CONDITION

Calcium pyrophosphate arthritis

Learn how calcium pyrophosphate crystals can cause sudden or ongoing joint inflammation, how the condition is diagnosed, and which treatments may relieve symptoms.

WHAT IT IS
Joint inflammation caused by calcium pyrophosphate crystals

BODY SYSTEM
Joints and bones

MAIN SYMPTOMS
Joint pain, swelling, warmth, stiffness

WHAT CAUSES IT
Calcium pyrophosphate crystals, often unknown why

HOW IT IS DIAGNOSED
Joint fluid microscopy for CPP crystals

MAIN TREATMENT
Anti-inflammatory treatment

CAN IT BE CURED?
No, crystals cannot reliably be removed

IS IT AN EMERGENCY?
Sometimes, confusion with joint symptoms

LONG-TERM OUTLOOK
Many attacks resolve, but repeated inflammation can damage joints

Overview

Calcium pyrophosphate arthritis is joint inflammation caused by calcium pyrophosphate crystals. These crystals can collect in cartilage, the smooth tissue that cushions the ends of bones, and in other tissues around a joint.

The broader term calcium pyrophosphate deposition disease , or CPPD , covers several patterns of illness. Some people have a sudden, painful attack called acute CPP crystal arthritis . It was once commonly called "pseudogout" because it can resemble gout, although the two conditions involve different crystals. Other people develop ongoing inflammatory arthritis or osteoarthritis linked to CPP crystals.

CPP crystals may also appear on an X-ray in someone who has no joint symptoms. This finding

is called chondrocalcinosis , meaning calcium deposits within cartilage. Chondrocalcinosis can support a CPPD diagnosis, but it does not always cause arthritis and can have other causes.

Calcium pyrophosphate arthritis matters because a sudden hot, swollen joint may look like an infection, gout, or another inflammatory condition. These problems require different treatment. Prompt assessment can identify the cause, control pain and inflammation, and reduce the chance of avoidable joint damage or medication-related harm.

There is currently no treatment that reliably removes CPP crystals from joints. Management focuses on settling attacks, preventing or reducing future symptoms when possible, supporting joint function, and treating related medical conditions.

Symptoms

Acute CPP crystal arthritis often begins suddenly, sometimes over several hours. Symptoms may become intense and then last for days or longer if untreated. The knee is affected most often, but attacks can also involve the wrist, ankle, elbow, shoulder, or other joints.

Symptoms may include:

Some people have repeated attacks separated by symptom-free periods. Others develop persistent pain, swelling, and stiffness that may resemble rheumatoid arthritis. CPPD can also occur alongside osteoarthritis. In that situation, symptoms may include activity-related pain, reduced movement, and occasional inflammatory flares.

Symptoms affecting the neck are uncommon but can occur when crystals collect around the upper spine. This may cause severe neck pain, stiffness, and fever and requires medical assessment because other serious conditions can cause similar symptoms.

A hot, swollen joint cannot be safely identified as CPPD based on symptoms alone. Seek same-day medical care for a new or rapidly worsening swollen joint, especially if it is the first episode or there is fever. Assessment is particularly important after joint surgery, with a prosthetic joint, or when the immune system is weakened.

- Joint pain, swelling, warmth, and tenderness
- Stiffness and difficulty moving the affected joint
- Redness over the joint
- Fever or a general feeling of being unwell during a strong inflammatory response
- One affected joint or several inflamed joints at the same time

Causes and risk factors

CPPD develops when calcium pyrophosphate crystals form in or around joint cartilage. The exact reason is not always known. Changes in aging cartilage appear to make crystal formation more likely, so the condition is much more common in older adults.

The crystals can remain quiet for long periods. An attack happens when crystals enter the joint space and trigger inflammation. Illness, an injury, or surgery may sometimes occur before an attack, but many episodes have no clear trigger.

Factors associated with CPPD include:

Having one of these factors does not mean a person will develop symptomatic arthritis. Most CPPD is not caused by calcium intake, and reducing dietary calcium is not a standard way to prevent crystal formation.

When CPPD appears at a younger-than-usual age, affects several joints, or repeatedly returns, a clinician may look for an inherited tendency or an underlying metabolic condition. Finding and treating such a condition is important for general health, although it may not remove crystals that are already present.

- Increasing age
- Osteoarthritis
- Previous joint injury or surgery
- A family history of CPPD, particularly when the condition starts unusually early
- Excess iron storage from hemochromatosis
- Overactive parathyroid glands, called hyperparathyroidism
- Low magnesium levels
- Certain other metabolic or hormonal disorders

Diagnosis

Diagnosis begins with the pattern of symptoms, a joint examination, medical history, and a review of medicines and other health conditions. The clinician may ask about earlier attacks, recent illness or surgery, family history, and possible risk factors for infection.

The most useful test during an acute attack is often joint aspiration , also called arthrocentesis. A clinician uses a sterile needle to remove a small amount of joint fluid. This can relieve pressure and provides fluid for testing.

Under a microscope, CPP crystals usually appear as rhomboid-shaped crystals with weak positive birefringence, a feature seen when the sample is examined with polarized light. Finding these crystals strongly supports the diagnosis.

Joint fluid should also be assessed for infection when clinically appropriate. A bacterial joint infection, called septic arthritis , may resemble CPP crystal arthritis and can occasionally occur at the same time as crystals. Finding crystals therefore does not automatically rule out infection. The fluid may be sent for a cell count, Gram stain, and culture.

Imaging can provide more information:

Imaging findings alone may not prove that CPP crystals are causing current symptoms. Some people have chondrocalcinosis without pain, while others with CPPD do not have obvious deposits on a standard X-ray.

Blood tests do not directly diagnose CPP crystal arthritis. They may help assess inflammation, look for infection, check kidney and liver function before certain treatments, or investigate associated conditions. Depending on age and clinical history, testing may include iron studies, calcium, magnesium, phosphorus, alkaline phosphatase, thyroid function, or parathyroid hormone levels.

- X-rays may show chondrocalcinosis, osteoarthritis, or other joint changes.
- Ultrasound may detect crystal deposits and can help guide joint aspiration or injection.
- CT scanning can be useful in selected locations, including suspected crystal deposits around the upper neck.

Treatment and management

Treatment depends on whether symptoms are a sudden attack, repeated episodes, chronic inflammatory arthritis, or osteoarthritis with CPPD. Other health conditions and current medicines also affect which options are safe.

During an acute attack, resting the joint and applying a wrapped cold pack for short periods may reduce discomfort. Prolonged complete inactivity is usually not helpful. Gentle movement can resume as pain and swelling improve.

A clinician may remove fluid from a swollen joint. If infection has been reasonably excluded, a corticosteroid may be injected into the joint to reduce inflammation. This approach can be useful when one or two accessible joints are affected.

Medicines used for an acute attack may include:

These medicines do not dissolve CPP crystals. They reduce the inflammatory response around

them.

Treatment must be selected carefully. NSAIDs can contribute to stomach bleeding, kidney problems, fluid retention, and cardiovascular complications in some people. Colchicine can cause digestive side effects and may interact with other medicines; kidney or liver problems can affect its safe use. Corticosteroids may raise blood sugar, affect mood or sleep, and increase infection risk. A clinician or pharmacist can review these issues before treatment.

For people with frequent attacks, a clinician may consider preventive anti-inflammatory treatment, often with colchicine or an NSAID. The potential benefit must be balanced against side effects and other medical conditions. There is no single preventive plan that is right for everyone.

Chronic CPP inflammatory arthritis can be more difficult to manage. Options may include NSAIDs, colchicine, or low-dose corticosteroid treatment. In selected cases, a rheumatologist may consider medicines such as hydroxychloroquine or methotrexate. Evidence for these treatments in CPPD is limited compared with their use in conditions such as rheumatoid arthritis. Specialist monitoring is needed.

Medicines that block interleukin-1, an inflammatory signal in the immune system, are sometimes considered by specialists for severe or treatment-resistant attacks. Their role is limited, and access and approval vary.

When CPPD occurs with osteoarthritis, management may also include:

Treating an associated condition, such as hemochromatosis, hyperparathyroidism, or low magnesium, is important. It may help prevent other health problems, but it does not necessarily reverse existing joint deposits.

- A nonsteroidal anti-inflammatory drug like ibuprofen or naproxen , or NSAID
- Colchicine, an anti-inflammatory medicine also used for gout
- A short course of an oral or injected corticosteroid like prednisone or hydrocortisone
- Physical therapy and exercises to improve strength and joint movement
- Gradual, appropriate physical activity
- A brace, walking aid, or other support when needed
- Weight management when body weight is adding stress to affected joints
- Pain-management strategies tailored to the person's health
- Joint replacement for severe structural damage when other measures no longer provide adequate function or relief

Complications

Many acute attacks resolve without lasting loss of function, especially when they are recognized and treated. However, repeated inflammation or CPPD associated with osteoarthritis may contribute to cartilage damage, chronic pain, stiffness, muscle weakness, and reduced mobility.

Persistent symptoms can interfere with sleep, work, exercise, and daily tasks. Reduced activity may also lead to loss of strength and balance.

Complications can arise from treatment as well as from the condition. Repeated or prolonged use of NSAIDs, colchicine, or corticosteroids requires medical review. Monitoring may include blood tests or checks of blood pressure, blood sugar, kidney function, liver function, and medication interactions.

Another important risk is assuming every swollen joint is a CPPD attack. Infection, gout, injury, and other inflammatory diseases can cause similar symptoms. A change from the usual pattern deserves reassessment.

Follow up

Routine follow-up is useful after a first attack, with repeated episodes, or when symptoms do not fully settle. The clinician may review test results, confirm whether infection was excluded, assess joint function, and discuss a plan for future flares.

Arrange a routine appointment if attacks are becoming more frequent, pain persists between episodes, treatment causes side effects, or joint problems are limiting daily activities. Follow-up may also be needed to investigate or manage an associated metabolic condition.

Seek same-day medical assessment for a newly hot, swollen, or very painful joint, particularly with fever, chills, recent surgery, a prosthetic joint, or a weakened immune system. Do not assume it is simply another crystal attack.

Emergency care is appropriate if joint symptoms occur with signs of severe illness, such as confusion, fainting, marked weakness, breathing difficulty, or rapidly worsening overall condition.

Sources

- National Institute of Arthritis and Musculoskeletal and Skin Diseases. Calcium Pyrophosphate Deposition Disease . National Institutes of Health.
- American College of Rheumatology. Calcium Pyrophosphate Deposition (CPPD) . Patient information.
- Rosenthal AK, Ryan LM. Calcium Pyrophosphate Deposition Disease. New England Journal of Medicine . 2016;374:2575-2584. doi:10.1056/NEJMra1511117.
- Zhang W, Doherty M, Bardin T, et al. European League Against Rheumatism recommendations for calcium pyrophosphate deposition. Part I: Terminology and diagnosis. Annals of the Rheumatic Diseases . 2011;70:563-570. doi:10.1136/ard.2010.139105.
- Zhang W, Doherty M, Pascual E, et al. European League Against Rheumatism recommendations for calcium pyrophosphate deposition. Part II: Management. Annals of the Rheumatic Diseases . 2011;70:571-575. doi:10.1136/ard.2010.139360.
- Cowley S, McCarthy G. Diagnosis and Treatment of Calcium Pyrophosphate Deposition Disease: A Review. Open Access Rheumatology . 2023;15:33-41. doi:10.2147/OARRR.S390771.