

Calcific shoulder peri-arthritis (tendinitis) in adult onset diabetes mellitus: a controlled study

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SUMMARY Two groups, one of 824 adult diabetics and one of 320 age and sex matched non-diabetics, were examined for abnormal glucose metabolism and calcifications on anteroposterior shoulder *x* rays. Two hundred and sixty two (31.8%) of the diabetics had shoulder calcification compared with 33 (10.3%) of the control group, with a preponderant localisation in the right shoulder. Diabetes of long duration treated with insulin for a long time was associated with a larger percentage of shoulder calcifications. These data and previous laboratory findings suggest a possible pathogenetic correlation between the prevalence of calcific shoulder tendinitis and diabetes.

Diabetes is a common disease, affecting about 6% of the Athens population, and generally making the patient susceptible to a wide range of metabolic disturbances.¹ A variety of rheumatological syndromes, such as osteopenia, gout, pseudogout, neuroarthropathy, osteolysis, carpal tunnel syndrome, osteoarthritis, Dupuytren's contracture, cheiroarthropathy, diffuse idiopathic skeletal hyperostosis, and peri-arthritis, may all present in association with diabetes mellitus. Only neuroarthropathy and osteolysis are definite associations, the others being considered as probable or even possible associations.²

Peri-arthritis is a term which refers to inflammatory disorders of structures surrounding joints—that is, tendons, tendon sheaths, capsules, and bursae. Publications discussing the relation between diabetes mellitus and peri-arthritis are few. Only three controlled studies have been published. Two suggest a four- to sixfold increased prevalence of association between frozen shoulder and diabetes^{3, 4} whereas the third records calcifications of the shoulders in a small group of diabetics.⁵

The purpose of this controlled study was to investigate the prevalence of calcific shoulder tendinitis in a large group of adult diabetics and to report

some clinical interrelations between these two entities.

Patients and methods

Eight hundred and twenty four consecutive adult diabetics (340 men, 484 women with type II diabetes) and 320 cases of age and sex matched non-diabetics (129 men, 191 women—the control group) were studied. The diabetic group ranged in age from 36 to 92 years (mean 66.1) and the control group from 34 to 86 years (mean 65.7).

The diagnosis of diabetes mellitus was based on the clinical history and the abnormal fasting blood sugar values. The control group comprised subjects without a family history of diabetes, with normal fasting blood sugar values, and with normal sugar values two hours after a meal.

All diabetics and controls were inpatients from an internal university medicine department.

For the diabetics the following were recorded: duration of the disease from diagnosis to enrolment in the study, details of antidiabetic drugs used (oral or parenteral insulin), and duration of the insulin administration.

Standard anteroposterior *x* ray examinations of both shoulders were made for all diabetics and controls. The films were evaluated 'blindly' by the same two observers. In addition, for diabetics and controls whose shoulder *x* rays showed calcifications a detailed clinical medical history of their symptoms and signs (pain in the shoulders either during the

study or previously) was obtained and the range of movement of the shoulders was evaluated. In the group of diabetics with calcific shoulder periarthritis the longitudinal axis of shoulder calcifications was measured, and a neurological examination was made in both groups. Subjects with clinical signs of peripheral neuropathy or evidence of cerebrovascular episodes, post infarction shoulder-hand syndrome, and those with known injuries or fractures in the region of shoulders and renal impairment were excluded from both groups. Serum urea, creatinine, calcium, and phosphorus were determined in diabetics and controls. Statistical analysis of the results was by χ^2 test and Student's *t* test.

Results

Unilateral or bilateral calcific shoulder periarthritis was found in 262/824 (31.8%) diabetics and in 33/320 (10.3%) of controls—a significant difference ($\chi^2=55.5$, $p<0.001$).

Calcific shoulder periarthritis in diabetics was located in the right shoulder in 117/262 (44.7%), in the left shoulder in 70/262 (26.7%), and bilaterally in 75/262 (28.6%), while in the control group the respective locations were 12/33 (36%), 9/33 (27%), and 12/33 (36%) in the right shoulder, left shoulder, and bilaterally ($\chi^2=3.64$, $p<0.05$; $\chi^2=4.6$, $p<0.05$; $\chi^2=0.8$, $p<0.05$ respectively).

Eighty four of 262 diabetics with calcific shoulder periarthritis (32.1%) had received insulin for a mean duration of 7.4 (SE 1.3) years (range 1–10),

while 105/562 (18.7%) of diabetics without calcific shoulder periarthritis ($\chi^2=18.09$, $p<0.001$) had received insulin for a mean duration of 4.2 (0.9) years (range 1–8)—a significant difference ($t=2.0$, $p<0.025$).

The mean duration of diabetes mellitus from diagnosis for diabetics with calcific shoulder periarthritis was 11.5 (SE 2.0) years (range 3–35) and for the diabetics without calcific shoulder periarthritis 6.2 (0.9) years ($t=2.4$, $p<0.01$).

The mean age of diabetics with calcific shoulder periarthritis was 66.0 (6.4) years (range 36–92), of diabetics without calcific shoulder periarthritis 66.2 (6.1) years (range 38–88), of controls with calcific shoulder tendinitis 65.5 (5.4) years (range 37–89), and of controls without calcific shoulder periarthritis 65.8 (6.2) years (range 34–86)—no significant difference.

The size of calcifications (longitudinal axis) in the group of diabetics ranged from 3 mm to 22 mm.

Among the 262 diabetics with calcific shoulder periarthritis, 85 (32.4%) were symptomatic either before or during the study (pain, limitation of range of movement of the calcified shoulders). Diabetics with calcific shoulder periarthritis were symptomatic when the size of calcification was more than 16 mm in the longitudinal axis.

Table 1 shows the serum mean values (SE) of urea, creatinine, calcium, and phosphorus for diabetics and controls with or without calcific shoulder periarthritis. No significant difference was found between any group for any of these serum values.

Table 1 Mean serum values, standard deviations, and standard errors of urea, calcium, phosphorus, and creatinine in diabetics and controls with and without calcific shoulder periarthritis

	Diabetes mellitus (n=824)		Controls (n=320)	
	With CSP* (n=262)	Without CSP (n=562)	With CSP (n=33)	Without CSP (n=287)
Urea (mmol/l)				
Mean	7.3	7.3	6.8	6.7
SD	2.9	2.9	2.4	2.1
SE	0.3	0.3	0.5	0.3
Calcium (mmol/l)				
Mean	2.2	2.2	2.2	2.2
SD	0.1	0.1	0.1	0.1
SE	0	0	0.2	0
Phosphorus (mmol/l)				
Mean	1.2	1.3	1.2	1.2
SD	0.2	0.2	0.2	0.2
SE	0	0	0	0
Creatinine (μ mol/l)				
Mean	109.3	105.8	99.3	99.0
SD	36.5	31.2	33.8	30.8
SE	3.7	3.7	7.0	4.0

*CSP=calcific shoulder periarthritis.

Discussion

This controlled study reports that calcific shoulder peri-arthritis is three times more prevalent in diabetics than in a non-diabetic control group. The increased prevalence of calcific shoulder tendinitis in diabetics suggests that the possibility of unsuspected or subclinical diabetes mellitus should be excluded in cases where shoulder calcifications are found by chance, especially if there is a positive family history of diabetes mellitus. In this study the increased prevalence of calcific shoulder tendinitis in diabetics could not be correlated with the age or presence of osteoarthritis as there was no difference in mean age of diabetics and controls, as shoulder osteoarthritis is not common,⁶ and additionally, because some patients showed radiologically degenerative changes of the shoulders without calcifications.

The greater number of calcifications in the right shoulder may be related not only to diabetes mellitus but also to the fact that most of the population is right handed and thus there is increased risk of microtraumas in this shoulder, which may be responsible for shoulder tendinitis.⁷

A close relation between diabetes mellitus and calcific shoulder tendinitis is indicated by the finding that the mean duration of diabetes mellitus in diabetics with calcific tendinitis was significantly longer than in the diabetics without calcification, and that a higher percentage of diabetics with calcific shoulder peri-arthritis had been treated with insulin and for a longer period of time.

It is well known that in longstanding and poorly controlled diabetes mellitus angiopathy is more common and severe. Experimental studies have shown that decreased blood flow in the shoulders facilitates and precipitates the calcification of the surrounding tendons.^{8,9}

In addition, studies in tissue cultures and in cultures of fibroblasts from diabetics have shown that insulin deficiency inhibits collagen synthesis¹⁰ as well as producing an early senescence of fibroblasts,¹¹ mechanisms which may contribute to calcification of the connective tissue.⁷

Furthermore, defective formation of glycosaminoglycan is suggested by the work of Schiller and Dröfman, who showed that insulin was necessary for the production of glycosaminoglycan from glucose.¹² In rats made diabetic by streptozocin the enzymes responsible for degradation of glycosaminoglycans were increased, an effect reversed by the transplantation of pancreatic cells.¹³ In addition, in such rats 24 hour glycosaminoglycan excretion was increased and correlated positively with the duration of experimental diabetes mellitus. A

significant reduction in the articular and peri-articular tissues was shown by the alcian blue stain.^{14,15} It is well known that chains of chondroitin sulphate bind Ca^{++} ions¹⁶ and that endochondral calcification is accompanied by a decrease in glycosaminoglycan content of the tissue.¹⁷

It appears possible that apart from these interrelations between diabetes mellitus and calcific shoulder peri-arthritis other factors, perhaps genetic or immunological, have at least some role in the pathogenesis of calcific shoulder peri-arthritis in adult diabetics.^{18,19}

Of the diabetics with calcific tendinitis of the shoulder, 32.4% were symptomatic, which is in accordance with the study of Simon, who reported a similar percentage (34.5%) in calcified shoulder peri-arthritis not related to diabetes.²⁰

In conclusion, it appears that calcific shoulder peri-arthritis has a high prevalence among adult onset diabetics, and that an interrelation exists between diabetes mellitus and calcific tendinitis of the shoulders. Many factors may play a part in the pathogenesis of calcification in diabetes mellitus, and as diabetes mellitus is a multifactorial disease calcific shoulder peri-arthritis may also represent a multifactorial entity.

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