RESEARCH ARTICLE

Prevalence of chondrocalcinosis in the temporomandibular joint in patients with chondrocalcinosis of the knee or wrist

¹Inneke Willekens, ¹Abdallah Fares, ¹Hannes Devos, ¹Maryam Shahabpour, ²Leon Lenchik, ¹Nico Buls and ¹Michel De Maeseneer

¹Department of Radiology, Universitair Ziekenhuis Brussel, Brussel, Belgium; ²Wake Forest University Medical School, Winston-Salem, USA

Objective: The aim of this study was to investigate the prevalence of TMJ chondrocalcinosis on head CT scans in patients with chondrocalcinosis of the knee or wrist.

Methods and materials: 227 patients with radiological evidence of calcifications on knee or wrist radiographs had a head CT scan obtained for unrelated purposes. CT scans were retrospectively reviewed for the presence of temporomandibular crystal deposition. Prevalence, bilaterality, age and gender distribution were determined.

Results: 41 of 227 (18%) of patients had TMJ chondrocalcinosis. TMJ chondrocalcinosis was more common in females (17%) than males (1%). It was more commonly unilateral (68%) than bilateral (32%).

Conclusion: In patients with peripheral calcific disease, the TMJ is more commonly involved than previously reported and this is more common in females compared to males.

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Introduction

“Chondrocalcinosis” is a general term that refers to the calcification of cartilage (hyaline or fibrocartilage) regardless of its origin.^{1,2} In the book of Hamblen and Simpson “chondrocalcinosis” was not mentioned, but the condition is named pyrophosphate arthropathy (pseudogout).³ In the book of Cassidy and Petty, the condition is named Calcium pyrophosphate deposition disease (pseudogout).² Although chondrocalcinosis also is generally used synonymously with calcium pyrophosphate dehydrate crystal deposition disease, the correct term for the disorder is CPDD, whereas the term chondrocalcinosis describes the observed abnormal calcifications.

The first reported case of synovial chondromatosis of the temporomandibular joint (TMJ) was in 1933, when Axhausen reported metaplastic chondrogenesis in the synovial membrane.⁴ Calcium pyrophosphate dehydrate

(CPPD) crystal deposition disease is a rare benign crystalline arthropathy, first reported by McGarty et al in 1962.⁵ 1 year later, Zitnan and Sitaj introduced the term “chondrocalcinosis.”⁶

In chondrocalcinosis linear or fleck like tendon, meniscus and ligament calcifications may be seen. The clinical manifestations may be quite variable and from a clinical perspective can not be differentiated from other joint disorders. The disorder may be asymptomatic, or it may be associated with acute and chronic pain symptoms.^{7,8} In some cases, it may lead to an arthropathy manifested by severe degenerative changes, ligament calcifications and large subchondral cysts (geodes). Erosions are not typical of chondrocalcinosis, but rather of rheumatoid arthritis. While chondrocalcinosis is well recognized in peripheral joints, it is not well known if involvement of the TMJ occurs commonly. Since chondrocalcinosis may become symptomatic in many other joints this could explain part of TMJ pain disorders. There are no data about the involvement of

Correspondence to: Inneke Willekens, E-mail: inneke.willekens@gmail.com

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Figure 1 Transverse CT of the head. Type 1 calcification corresponds to very subtle area of mineralization in the meniscus (arrow).

the TMJ in this disorder. Hence, we thought it would be of interest to investigate if the TMJ is commonly involved.

Chondrocalcinosis is usually polyarticular, characterized by deposition of calcium pyrophosphate crystals in hyaline and fibrocartilage, ligaments, tendons, and joint capsule. The prevalence increases with age, with approximately 30–40% of people older than 80 years affected⁷ Although the etiology is not fully understood, it may result from a dysfunction of phosphate metabolism.^{8–12}

The purpose of our study was to investigate the prevalence of TMJ chondrocalcinosis in patients with knee and/or wrist chondrocalcinosis. Involvement of the TMJ could also explain part of TMJ pain syndromes.

Figure 2 Transverse CT of the head. Type 2 calcifications. Note more prominent calcifications surrounding the temporomandibular head (arrowheads).

Figure 3 Transverse CT of the head. Type 3. Note extensive calcifications at anterior aspect of joint around the temporomandibular head and in the meniscus (arrowheads).

Methods and materials

An electronic health record search was performed over the last 3 years of patients having knee or wrist radiography and having a diagnosis of knee or wrist chondrocalcinosis based on the radiology report. From this group, patients who had a head CT were selected. CT scans were obtained during routine visits for headache and altered mental status or in an emergency setting. The period of CT scans was around the same time period as the radiographs, with 1 year as maximum difference in time period.

The knee and wrist radiographs were reviewed in consensus by two staff radiologists for confirmation of the diagnosis of chondrocalcinosis. The amount of calcifications in peripheral joints was not graded, but only used to confirm the presence of joint calcifications. The diagnosis was considered if punctate or linear calcifications were seen in the menisci, cartilage or triangular fibrocartilage. CT scans of these patients were retrospectively reviewed by the same two radiologists for the presence of TMJ crystal deposition. Punctate, linear or fleck like calcifications in the TMJ space were considered positive (Figures 1–3). On CT scans, the TMJ calcifications were graded as delicate, mild, or marked. The two radiologists agreed on the classification system by consensus.

Prevalence, age distribution, bilaterality, and gender differences for TMJ chondrocalcinosis was determined. Age distribution was examined with a Shapiro–Wilk test. Differences in bilaterality and sex distribution were studied with a Fisher Exact test. Differences in age between the positive and negative groups was evaluated by an independent samples *t*-test.

Results

The study group consisted of 227 patients: 61 males, (mean age, 78 years, age range, 51–93 years); 166 females, (mean age, 76 years, age range, 54–99 years). On knee and wrist radiographs, there was evidence of chondrocalcinosis in the knee in 198 (43%) patients or wrist in 29 (13%) patients. In 33 out of 227 (15%) patients, there was chondrocalcinosis in the knee and the wrist.

CT scan of the head showed presence of TMJ chondrocalcinosis in 41 out of 227 (18%) patients (Figures 1–3). The findings were seen in 38 (17%) females and 3 (1%) males. In 32% of patients both TMJ were equally affected. The calcifications were subtle in 16 patients, mild in 13 patients, and marked in 12 patients.

Females were more commonly affected than males ($p = 0.003$).

Age was normally distributed, however, no statistically significant age difference was found between involved and non-involved groups ($p = 0.331$).

Discussion

To our knowledge, this is the first study in which the prevalence of chondrocalcinosis crystal deposition in the TMJ in patients with known chondrocalcinosis in knee and/or wrist is systematically examined. To date, only case reports have addressed this subject.

Arthropathy is typically seen involving the synovial membrane, hyaline and fibrocartilage, ligaments, tendons and even intervertebral disks. Chondrocalcinosis can be mono- or polyarticular. Another disorder causing similar calcifications is hemochromatosis.

Generalized deposition of calcifications may be seen in association with connective tissue diseases, such as scleroderma, where they have a lace like appearance in the subcutaneous tissue. Generalized calcifications resembling CHADD deposits may be seen in hyperparathyroidism, renal failure, hypomagnesemia, and hypophosphatemia.¹³

CHADD is a disorder of unknown origin causing rounded amorphous calcifications particularly in tendons, especially about the shoulder. The calcifications are dissimilar from the linear fleck like calcifications of chondrocalcinosis. The clinical presentation of chondrocalcinosis can vary from asymptomatic to acute inflammatory arthritis (‘also termed a pseudogout attack’), chronic degenerative arthritis. A peculiar manifestation is similar to degenerative arthritis

but with the inclusion of ligament calcification and subchondral cysts, that are quite larger than would be expected in simple degenerative disease.¹⁴ Crystal deposition most commonly affects large joints such as elbow and knee, and less commonly smaller joints, such as the wrist or the TMJ.^{9–17}

Because chondrocalcinosis in other joints may become symptomatic it is plausible that TMJ affliction may also cause articular symptoms. Although we acknowledge our study did not examine clinical symptoms such as pain, crepitus, swelling, and limitation of mouth opening.

The differential diagnostic considerations for calcifications in the TMJ should include gout, potentially showing elevated serum uric acid levels and deposition of sodium urate crystals in tissues.¹⁸ Gout in the TMJ may present with large calcified tophi and large bony erosions with an overhanging edge. These tophi and erosions are quite dissimilar from the findings in chondrocalcinosis. Long lasting symptoms are very frequent.¹⁹

Prior studies have reported that females are about three times more likely to be affected with chondrocalcinosis than males. Our study supports this, with a knee and wrist female to male ratio of 2.8. The extremely high female to male ratio of TMJ involvement found in our study has not previously been reported.²⁰ We are uncertain why this is the case as the age distributions between males and females were similar in our study. The mean age was 78 years in females and 76 in males.

Unlike prior studies, we found no statistically significant difference in age between involved and non-involved patients.

Bilateral involvement of the TMJ has rarely been reported.¹³ However, in our study 34% of patients had bilateral chondrocalcinosis of the TMJ.

Treatment may be similar to treatments used in degenerative arthritis of the TMJ. It may initially be treated with nonsteroidal anti-inflammatory medications.^{17,21} Surgery (discectomy, osteotomy, condylectomy) may be used as a last resort for intractable symptoms.

Our study has several limitations. First, there is selection bias as higher prevalence of TMJ chondrocalcinosis is expected in patients with peripheral chondrocalcinosis compared to the general population.

We did not calculate interreader variation for detection of knee or wrist chondrocalcinosis. However, the reviews were done by two readers and were in agreement with the original radiology reports. We did not assess biochemical markers in the patients, and hence can not entirely exclude that a patient with hemochromatosis could have been included.

We did not categorize the degree of joint destruction of the TMJ joints. This could have been helpful. Unfortunately, the resolution of general head CTs and the accompanying bone reconstructions did not give us enough detail for such assessment. More specific facial CT protocols would be needed to analyze this.

In summary, in patients with peripheral chondrocalcinosis involvement of the TMJ is much more common than previously reported. There is a very clear female predilection, and involvement is also more commonly

bilateral than previously reported. It is plausible that it plays a role in symptomatic TMJ disease as it does in peripheral joints. Additional studies are needed to examine this further.

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