Calcium Pyrophosphate Dihydrate Crystal Deposition Disease Simulating Osteoarthrosis of the Knee: A Case Report

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ABSTRACT

Objective: The purpose of this case report is to describe a case where calcium pyrophosphate dehydrate crystal deposition disease (CPPD) simulated osteoarthritis of the knee.

Clinical Features: A 78-year-old woman had a 2-week history of severe right knee pain accompanied by mild swelling. The onset was sudden and did not involve a history of trauma or previous injury to the right knee. Inspection and palpation revealed pain along the medial joint line and marked difficulty ambulating. Results of Lachman's test, anterior drawer test, and posterior sag sign were negative upon orthopedic assessment. Diagnostic imaging was performed and showed degenerative changes with diffuse calcification of the fibrocartilage and hyaline articular cartilage within the knee joint and the medial collateral ligament consistent with the appearance of CPPD crystal deposition.

Intervention and Outcome: Low-level laser therapy was performed to the affected medial joint line of the knee, and knee stabilization exercises were given. Lower Extremity Function Scale changed from 34% to 60% after 4 weeks of care.

Conclusion: Although knee osteoarthritis is much more common than knee CPPD, it is important to consider both diagnoses in elderly patients who present with unilateral knee pain. Diagnosis should be based on clinical presentation, history, and radiographic or histological means to ensure accuracy and proper diagnosis. (J Chiropr Med 2016;15:219-223)

Key Indexing Terms: Osteoarthritis; Chondrocalcinosis; Calcium pyrophosphate; Musculoskeletal diseases

INTRODUCTION

Radiographs are the most important imaging tests in evaluation of calcium pyrophosphate dehydrate crystal deposition disease (CPPD). The hallmark finding is chondrocalcinosis of hyaline or fibrocartilage.¹ CPPD is the third most common inflammatory arthritis, and it tends to affect areas not typically involved by degenerative joint

disease.² Chondrocalcinosis is depicted as radiopaque calcifications that are linear, punctate, or granular in shape and are seen in the cartilage within affected joint spaces.³ In the knee, meniscal involvement is seen as coarse granular calcifications, whereas hyaline cartilage involvement appears more as linear densities that parallel the articular surfaces.⁵ Chondrocalcinosis is often asymptomatic and occurs most commonly in women older than 80 years.³ It predominantly affects large joints including the knees, wrists, and hips (Table 1).^{6,7} It most commonly affects the knee, where cartilage space narrowing and osteophytes may involve all 3 compartments.

CPPD may be asymptomatic or present as pseudogout characterized by severe, intermittent attacks of pain.⁸ The term *pseudogout* came about because of the similarity in symptoms to another common inflammatory arthritis known as *gout*.⁸ Both involve intraarticular crystal formation and present with acute flare-ups characterized by intense pain usually affecting a single joint. Although both pseudogout and gout involve abnormal crystal deposition, the composition of crystals differs. Gout is

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Table 1. Most Common Sites of Symptoms in Patients With CPPD⁴

Site	% of Patients With Symptoms (n = 85)
Knees	24.5%
Wrists	14.0%
Hands	7.2%
Ankles	6.8%
Hips	6.3%
Elbows	5.9%
Shoulders	5.9%
Neck	4.2%
Low back	2.5%
Feet	2.1%
Hands	1.7%

characterized by a deposition of uric acid crystals, whereas the crystals of pseudogout are comprised of calcium salt called *calcium pyrophosphate dihydrate* that accumulates in periarticular and articular tissues described on radiographs as chondrocalcinosis.^{6,9,10} Pseudogout accounts for about 25% of all cases of CPPD.⁶ Overall, the lack of erosion differentiates CPPD disease from gout and rheumatoid arthritis.¹¹

Treatment Options

Recurrent acute calcium pyrophosphate (CPP) arthritis and chronic recurrent CPP arthropathy can lead to severe joint destruction.¹² It is important to seek the most evidence-based practice approaches to treating patients with this condition. Unfortunately, the newest research suggests that there is no specific treatment to prevent or slow the progression of CPP deposition.¹² Although there is specific treatment, it is nonspecifically treated by nonsteroidal anti-inflammatory agents, glucocorticoids, or colchicine. However, these tend to be ineffective, particularly in recurrent or chronic cases.¹² CPPD disease is often misdiagnosed and frequently only treated symptomatically, which can lead to accelerated joint destruction. There has been little representation of conservative nonpharmaceutical therapy for CPPD. There was 1 case report found through a PubMed search that resulted in a patient with CPPD being cared for with exercises and over-the-counter glucosamine sulfate supplementation.¹³

The purpose of this study is to describe a case of CPPD simulating osteoarthritis (OA) of the knee presenting to a chiropractic clinic.

CASE REPORT

History

A 78-year-old woman presented to a chiropractic clinic with a 2-week history of severe right knee pain and mild

swelling. The onset of symptoms occurred suddenly with no known history of recent trauma or previous injury to her right knee. The pain was localized along the medial joint line and resulted in marked difficulty ambulating. The pain was described as a constant, deep, achy pain that became sharp upon walking. The pain did not refer into the lower extremity. Although in her retirement years, this patient worked part-time and has an active lifestyle, participating in yoga and Pilates 3 to 4 times per week. She does not drive; however, she primarily walks to and from her destinations. She claimed that the intense knee pain was interfering with work-related tasks and activities of daily living. In addition, she reported that extended periods of standing or walking increased her knee pain and that rest offered minimal relief. The patient has a medical history of a severe degenerative disease throughout the cervical spine, which was demonstrated through radiographs.

Functional Outcome Assessment

The severity of pain was rated as 9 of 10 on a numerical rating scale. The scale is represented through a pain scale in which a pain level of 0 indicates the absence of pain and 10 represents the most intense pain possible. On the Lower Extremity Functional Scale (LEFS), she scored 34% of maximum function. The LEFS is a lower extremity questionnaire containing 20 questions about a person's ability to perform everyday tasks. The LEFS can be used by clinicians as a measure of patients' initial function, ongoing progress, and outcome, as well as to set functional goals.¹⁴ In this case, it was used to monitor the patient over time and to evaluate the effectiveness of chiropractic care.

Physical Examination

Physical examination revealed mild visible swelling along the medial joint line of the affected right knee. She exhibited great difficulty with ambulation and getting up from a seated position to standing. Palpation of the knee demonstrated diffuse pain around the joint, which was most focused over the medial collateral ligament region. Right knee extension was restricted by approximately 50% in both active and passive ranges of motion because of pain. Valgus stress exacerbated the pain in her knee. Results of Lachman's test, anterior drawer test, and posterior sag sign were all negative, and no other notable findings were elicited through orthopedic testing. Result of lower extremity motor testing was unremarkable. Reflexes in the lower extremities were 2+ bilaterally, aside from the right patellar reflex which could not be elicited because of pain. Lower extremity dermatome testing was intact and equal bilaterally. The working diagnosis based on presentation of symptoms, patient age,

and medical history was osteoarthritis of the right knee. Radiographs of the right knee revealed degenerative changes with diffuse calcification of the fibrocartilage and hyaline articular cartilage within the knee joint and

the medial collateral ligament consistent with the appearance of CPPD (Fig 1). The patient followed a treatment plan that consisted of low-level laser therapy (LLLT) to affected medial joint line of the knee 2 times per week for 4 weeks. The parameters for the LLLT therapy were 2 minutes of treatment time at 6 J/cm.² In addition, she was given a knee stabilization exercise program. This consisted of quadriceps, hamstring, and gluteal exercises done actively at the patient's home 3 times per week. The patient's LEFS measurement progressed to 60% (26% increase), and her subjective pain was minimized (<4/10) during her activities of daily living. After the 4 weeks of active care, she was placed on a maintenance program, which consisted of 1 treatment visit every 2 to 3 weeks as needed for 4 months. At the end of her maintenance program, the patient was discharged from care and told that she should continue her strengthening exercises bilaterally for overall stability of her knees.

DISCUSSION

Symptoms of OA and severe pain caused by acute CPPD crystal arthritis are very similar in nature. Both OA and CPPD are common articular diseases especially in elderly people.^{5,9} Although chondrocalcinosis is most commonly due to CPPD crystals, it is not exclusive of this disease and could appear as an incidental finding or coexist with structural changes that resemble OA.¹⁵ Common findings of OA on radiographs include nonuniform joint space narrowing, osteophyte formation, subchondral cyst formation, and subchondral sclerosis. CPPD is characterized by a radiographic finding of calcification within the articular cartilage (chondrocalcinosis) and periarticular soft tissues and may involve a number of variants (Table 2).

Fig 1. Anteroposterior (A), lateral (B), and tangential (C) projections of the right knee. Extensive chondrocalcinosis of the fibrocartilage of the medial and lateral menisci (black arrows) is present on the anteroposterior and lateral radiographs. Linear calcification of the medial collateral ligament (white dotted arrows) is evident on the anteroposterior and tangential projections. In addition, linear calcification of the paralleling the undersurface of the patella (white arrows) is consistent with chondrocalcinosis of the articular hyaline cartilage. Moderate degenerative changes including knee joint space narrowing, worse on the lateral compartment, and osteophytes arising from the tibial eminences and margins of the femur and patella are present. This constellation of findings is consistent with a diagnosis of CPPD. Moderate osteopenia and vascular calcification within the popliteal artery (black dotted arrow) are consistent with the patient's age of 87 years but unrelated to the crystal deposition disease.

Table 2. *Several Variants of CPPD*⁶

Types of CPPD	Incidence
Pseudogout	10%-20%
Pseudo-rheumatoid arthritis	2%-6%
Pseudo-OA (with acute exacerbations)	35%-60%
Pseudo-osteoarthritis (without acute exacerbations)	10%-35%
Pseudo-neuropathic arthropathy	0%-2%
Miscellaneous patterns	0%-2%

CPPD, calcium pyrophosphate dehydrate crystal deposition disease; OA, osteoarthritis

Although OA and CPPD are unique disorders, crystal deposition can also be present in patients with OA, and it has been suggested that destruction of the articular cartilage caused by the crystals may predispose a patient to developing secondary OA.⁷ In addition, it has also been hypothesized that OA could favor local development of CPPD deposits in the articular cartilage due to metabolic changes in the joint matrix.⁵ Although radiographic evidence of synovial calcification can be an effective tool in the diagnosis of CPPD, the absence of calcification does not rule out the diagnosis.¹⁵ Joint aspiration and histologic evaluation of crystals in the synovial fluid by light microscopy, compensated polarized light microscopy, or phase contrast light microscopy are considered the criterion standard in the diagnosis of CPPD.² Although joint aspiration with crystal identification is the criterion standard, this test is rarely ever performed in a clinical setting because the exact crystal composition is unlikely to alter either the management or the prognosis. A comparison of the characteristics of OA vs CPPD is summarized below (Table 3).

Chondrocalcinosis is indeed one of the most common joint disorders, affecting up to 5% of the human population, with the prevalence rising because of the

aging population.¹⁵ Although OA is much more prevalent than CPPD, it is important to consider both diagnoses in elderly patients who present with unilateral knee pain. By knowing one's anatomy and through observing the changes that the disease has produced in the anatomy, it is possible to identify the pathologic process(es) that produced those changes. Therefore, diagnosis should be based on clinical presentation, history, and radiographic or histological means to ensure accuracy and proper diagnosis.

LIMITATIONS

Because this is a single case study, the results cannot be extrapolated to the general population. Also, the fact that no synovial aspiration was performed to identify the exact composition of the crystals is a limitation of this case report.

CONCLUSIONS

Empirically, knee OA is more common than knee CPPD. However, it is important to consider both diagnoses in elderly patients who present with unilateral knee pain. In this particular case, the patient was diagnosed with CPPD through history, examination, and knee radiographs. She was treated acutely and conservatively over 4 weeks with LLLT and home care exercises. After 8 treatment visits, her LEFS functional outcome score significantly changed, and her pain decreased by approximately 50%.

FUNDING SOURCES AND CONFLICTS OF INTEREST

No funding sources or conflicts of interest were reported for this study.

Table 3. *Comparison of Characteristics of OA Vs CPPD*

	OA	CPPD
Age of onset	Later in life	Later in life
Sex bias	Women	Women
Pattern of onset	Slow, progressive	Asymptomatic or sudden, intermittent attacks
Joint symptoms	Achy, tender, minimal to no swelling	Severe pain, warmth, swelling
Joints affected	Begins unilateral, often starts with distal interphalangeal joints, or large weight bearing joints such as the hip and knee	Unilateral, often affects large joints such as the hip, knee, and wrist
Risk factors	Include obesity, previous joint trauma, congenital bone deformities	Include genetic predisposition, mineral imbalances, previous joint trauma, thyroid disease

CPPD, calcium pyrophosphate dehydrate crystal deposition disease; OA, osteoarthritis

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