ketonuria or mean glucose, hemoglobin A_1, fasting triglyceride, or cholesterol value.

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In 1957 Lundbaek[1] first described a "diabetic hand syndrome" comprised of flexion contractures of the fingers and palmar thickening in five patients with long-standing diabetes without neuropathy. In 1974 Rosenbloom and Frias[2] described three young patients with type I diabetes of 8–14 yr duration who had limited joint mobility (LJM) of the hands, large joints associated with growth retardation, and thick, waxy skin. Recent studies have shown LJM to be present in 3–30%[3,4] of patients with type I diabetes, and Rosenbloom[5] has reported increased risk of microvascular disease in this population. The presence of LJM appears to be unassociated with sex, race, or indices of diabetic control, but there have been conflicting reports as to the influence of age, age of onset, and duration of diabetes on the presence of this finding.[2–5]

METHODS

Forty-eight male and 52 female subjects, aged 3–22 yr with type I diabetes for 0–15 yr, were admitted to the Joslin Clinic inpatient youth service from May to December of 1980. None had a history of previous trauma to the hands.

Limited joint mobility of the hands was quantitated using the method of Rosenbloom.[3] Two observers asked each subject to place their hands in the "clapping" position, and flat on the table with fingers spread, while observing for contact of opposing finger joints. Subjects were put in group 0 if there was contact between all opposing joints, in group 1 if it was not possible to approximate the joints of the fifth finger in either position, or in group 2 if, in addition to fifth finger involvement, it was not possible to oppose the joints of other fingers or there was limitation of range of motion of the wrist.

Presence of insulin allergy and family history of arthritis, as well as number of ketoacidotic and hypoglycemic episodes, were documented. Ketonuria for the months preceding hospitalization was quantitated as never, rarely, monthly, daily, or unknown.

Heights of all subjects were plotted on growth grids (National Center for Health Statistics, 1976) and those whose heights fell below the third percentile or showed decreased rates of linear growth since diagnosis of diabetes were defined as growth retarded.

Laboratory evaluation included a random admission capillary blood sugar (Dextrometer, Ames, Elkhart, Indiana) as well as a fasting triglyceride and cholesterol determination. Total glycosylated hemoglobin (A_1) was measured by gel electrophoresis (Corning Medical, Medfield, Massachusetts).

RESULTS

Thirty-two percent of subjects were noted to have LJM of the hand (group 1: 22%, group 2: 10%). There was no correlation of the presence of LJM with sex or age of subject, but there was a significant association with duration of diabetes, with peak prevalence occurring after 5 yr ($P < 0.005$) (Table 1).

LJM groups 1 and 2 were combined and paired with age- and duration-matched controls (group 0) (Table 2). In 31

TABLE 1
Relationship of age and duration of diabetes to prevalence of LJM of the hand

Age (yr)	LJM group	Duration (yr)			
		< 1	1–5	> 5	Total
1–4	0	0	1	0	1
	1	0	0	0	0
	2	0	0	0	0
5–9	0	4	9	2	15
	1	1	2	1	4
	2	0	1	0	1
10–14	0	4	16	7	27
	1	0	5	6	11
	2	0	2	3	5
15–22	0	3	14	8	25
	1	0	2	5	7
	2	0	0	4	4

matched pairs, there was no difference noted in the prevalence of insulin allergy or type of insulin used. There was also no difference in the number of hypoglycemic episodes or the mean value of fasting triglyceride (116 versus 107 mg/dl), fasting cholesterol (173 versus 182 mg/dl), or hemoglobin A_1 (13.8 versus 13.1%) between the LJM and control populations, respectively. There was a tendency toward more growth retardation, ketonuria, and episodes of ketoacidosis as well as higher mean blood glucose (268 versus 223 mg/dl) in the LJM population, but these did not reach statistical significance. An increased number of family members with arthritis was noted in the LJM group, but this, too, was not significant.

DISCUSSION

Our data show a 32% prevalence of LJM of the hand in subjects with type I diabetes. We found hand involvement correlated with duration of diabetes, but not with parameters of diabetic control. These results are similar to those previously reported, except for the correlation with duration that was noted by Rosenbloom in 1976,[3] but not in subsequent studies by this group[5] or others.[4]

Increased collagen deposition,[5,6] cross-linking,[6] and glycosylation[6] have been noted in the thickened skin of diabetic individuals with LJM. In addition, there have been reports of alterations in elastin fibers,[7] glycosaminoglycan synthesis,[8,9] and fibroblast function[10–12] in the diabetic state. These connective tissue changes have been postulated to account for the increased left ventricular,[13] lung,[6,14,15] and arterial[16,17] stiffness noted in diabetic subjects and may account for the joint findings as well. Rosenbloom's study[5] correlating LJM with microvasculopathy suggests that similar connective tissue changes are occurring in the eye and kidney.

Although there has been a report of reversal of skin thickening with improved blood sugar control,[18] the relationship between hyperglycemia and the LJM remains unclear. The lack of association of hand changes with indices of diabetic control in our study and others can perhaps be attributed to the isolated point in time at which these control parameters were examined.

In addition to serving as an easily identifiable marker of those at risk for complications, LJM may be an index of connective tissue involvement in diabetes. A longitudinal prospective study is planned to delineate the natural history of joint and other connective tissue changes and their relationship to metabolic milieu and microvasculopathy.

TABLE 2
Historical features in age- and duration-matched LJM subjects compared with controls

Historical features	LJM group*	Control group*
Insulin allergy	01/31	02/31
Family history of arthritis	08/31	03/29
NPH insulin use	21/31	20/31
Lente insulin use	07/31	09/31
Growth retardation	13/31	07/31
More than three episodes of ketoacidosis	11/31	06/30
Ketonuria (weekly or more)	15/29	07/29
Hypoglycemia (weekly or more)	12/31	09/30

* Data were not available for all variables for each patient; therefore, some denominators are less than 31.

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