

Diagnosis and Clinical Manifestations of Calcium Pyrophosphate and Basic Calcium Phosphate Crystal Deposition Diseases

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KEYWORDS

- Calcium pyrophosphate • Basic calcium phosphate • Apatite • Calcification
- Calcific tendinitis • Chondrocalcinosis • Crowned dens syndrome • Ultrasonography

KEY POINTS

- Calcium pyrophosphate (CPP) and basic calcium phosphate (BCP) crystals are the 2 main families of calcium-containing crystals that can form simultaneously in all joint structures, ligament, tendon, muscle, and soft tissue.
- BCP and CPP crystal deposition are 2 common multifaceted diseases that can mimic alarming clinical manifestations.
- Ultrasonography seems to be an excellent imaging technique for CPP crystal detection but lacks efficacy for deep locations.
- Computed tomography remains the gold standard imaging modality for detection of calcification in the axial skeleton, especially at the cervical level.

INTRODUCTION

Calcium pyrophosphate (CPP) and basic calcium phosphate (BCP) crystals are the 2 main families of calcium-containing crystals that can form simultaneously in all joint structures, ligament, tendon, muscle, and soft tissue. Although these calcium crystal depositions are mostly asymptomatic, they can give rise to a wide range of clinical

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manifestations and syndromes, including acute inflammatory articular or periarticular attacks, chronic tendinitis, rapidly destructive arthropathies, or osteoarthritis (OA)-like lesions, as well as nervous compressions (Table 1). Some of these clinical symptoms have been referred to by a variety of names and confusing terms. Recently, a group of experts from the European League Against Rheumatism (EULAR) have elaborated 2 sets of recommendations for the terminology and diagnosis of CPP and its management.^{1,2} Similar efforts should be made for BCP crystals.

Table 1		
Summary of BCP and CPP crystal deposition-related manifestations		
	CPP Crystals	BCP Crystals
Chemical composition	$\text{Ca}_2\text{P}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	$\text{Ca}_{10-x}(\text{HPO}_4)_x(\text{PO}_4)_{6-x}(\text{OH})_{2-x}$
Ca^{2+}/P ratio	1.67	1.3
Members identified in human samples	Monoclinic Triclinic	Carbonated-apatite Octacalcium phosphate Whitlockite Tricalcium phosphate (?)
Intra-articular deposition	+++	+
Extra-articular deposition	+	+++
Clinical Manifestations		
Asymptomatic	++	++
Acute joint flare	++	?
Acute tendinitis	+	++
Acute bone erosion	+	+
Acute neck pain	++	+
Acute spinal pain	++	+
Chronic arthritis	++	+/-
OA associated	++	+++
Calcific tendinitis	+	+++
Milwaukee shoulder	?	++
Destructive arthropathies	+	+
Crowned dens syndrome	++	+
Spinal cord compression	+	+
Tumoral deposition	+	++
Synovial fluid detection	+++	+/-
Alizarin red staining	+	+
Radiographic pattern	Dense, linear	Dense, homogeneous without bone trabeculation
Ultrasonography	Hyperechoic deposits without posterior shadow	Hyperechoic with posterior acoustic shadowing
CT scan	+++	+++
Associated clinical conditions	Aging, OA, trauma Hemochromatosis hyperparathyroidism Hypomagnesemia Hypophosphatasia Wilson disease? Ochronosis?	Aging, OA Diabetes mellitus Chronic kidney disease Connective diseases Trauma, infection

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