

## ARTICULAR CHONDROCALCINOSIS IN A HOSPITAL POPULATION: AN AUSTRALIAN EXPERIENCE

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### Abstract:

A group of hospital patients aged 55 years or over (53 men, 74 women) were screened for articular chondrocalcinosis (ACC) with high-resolution radiographs of knees, wrists, hands and pelvis. Two men (4%) aged 79 and 86 years had ACC involving knees, wrists and symphysis pubis. Both had clinical joint disease and radiological osteoarthritis (OA). Eighteen women (24%) had ACC with sites affected including the knees (89%), wrists (39%) and symphysis pubis (44%). Metabolic screening did not reveal any predisposing factors in patients with ACC. Symptoms and signs of joint disease were not significantly more common in women with ACC compared to those without ACC, and 44% of those with knee calcification were clinically asymptomatic and had no evidence of OA radiologically. However, the presence of knee ACC significantly increased the risk for OA in the same knee by a factor of three-to-four while knee calcification was associated with the more severe grades of radiographic OA. (*Aust NZ J Med* 1984; 14: 655-659.)

**Key words:** Articular chondrocalcinosis, prevalence, osteoarthritis.

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### INTRODUCTION

Articular chondrocalcinosis (ACC) refers to the characteristic radiographic appearance of linear and punctate calcification in joint cartilage.<sup>1</sup> Most cases are due to deposition of calcium pyrophosphate dihydrate crystals (CPPD) although other calcium salts can occasionally cause chondrocalcinosis.<sup>2</sup> Crystallographic analysis of menisci taken from cadavers has revealed deposits of CPPD (3.2% of cadavers), calcium hydrogen phosphate dihydrate or brushite (2.3%) and hydroxyapatite (1.4%),<sup>3</sup> and radiological studies have shown a somewhat higher prevalence of ACC ranging from 7% to as high as 34% in an acute geriatric unit using high resolution film.<sup>4-6</sup> A rise in prevalence with age and an

increased incidence of joint disease have been observed, but many patients with ACC remain clinically silent<sup>5,6</sup> raising questions as to the relationship of crystal deposition and arthritis.

In this survey we determined the prevalence of ACC in a hospital population over 55 years of age using high-resolution radiographs and correlated this finding with clinical joint disease and radiographic osteoarthritis.

### PATIENTS AND METHODS

Fifty-three men (mean age 70.4 years, SD 7.3) and seventy-four women (mean age 74.8 years, SD 9.3) were selected from the admission records of the Repatriation General Hospital (Daw Park) over a

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TABLE 1  
Associated Conditions of Patients

	Chondrocalcinosis	
	Present (n = 20)	Absent (n = 107)
Number of patients		
F	18	56
M	2	51
Age (mean $\pm$ SD)		
F	77.4 $\pm$ 9.4	74.0 $\pm$ 9.1
M	82.5	69.9 $\pm$ 7.0
Diabetes mellitus		
F	9	17
M	1	19
Hypothyroidism		
F	3	4
M	0	2
Gout		
F	0	1
M	0	4
Rheumatoid arthritis		
F	0	2
M	0	0
Previous meniscectomy		
F	2	1
M	1	3

six month period and studied whilst inpatients. Every tenth male and fifth female admission were chosen for inclusion, and those younger than 55 years and/or remaining in hospital for less than 48 hours were omitted from the study.

All patients were assessed by the same observer and the following clinical variables recorded as present or absent in the knees, wrists and hands: acute attacks of arthritis (defined as severe joint pain and swelling lasting between 24 hours and 3 weeks); constant joint pain (>6 months); inactivity stiffness (>5 min); varus (>10°), valgus (>10°) and fixed flexion deformities (>5°) at the knee; joint line tenderness; crepitus; effusion; instability, and restriction of movement (<110° from full flexion to full extension of the knee). Pain and loss of movement at any other joints, the presence of Heberden's or Bouchard's nodes and associated medical and drug history were recorded.

Anteroposterior X-rays of the knees, wrists and hands were taken using Kodak single emulsion film and an anteroposterior view of the pelvis taken on Fuji standard speed film. X-rays were examined blind by a radiologist and two rheumatologists and a consensus was reached where disagreement existed (<10% of cases). Care was taken to record as positive only those calcific densities with the characteristic appearance of CPPD deposits. The site, density (mild, moderate, dense) and appearance (linear or punctate) of ACC were noted.<sup>8</sup> Radiographic osteoarthritis was graded in the medial and lateral compartments of the knee

and wrist joints as mild, moderate or severe,<sup>9</sup> and X-ray changes in the hands consistent with primary generalised osteoarthritis (GOA) were reported as described previously.<sup>10</sup>

Laboratory investigations included fasting blood calcium, glucose and iron studies, and thyroid function tests (T4, T3, TSH).

## RESULTS

Eighteen women (24%) and two men (4%) were found to have the characteristic linear or punctate calcification of ACC. No patients with ACC were found to have hypercalcaemia or hemochromatosis, and none of the other disorders listed in Table 1 was significantly more common amongst patients with chondrocalcinosis than those without.

The two men aged 79 and 86 years had widespread bilateral ACC involving the hyaline cartilages and fibrocartilages of the knees, triangular ligaments of the wrists and symphysis pubis (Figure 1). Both had clinical joint disease with acute attacks of arthritis superimposed on constant



Figure 1. Moderate calcification in the triangular ligament of the wrist of a male aged 79 years. Note the characteristic joint space narrowing and cyst formation at the second and third metacarpophalangeal joints. Severe degenerative changes are present at the first carpometacarpal joint.

TABLE 2  
Symptoms and Signs of Knee Joint Disease in Women With and Without Knee Chondrocalcinosis

	Chondrocalcinosis of Knee	
	Present (n = 16)	Absent (n = 58)
Acute attacks of arthritis	0	3
Constant joint pain	5 (31%)	17 (30%)
Inactivity stiffness	4 (25%)	13 (23%)
Flexion contractures	1 (6%)	2 (4%)
Varus	1 (6%)	3 (5%)
Valgus	4 (7%)	5 (9%)
Joint line tenderness	3 (19%)	11 (20%)
Crepitus	8 (50%)	15 (27%)
Effusion	2 (13%)	6 (11%)
Instability	2 (12%)	1 (6%)
Restriction of movement	1 (6%)	4 (7%)

joint pain at the knees, and varus deformities, joint line tenderness, crepitus and instability involving the knee joints. X-rays in both men revealed bilateral degenerative changes of the knees, metacarpophalangeal (MCP) joints and first carpometacarpophalangeal joints.

Sites affected in the women with ACC included the knees (89%), triangular ligaments of the wrists (39%) and symphysis pubis (44%). Combined involvement of the knees, wrists and symphysis



Figure 2. Hyaline cartilage and fibrocartilage calcification in the knee of a 70 year old woman who was clinically asymptomatic and had no evidence of osteoarthritis.

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pubis was seen in 22%, while 16% had ACC of the knees and symphysis pubis and 11% knee and wrist calcification. One woman had calcification of the symphysis pubis alone and, in another, ACC was confined to the wrists. None of the women with ACC of the wrist had tenderness or deformity of the wrists or MCP joints. Two women had mild degenerative changes at the radiocarpal joint and four showed clinical and radiographic evidence of primary GOA of the hands. Fibrocartilage and articular hyaline cartilage calcification were seen in 88% and 56%, respectively, of those with ACC of the knees. Symptoms and signs of knee joint disease were not significantly more common in women with ACC of the knees than in those without (Table 2). Seven women with knee calcification (44%) had no clinical or radiographic evidence of knee joint disease (Figure 2).

In analysing the association between OA and ACC, an age-confounding effect must be taken into account. OA is well known to be age-related and the prevalence of ACC appeared to increase with age in this study (although the test for linear trend in proportions<sup>11</sup> was not statistically significant;  $\chi^2_1 = 0.73$ ),<sup>†</sup> thence the data were stratified into 10 year age groups and a Mantel Haenszel summary  $\chi^2$  and odds ratio estimates were calculated.<sup>11,12</sup> The prevalence of OA was three-to-four times greater in knees with ACC than in those without, an association which was significant at the 5 percent level for one knee only (Table 3). With the data stratified for age (greater or less than 75 years), age adjusted odds ratios were calculated for two categories of OA (mild, moderate plus severe) with the absence of OA as the reference category. Knees with mild OA were three times, and those with moderate or severe OA were eight times more likely to be associated with the presence of ACC (age-adjusted test for trend,  $\chi^2_1 = 10.4$ ,  $p < 0.005$ ).

#### DISCUSSION

This radiological survey of a general hospital population shows a high prevalence of ACC in elderly women, similar to other surveys using high-resolution radiographs.<sup>5,6</sup> It should be noted, however, that radiological surveys may not give a valid measure of the prevalence of CPPD deposits, because some deposits of CPPD may not be seen radiographically and it is not always possible to distinguish between different calcium species.<sup>13,14</sup> The lower prevalence in men contrasts with the approximately equal sex ratios reported in patients

<sup>†</sup>  $\chi^2_1$  = chi-squared on zero degrees of freedom;  $\chi^2_1$  = chi-squared on one degree of freedom.

TABLE 3  
Chondrocalcinosis and Osteoarthritis of the Knee

Age Group	Chondrocalcinosis	L Knee Osteoarthritis		R Knee Osteoarthritis	
		Present	Absent	Present	Absent
55-64 yr	Present	1	1	1	1
	Absent	0	10	0	10
65-74 yr	Present	3	0	2	0
	Absent	4	16	5	16
75-84 yr	Present	3	3	4	5
	Absent	9	12	8	10
85-94 yr	Present	2	1	2	0
	Absent	3	6	3	7
Odds ratio*					
—unadjusted		4.9 (1.5-15.9)		4.0 (1.3-12.4)	
—adjusted for age†		4.2 (1.4-12.8)		3.3 (1.1-9.8)	
—age standardised‡		4.2 (1.4-12.8)		3.0 (1.1-8.2)	
Mantel Haenszel Summary $\chi^2$		4.89 ( $p < 0.05$ )		3.31 (0.10 $< p < 0.05$ )	

\* With 95% test-based confidence limits.

† Mantel Haenszel estimate.

‡ Standardised to distribution of women with chondrocalcinosis.

at arthritic clinics and lends support to the suggestion by Ellman *et al.*<sup>5</sup> that women may have asymptomatic chondrocalcinosis more often than men. We are unable to offer any plausible explanation for this finding.

A number of metabolic and endocrine diseases and local abnormalities have been reported in sporadic CPPD deposition disease, but many of these may represent chance rather than true associations.<sup>14,15</sup> There were no obvious predisposing factors in our patients with ACC. Ten had diabetes mellitus and three had hypothyroidism, but these conditions were not significantly more common than in patients without ACC.

In our study there was no definite relationship between symptoms and signs of joint disease and the presence of chondrocalcinosis, which may in part reflect the difficulties of clinical and radiological correlation. A lack of inflammatory arthritic symptoms associated with ACC has been demonstrated by others,<sup>4,5</sup> although Wilkins *et al.* showed that the combination of ACC and radiographic OA was characterised by an increased incidence of clinical joint disease.<sup>8</sup>

Our results confirm that CPPD crystal deposition commonly occurs in the absence of inflammation and joint damage.<sup>5,8,13</sup> This observation has raised the unresolved question of whether the crystals precede and cause osteoarthritis, whether the two are a chance association, or that the cartilage calcification is secondary to the degenerative changes.<sup>16</sup> The relationship between ACC of the knee and radiographic OA demonstrated in this survey would argue against a chance coincidence of

these two conditions. However, in view of the small numbers of patients studied and the possible observer bias in the grading of osteoarthritis in the presence of chondrocalcinosis, these results should be interpreted with caution. The finding of more severe radiological OA in women with ACC compared to those with OA alone supports the hypothesis that once the crystals are shed from cartilage into the joint space they can interact with synoviocytes and other inflammatory mediators, accelerating joint damage. This in turn predisposes to additional crystal formation, producing a vicious cycle of crystal deposition and joint destruction.<sup>17</sup>

ACC is a common finding in hospital populations, yet its clinical and pathological significance remains unclear. Prospective clinical and radiological studies on this group of patients with ACC may provide useful information on the natural history of this disorder and shed further light on the role of CPPD crystals in causing joint damage.

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