Limited joint mobility in Type I diabetes mellitus

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Summary

Forty-two of 115 patients with Type I (insulin dependent) diabetes were found to have limited joint mobility affecting mainly the small joints of the hands. The presence of joint abnormalities was related to duration of diabetes. Patients with limited joint mobility had a significantly higher incidence of proliferative retinopathy than patients with normal joint mobility and a similar duration of diabetes ($P < 0.001$). Limited joint mobility appears to be an early marker for the development of microvascular complications in diabetes.

Barta, 1980), though Benedetti and Noacco, in describing 11 patients with joint involvement, estimated that a prevalence of 1 in 10 could be expected in adolescents with childhood onset of diabetes (Benedetti and Noacco, 1976). We have investigated the prevalence of limited joint mobility in the hands of patients with childhood onset, Type I diabetes attending our paediatric and adult diabetic clinics. The findings confirm that such limited joint mobility is common in Type I diabetes. Its prevalence increases with duration of diabetes and there appears to be a strong correlation with severe proliferative retinopathy.

Introduction

In 1976 joint contractures, involving mainly proximal interphalangeal joints of the hands, were found in approximately 28% of diabetic children attending a summer camp in Florida (Grgic *et al.*, 1976). A more recent study by the same group confirmed that finding and the authors also claimed that the presence of limited joint mobility in these patients indicated an increased risk for microvascular disease (Rosenbloom *et al.*, 1981). These contractures differ from Dupuytren's contracture in that they do not have sharp angulation at the metacarpophalangeal joint of the fourth finger (Skoog, 1948). Outside North America reports of these joint abnormalities in childhood diabetes have been limited largely to sporadic case reports (Choulot and St Martin, 1980;

Patients and methods

One-hundred and fifteen patients attending the diabetic clinics of the Royal Victoria Hospital, Belfast and the Royal Belfast Hospital for Sick Children were studied. There were 60 males and 55 females and all had Type I (insulin dependent) diabetes diagnosed before the age of 20 years. Their ages ranged from 5 to 57 years (mean 22.3, median 17) and duration of diabetes from 6 months to 43 years. Ninety non-diabetic subjects (47 males and 43 females) with ages ranging from 7 to 72 years (mean 29.5, median 24) were also examined for the presence of limited joint mobility.

Limited joint mobility was determined by the method outlined by Grgic *et al.* (1976). The subject's hands are placed on a table top with palms downward and fingers fanned and the examiner views the hands at table level. Normally the entire palmar

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FIG. 1. Demonstration of limited joint mobility in a diabetic patient. Inability to approximate the interphalangeal joints of the second to fifth digits—Stage II (see text).

surface of the fingers makes contact with the table. Classification of contractures is as follows:— Stage I—unable to make contact with some portion of one finger of each hand, usually fifth proximal interphalangeal joint; Stage II—unable to make contact with two or more fingers of each hand; Stage III—involvement of all fingers of each hand, plus limitation of movement at some larger joint(s), usually wrist or

elbow. Any abnormality present may become more obvious when the patient attempts to approximate the palmar surface of the interphalangeal joints of both hands tightly (Fig. 1). Equivocal cases were classified as having no limited joint mobility.

Ophthalmological assessment, for the presence of retinopathy, was performed in each case by a consultant ophthalmologist. This was carried out in a darkened room after the pupils had been dilated with cyclopentolate hydrochloride, 0.5%. The patient's height at the time of examination was recorded as centile for age and sex according to the charts of Tanner and Whitehouse. A note was made of the age of onset and duration of diabetes, and the daily insulin dose at the time of examination. Comparisons were made using Student's *t*-test for unpaired data and the χ^2 squared test.

Results

Forty-two patients (36.5%) had limited joint mobility. Eleven were classified as Stage I, 30 as Stage II, and 1 as Stage III. Only 3 of the non-diabetic subjects had similar limited joint mobility ($P < 0.001$, compared to diabetic subjects). Table 1 compares diabetic patients with contractures with those without. There was no significant difference in the age at diagnosis but patients with limited joint mobility had significantly longer duration of diabetes. Many of the patients were unaware of any abnormality in their hands and it was not possible therefore to assess accurately when the limited joint mobility may have begun. The shortest duration of diabetes in any patient with limited joint mobility was just over 1 year, and only 5 patients with joint abnormalities had had diabetes less than 5 years. On the other hand, only 7 of the 73 patients without joint abnormality had had diabetes longer than 20 years. The mean insulin dose was also significantly higher in patients with limited joint mobility, a finding which would be expected in view of their longer duration of diabetes.

Retinopathy was detected in 52.4% of the patients

TABLE 1. Characteristics of all diabetic patients studied, with comparison between those with and without limited joint mobility

	42 patients with limited joint mobility	73 patients without limited joint mobility	Significance
Age of onset of diabetes (years)*	9.8 $\pm$ 0.78	8.8 $\pm$ 0.56	n.s.
Duration of diabetes (years)*	19.1 $\pm$ 1.92	8.5 $\pm$ 0.96	$P < 0.001$
Daily insulin dose (units)*	66.5 $\pm$ 4.94	53.4 $\pm$ 6.00	$P < 0.01$
Incidence of retinopathy	22/42 (52.4%)	9/73 (12.3%)	$P < 0.001$

*Mean $\pm$ s.e. mean.

TABLE 2. Comparison of prevalence of retinopathy in longstanding diabetic patients with and without limited joint mobility

	Limited joint mobility	Normal joint mobility	Significance
Male/Female	12/8	10/10	n.s.
Duration of diabetes (years)			
—Range	9–39	11–39	
—Mean $\pm$ s.e. mean	21.5 $\pm$ 1.7	20.5 $\pm$ 1.7	n.s.
Retinopathy			
—any	17	8	$P < 0.10$
—proliferative*	14	3	$P < 0.01$

*Defined as presence of neovascularization.

with limited joint mobility compared to only 12.3% without. The 22 patients with both limited joint mobility and retinopathy had a duration of diabetes of 27.4 ± 1.8 years (mean $\pm$ s.e. mean) compared to 10.1 ± 2.1 years in the 20 patients with limited joint mobility but no retinopathy ($P < 0.001$). In order to assess whether the presence of limited joint mobility was a risk factor for the development of retinopathy, independent of duration of diabetes, two sub-groups of 20 patients, with and without limited joint mobility, and matched for duration of diabetes, were compared (Table 2). Retinopathy was much commoner in the group with limited joint mobility (85.0% v. 40.0%), though the difference in this relatively small sample group was not statistically significant. There was, however a highly significant difference in the prevalence of proliferative retinopathy—70.0% in patients with limited joint mobility compared to 15.0% in patients with normal joint mobility.

Height was measured accurately in 36 patients with limited joint mobility and 69 patients without. It can be seen from Fig. 2 that short stature was common in both groups, with 72.2% of the limited joint mobility group and 60.8% of the normal joint mobility group lying below the 50th centile for age and sex. Although short stature was commoner in those patients with limited joint mobility, there was no statistically significant difference in the numbers of either group lying below any centile point.

Discussion

Writing in *Joslin's Diabetes Mellitus*, Meissner and Legg (1971) suggested that joint changes in diabetes are limited to the Charcot joints related to peripheral diabetic neuropathy. In the same text, Krall and Zorrilla refer to Dupuytren's contracture as being more frequent among older diabetic patients than among non-diabetic subjects, but make no allusion to any other form of contracture or limited joint mobility. The present study shows that limited joint mobility, mainly involving the small joints of the

FIG. 2. Distribution of height, as centile for age and sex, in patients with (▨) and without (■) limited joint mobility.

hands, is a common manifestation of childhood onset Type I diabetes, whereas it is uncommon in non-diabetic subjects.

The prevalence of limited joint mobility found in surveys of diabetic populations in North America has varied from 8.4 to 30% (Grgic *et al.*, 1976; Traisman *et al.*, 1978; Rosenbloom *et al.*, 1981). The present study shows an even higher prevalence, with 36.5% of the patients studied being affected. Our finding of a strong correlation between limited joint mobility and duration of diabetes probably explains the great variation in the observed prevalence of these joint abnormalities. Thus Traisman *et al.* (1978), who studied patients only up to the age of 18 years, found a prevalence of 8.4%. In Rosenbloom's study, which described a prevalence of joint abnormalities of 30%, patients up to the age of 28 years were studied. Many of the patients in our study were more than 40 years of age and had had diabetes for more than 25 years.

Since the presence of limited joint mobility is related to duration of diabetes a correlation with the presence of retinopathy could be predicted, as it is well recognized that the incidence of retinopathy increases with longer duration of diabetes. However,

from our comparison of patients, matched for duration of diabetes, with and without limited joint mobility, it is clear that there is a higher prevalence of retinopathy in those patients with limited joint mobility. In particular the prevalence of proliferative retinopathy was markedly increased in those patients (Table 2). This accords with the findings of Rosenbloom *et al.* (1981) that there was an 83% risk for microvascular complications after 16 years of diabetes if joint limitation was present, but only a 25% risk if joint limitation was absent. Those authors also pointed out that in the majority of patients joint abnormalities preceded the finding of retinopathy by several months to years. Our finding of a shorter duration of diabetes in patients with limited joint mobility but no retinopathy compared to patients with both would support this assertion. Therefore the presence of limited joint mobility would appear to be an early marker for the potentially serious microvascular complications of diabetes.

Since short stature has been a marked feature in many of the patients described in case reports it seemed pertinent to examine this aspect in our study (Benedetti and Noacco, 1976; Choulot and St Martin, 1980). The findings demonstrate that short stature is common in childhood onset Type I diabetes regardless of the presence or absence of limited joint mobility (Fig. 2). In their recent study, Rosenbloom *et al.* (1981) drew attention to the presence of thick tight waxy skin seen mainly over the dorsum of the hands in patients with limited joint mobility. Although several of our patients seemed to have thickened, waxy skin this aspect was not assessed formally in our study as we felt the interpretation of such skin findings was rather subjective. The possible roles of genetic factors (Traisman *et al.*, 1978; Brice, Johnston and Noronha, 1981) or neuropathy (Jung *et al.*, 1971) in the development of limited joint mobility in these patients have not been investigated in our study.

Although the exact aetiology of limited joint mobility in diabetes is unknown, our findings are consistent with the conjecture that it may have an origin similar to that of diabetic microangiopathy (Knowles, 1981). It is now accepted that laser photocoagulation is an effective therapy in preserving vision in patients with proliferative diabetic retinopathy, so it is imperative that susceptible

patients are identified and referred for treatment early since diabetic retinopathy remains the major cause of serious visual loss in most western industrialised countries (Patz, 1974). Although there can be no substitute for careful ophthalmological examination, detection of limited joint mobility, which requires no special skill or equipment, would appear to identify diabetic patients who are particularly susceptible to serious retinopathy.

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