Joint contractures and diabetic retinopathy

M. CHAPPLE
M.B., B.S.

J. FRANCIS
M.B., B.S.

E. M. KOHNER
M.D., F.R.C.P.

R. T. JUNG
M.A., M.D., M.R.C.P.

J. WEBSTER
B.Sc

S. R. BLOOM
M.A., D.Sc, M.D., F.R.C.P.

Department of Medicine, Hammersmith Hospital, London W12

Summary

It has been suggested that joint contractures may be an early marker of microangiopathy, especially retinopathy, in diabetic patients. To investigate this possibility, the prevalence of contractures of the finger joints, as assessed by the painted hand technique, was compared in 106 diabetic patients without, and 105 with retinopathy (proliferative in 66%). There was an increased prevalence of contractures in those with diabetes (25.2%) as compared with an age-matched control of 106 subjects (7.5%, $P < 0.01$). The prevalence of contractures was similar in those diabetics with and without retinopathy (29.5% v. 20.8%, $P < 0.1$), and did not vary with the type of retinopathy. The contracture prevalence rate was also similar in those with a diabetes duration of 5 or more years (retinopathy 29.3%, no retinopathy, 30%) or of similar diabetic duration (retinopathy 20.8%, no retinopathy, 25%). Diabetic control, as assessed by HbA_{1c}, was similar in retinopathic patients with or without contractures. We conclude that although finger joint contractures are more prevalent in adult diabetic patients, they are not necessarily a reliable early indicator of the development of retinopathy of any specific type.

KEY WORDS: diabetes mellitus, retinopathy, joint contractures.

Introduction

Contractures of the finger joints have been suggested as an early marker of the development of microvascular disease, especially retinopathy in young diabetics (Rosenbloom *et al.*, 1981). To investigate this we have studied the prevalence of finger joint contractures in 2 groups of diabetics, one group having no evidence of retinopathy, the other

showing variable types of retinopathy. These results were compared with an age-matched control group of non-diabetic subjects.

Patients and methods

We evaluated 211 diabetic patients attending outpatient clinics at the Hammersmith Hospital. One-hundred-and-six patients had no retinopathy on optic fundal examination. One-hundred-and-five of the diabetic subjects had retinopathy confirmed at full ophthalmological examination by one of us (EMK) who was not aware of the finger contracture results. Retinopathy was confirmed by colour photographs with supporting fluorescein angiography. Sixty-nine of the diabetic subjects had a proliferative retinopathy, whereas 13 had maculopathy. Twenty-three of the diabetics had background retinopathy with small dot haemorrhages and exudates, and of these, 7 had signs of capillary non-perfusion with clusters of large haemorrhages, cotton-wool spots and an atrophic-looking retina.

Evaluation included a review of diabetes control and a systematic clinical examination. Vibration sense on the medial malleolus was abnormal if a 128 cps tuning-fork, sprung with the fingers, was sensed for less than 10 s. The urine was tested for proteinuria (with 'Ames' Multistix); the mean serum creatinine (by autoanalyser) and HbA_{1c} levels (Biorad microcolumn method) were measured; this latter has a coefficient of variation intra-assay of 3% and inter-assay of 11%; normal range is 4.2-9.1, measured over a 1 year interval, were recorded. To demonstrate finger joint contractures, the subjects' fingers and palms were initially examined visually and then painted with a water-soluble gel paint. Subjects with Dupuytren's contractures were excluded. The subject

then laid both hands palmar surfaces down onto a sheet of paper and pressed his/her weight firmly onto the distal metacarpal heads and fingers. An imprint of the palmar surface of both hands was, thus, clearly made and any fixed flexion deformity of the finger could easily be visualised. If a deformity was noted, then the hands were re-examined to confirm the contracture by attempting passive extension of the subject's fingers. The normal was taken to be 180° or more of extension at the interphalangeal and 90° at the metacarpo-phalangeal joints. One-hundred-and-six healthy subjects, staff and visitors to the hospital acted as a control group. Statistical analysis was by the Student's *t* test and the χ^2 test. Each subject gave fully informed consent. Results are expressed, unless indicated, as mean $\pm$ s.d.

Results

The prevalence of finger contractures was significantly higher in the diabetic patients (25.2%) as compared with a similar age-matched control non-diabetic population (7.5%; $P < 0.01$). The prevalence of contractures was similar in diabetic patients with (29.5%), and without (20.8%), retinopathy ($P > 0.1$), and the prevalence did not vary with the type of retinopathy (Table 1). The prevalence of contractures was 29% in those diabetics with lens opacities. As microvascular disease is more common after 5 years of diabetic duration (Rosenbloom *et al.*, 1981), we compared the prevalence of contractures in those who had had diabetes for 5 or more years; the prevalence of contractures was practically identical being 29.3% in those with and 30% in those without retinopathy (Table 2). In those whose diabetes began before the age of 18 years (Table 2), the prevalence of contractures was also similar, 28.6% in those with,

and 25% in those without, retinopathy. As the duration of diabetes varied significantly in the above comparisons, we also compared subjects paired for diabetic duration. Once again, the prevalence of contractures was similar (Table 2); 20.8% in those with, and 25% in those without, retinopathy. Overall retinopathy was present in 58.5% of those with, and 47% of those without, contractures ($P < 0.5$).

The prevalence of contractures was also similar in the insulin- and non-insulin-dependent diabetics with, or without, retinopathy (Retinopathy: contracture prevalence in insulin-dependent = 31%, in non-insulin-dependent = 27%. Non-retinopathy: contracture prevalence in insulin-dependent = 19.5%, in non-insulin-dependent = 20%).

In those with retinopathy, finger contractures were more prevalent in males (39%) than females (21%) ($P < 0.05$), but in those without retinopathy the prevalence was similar in the sexes (male 21%; female 20%). In those without retinopathy, contractures were associated with a longer duration of diabetes, a reduction in vibration sense and an absence of ankle jerks (Table 3), but these associations were not a feature of those with retinopathy. In both those with and without retinopathy, there was no association between the presence of contractures and the supine systolic and diastolic blood pressures, the change in systolic pressure on standing, the presence of proteinuria, the plasma creatinine, absence of foot pulses or insulin dependence (Table 3).

In those with retinopathy, diabetic control, as assessed by HbA_{1c}, was similar in those with and without contractures (Table 3). There was also no association between the presence of retinopathy and the severity of contractures as measured by the number of fingers involved.

TABLE 1. Data on the subject groups investigated

	Diabetes Mellitus						
	No Retinopathy		Retinopathy				
			Background		Proliferative	Maculopathy	Total
	Control		Total (including PP)	Pre-prolif- erative (PP)			
Number of subjects	106	106	23	7	69	13	105
Number with contractures	8(7.5%†)	22(20.8%)	6(26.1%)	2(28.6%)	21(30.4%)	4(30.8%)	31(29.5%)
Age (years)	48.6 ± 12.2	49.9 ± 17.3	56.5 ± 15.5	52.7 ± 14.4	45.4 ± 13.5	57.1 ± 13.3	49.4 ± 14.7
Duration of diabetes (years)	—	5.9 ± 5.5*	14.2 ± 9.5	17.1 ± 8.7	20.3 ± 8.7	16.4 ± 14.2	18.5 ± 10.2

*Compared to total with retinopathy. $P < 0.001$.

†Compared to diabetics with ($P < 0.01$) or without ($P < 0.001$) retinopathy.

TABLE 2. Comparisons of contracture prevalence with duration of diabetes and age of onset

Paired for;		No retinopathy	Retinopathy	Significance
Duration of diabetes	Number of subjects	40	24	—
	Diabetic duration (years)	9.8 ± 3.0	8.7 ± 2.6	NS
	Contracture prevalence	10(25%)	5(20.8%)	NS
Diabetic duration of 5 years or more	Number of subjects	50	92	—
	Diabetic duration (years)	10.8 ± 4.9	19.5 ± 9.0	$P < 0.001$
	Contracture prevalence	15(30%)	27(29.3%)	NS
Onset at age < 18 year	Number of subjects	12	28	—
	Diabetic duration (years)	8.8 ± 5.4	29.9 ± 8.0	$P < 0.001$
	Diabetic onset age (years)	11.5 ± 3.6	11.9 ± 5.6	NS
	Contracture prevalence	3(25%)	8(28.6%)	NS

NS = not significant.

Discussion

In this study, adult diabetic patients had a 4-fold higher prevalence of finger joint contractures as compared with an age-matched control population. A variable prevalence, ranging from zero (Jackson *et al.*, 1978) to 32% (Kennedy *et al.*, 1982), has been previously reported by others, but mainly in diabetic children, adolescents and adults under the age of 30 years. In 7 other reported studies (Grgic *et al.*, 1976; Jackson *et al.*, 1978; Traisman *et al.*, 1978; Benedetti and Noacco, 1981; Buckingham *et al.*, 1981; Rosenbloom *et al.*, 1981; Beacom *et al.*, 1982), the overall prevalence of contractures in 1482 young patients was 13.8%, somewhat lower than the overall 25.2% in our older age group adult diabetic population.

Recently, Rosenbloom and colleagues (1981) have suggested that contractures precede the development of microangiopathy and have postulated from life-table analysis of risk that contractures may be of clinical value as a marker for subsequent microangiopathy, including retinopathy. Our study suggests that this is not the case, for despite severe retinopathy in many of our patients and a prolonged diabetic duration, we were unable to show a significant difference in the prevalence of contractures in such patients as compared to those without retinopathy. The prevalence was likewise similar in those with a diabetic duration of 5 or more years, and in those

matched for diabetic duration. We did note, however, that despite the lack of statistical significance, there was a greater number of patients with contractures in the retinopathic group and, therefore, it is conceivable that a much larger series might show a significant difference. Such would not alter our view, as suggested by this study, that an absence of contractures does not preclude the development of retinopathy.

The reasons why our study is at variance with that reported by others (Rosenbloom *et al.*, 1981; Beacom *et al.*, 1982) might be that, in the other studies, the number of diabetic patients with retinopathy was small and mainly involved a younger age group of patients. We have, however, also found a similar prevalence of contractures in those diabetics whose disease began before the age of 18 years. Our technique also differed from that used by most other studies which were based on subjective examination rather than the more objective method of hand painting. Where such objective methods have been used (Benedetti and Noacco, 1981), the incidence of contractures has been lower. Another difference is that the other reported series were concerned predominantly with insulin dependent diabetics whereas our series included both insulin-dependent and non-dependent diabetics, although the percent requiring insulin was similar in both those with and without

TABLE 3. Comparison of various features in those with and without contractures or retinopathy

	No retinopathy			With retinopathy (all types)		
	Contracture (22)	No contracture (84)	Significance	Contracture (31)	No contracture (74)	Significance
Sex M/F ratio	1.0	1.0	NS	1.8	0.76	$P < 0.05$
Age (years)	58.4 ± 18.0	48.0 ± 16.6	$P < 0.02$	47.4 ± 13.7	49.6 ± 14.9	NS
Duration of diabetes (years)	8.5 ± 6.5	5.3 ± 5.2	$P < 0.05$	20.7 ± 9.3	17.7 ± 10.3	NS
Insulin requiring	9(40%)	37(43%)	NS	24(77%)	52(70%)	NS
Vibration perception reduction	18(82%)	33(39%)	$P < 0.001$	22(71%)	55(75%)	NS
Systolic pressure (mmHg)	148 ± 26.3	140 ± 24.2	NS	153.6 ± 27.7	150 ± 25.0	NS
Diastolic pressure (mmHg)	82.7 ± 9.9	81.8 ± 12.6	NS	86.2 ± 11.9	83.6 ± 12.4	NS
Postural systolic change (mmHg)	-2.5 ± 17.0	0.1 ± 15.0	NS	-12.1 ± 16.0	-9.8 ± 18.4	NS
Absent ankle jerks	11(50%)	23(27%)	$P < 0.05$	23(74%)	57(77%)	NS
Proteinuria	1(4.5%)	2(2.4%)	NS	9(29%)	27(27%)	NS
Creatinine (pmol/l)	92.1 ± 17.9	88.4 ± 20.0	NS	96.8 ± 27.5	108 ± 71.8	NS
HbA _{1c}	—	—	—	10.1 ± 1.4	10.0 ± 1.7	NS

NS = not significant.

contractures, whether retinopathy was a feature or not.

We were able to confirm that contractures are associated with the duration of diabetes, but only when this was less than 15 years. There was also an association with reduced vibration perception and absence of ankle jerks in the early years of diabetic involvement, but not in those with a prolonged diabetic duration. This suggests that if a diabetic patient does develop contractures, then he will most likely do so in the first decade of the disease. This may be a reflection of poor control, although we and others have not found an association between diabetic control as measured by HbA_{1c} and contractures. Control in the early years of diabetes is, however, unknown in most reports, but was likely to be poor as many of the children were stunted (Benedetti and Noacco, 1981; Grgic *et al.*, 1976).

We conclude that although finger-joint contractures are more prevalent in adult diabetic patients, their presence is not necessarily an indicator of the development of retinopathy.

References

- BEACOM, R., KENNEDY, L., CARSON, D. & CAMPBELL, S.L. (1981) Joint contractures in type 1 (insulin dependent) diabetes. *Diabetologia*, **21**, 1.
- BENEDETTI, A. & NOACCO, C. (1981) Hand changes in childhood onset diabetes. *Paediatric and Adolescent Endocrinology*, **9**, 149.
- BUCKINGHAM, B.A., UITTO, J., SANDBORG, C., KEENS, T., KAUFMAN, F. & LANDING, B. (1981) Scleroderma-like syndrome and the non-enzymatic glucosylation of collagen in children with poorly controlled insulin dependent diabetes (IDDM). *Pediatric Research*, **15** (Part 2), 626.
- GRGIC, A., ROSENBLUM, A.L., WEBER, F.T., GIORDANO, B., MALONE, J.I. & SHUSTER, J.J. (1976) Joint contracture—common manifestation of childhood diabetes mellitus. *Journal of Pediatrics*, **88**, 584.
- JACKSON, R.L., HOLLAND, E., CHATMAN, I.D., GUTHRIE, D. & HEWETT, J.E. (1978) Growth and maturation of children with insulin-dependent diabetes mellitus. *Diabetes Care*, **1**, 96.
- KENNEDY, L., BEACOM, R., ARCHER, D.B., CARSON, D.J., CAMPBELL, S.L., JOHNSTON, P.B. & MAGUIRE, C.J. (1982) Limited joint mobility in Type 1 diabetes mellitus. *Postgraduate Medical Journal*, **58**, 481.
- ROSENBLUM, A.L., SILVERSTEIN, J.H., LEZOTTE, D.C., RICHARDSON, K. & MCCALLUM, M. (1981) Limited joint mobility in childhood diabetes mellitus indicates increase risk for microvascular disease. *New England Journal of Medicine*, **305**, 191.
- TRAISMAN, H.S., TRAISMAN, E.S., MARR, T.J. & WISE, J. (1978) Joint contractures in patients with juvenile diabetes and their siblings. *Diabetes Care*, **1**, 360.

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