Supplementary Table 1. Ultrasound findings in crystal arthropathies.

	Crystal deposits	**Soft tissue pathologies**	**Structural damage**
Gout	- Cloudy hyperechoic intra-articular deposits lying within the soft tissues (e.g., in tendons, entheses, cutis, subcutis, fascia), with complete or partial acoustic shadow due to ultrasound beam reflection - Crystal deposits presenting as hyperechoic lines overlying the hyaline cartilage ("double contour" sign)	- Synovitis with hyperechoic spots or crystal aggregates within the synovial membrane - Crystal aggregates floating in the synovial fluid (micro-tophi) - Hyperechoic tophi located in soft tissues with or without acoustic shadow due to ultrasound beam reflection ("soft" *vs*. "hard" tophi - Bursitis - Tenosynovitis - Enthesitis - Soft tissue edema in the acute phase of gout	- Erosions - Osteophytes - Hyperechoic tophi located within a bony erosion with or without acoustic shadow due to ultrasound beam reflection. ("soft" *vs*. "hard" tophi
CPPD	- Hyperechoic dots or lines, with no, partial or complete, acoustic shadow due to ultrasound beam reflection, within the hyaline cartilage or fibrocartilage - Occasionally, crystal deposits overlying the cartilage as in gout – i.e., the "sandwich" sign with hyperechoic lines within and over the hyaline cartilage - Calcifications within the synovium, joint capsule, tendon, enthesis or ligament.	- Synovitis - Bursitis - Tenosynovitis - Enthesitis - Soft tissue edema in acute inflammation	- Bony erosions - Osteophytes
Hydroxyapatit arthropathy	- Hyperechoic "hard" calcifications with acoustic reflection - "Soft" diffuse calcifications within tendons, ligaments, or a joint capsule, often with "twinkling" artifacts	- Synovitis - Bursitis - Tenosynovitis	- Bony erosions - Osteophytes - Destructive arthropathy, *e.g.* Milwaukee shoulder

CPPD, calcium pyrophosphate deposition arthropathy.

Supplementary Table 2. Semiquantitative synovitis score according to the Swiss Sonography Group in Arthritis and Rheumatism (SONAR) and definitions of severity grades (0-3) for each elementary component and for the European League Against Rheumatisms-Outcomes Measures in Rheumatology combined score. The SONAR score analyses 22 joints and tendons in order to include approximately the same joints as the DAS, excluding the thumbs and shoulders.

Synovitis	**Synovial hypertrophy (greyscale), MCP joints**	**Doppler (Powerd-Doppler)**	**EULAR-OMERACT combined score (2017) (greyscale SH+PD)**	**Sonar Score (2008) SH (22 joints and tendons)**	**Sonar Score (2008) PD (22 joints and tendons)**
Grade 0 (normal)	No SH independently of the presence of effusion	No Doppler signal	No SH and no PD signal	No SH (no synovium visible or synovium barely visible)	No Doppler signal inside SH
Grade 1 (minimal)	Minimal hypoechoic SH up to the level of the horizontal line connecting bone surfaces between the metacarpal head and the proximal phalanx	Up to three single Doppler spots OR up to one confluent spot and two single spots OR up to two confluent spots	Grade 1 hypoechoic SH and ≤ grade 1 PD signal	Minimal hypoechoic SH (slight fluid collection or slight synovial thickening = normal findings), synovial membrane clearly visible above the diaphysis, upper and lower border parallel or only very slightly ballooned and normal at the level of the epiphysis (collapsed)	Mild single or isolated Doppler spots inside SH
Grade 2 (moderate)	Moderate hypoechoic SH independently of the presence of effusion extending beyond joint line but with	>Grade 1 but <50% Doppler signals in the total greyscale background	Grade 2 hypoechoic SH and ≤ grade 2 PD signal; or grade 1 SH and a grade 2 PD signal	Moderate hypoechoic SH (borderline findings or pathological), upper and lower synovial contour convex,	Moderate confluent Doppler signals <50% inside SH

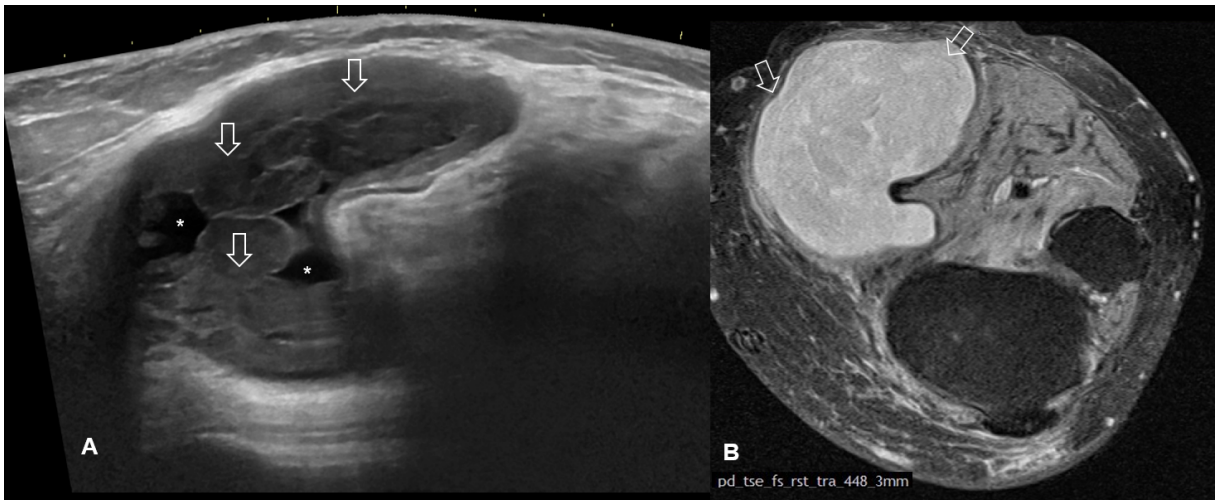
	the upper surface concave (curved downwards) or hypertrophy extending beyond the joint line but with the upper surface flat			not reaching the base of e.g. the metacarpal or phalanx, or not raised at the level of the cartilage	
Grade 3 (severe)	Severe hypoechoic SH independently of the presence of effusion with or without effusion extending beyond the joint line but with the upper surface convex (curved upwards)	>Grade 2 (>50% of the total greyscale background)	Grade 3 hypoechoic SH and ≤ grade 3 PD signal; or grade 1 or 2 SH and a grade 3 PD signal	Severe hypoechoic SH (massive synovitis (pathological findings)), upper and lower synovial contour convex, reaching the base of the phalanx, respectively raised to the level of e.g. the metacarpal or phalangeal head.	Severe Doppler signals >50% inside SH

SH, synovial hypertrophy; PD, powerd-doppler; EULAR-OMERACT, European League Against Rheumatisms-Outcomes Measures in Rheumatology; SONAR, Swiss Sonography Group in Arthritis and Rheumatism.

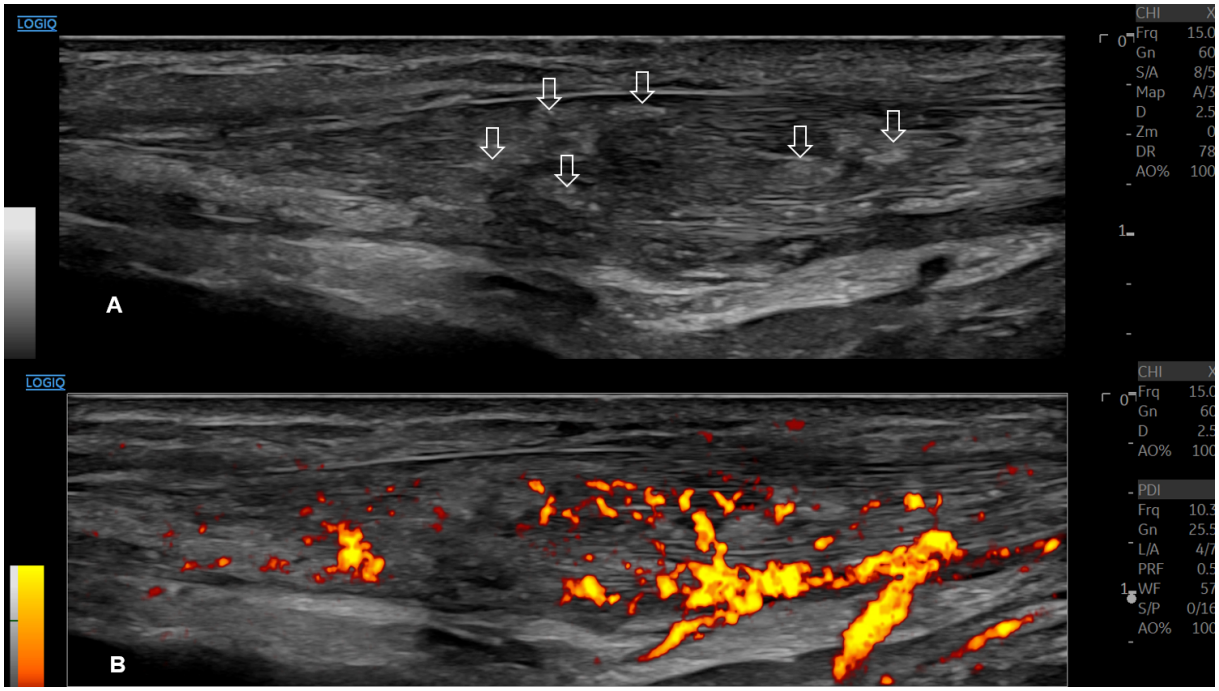
Supplementary Table 3. Sensitivity and specificity of various examination methods in diagnosis of calcium pyrophosphate deposition arthropathy.

Method	Sensitivity (%)	Specificity (%)
Ultrasound	96	87-100
X-ray	75	93
SFA	77	100

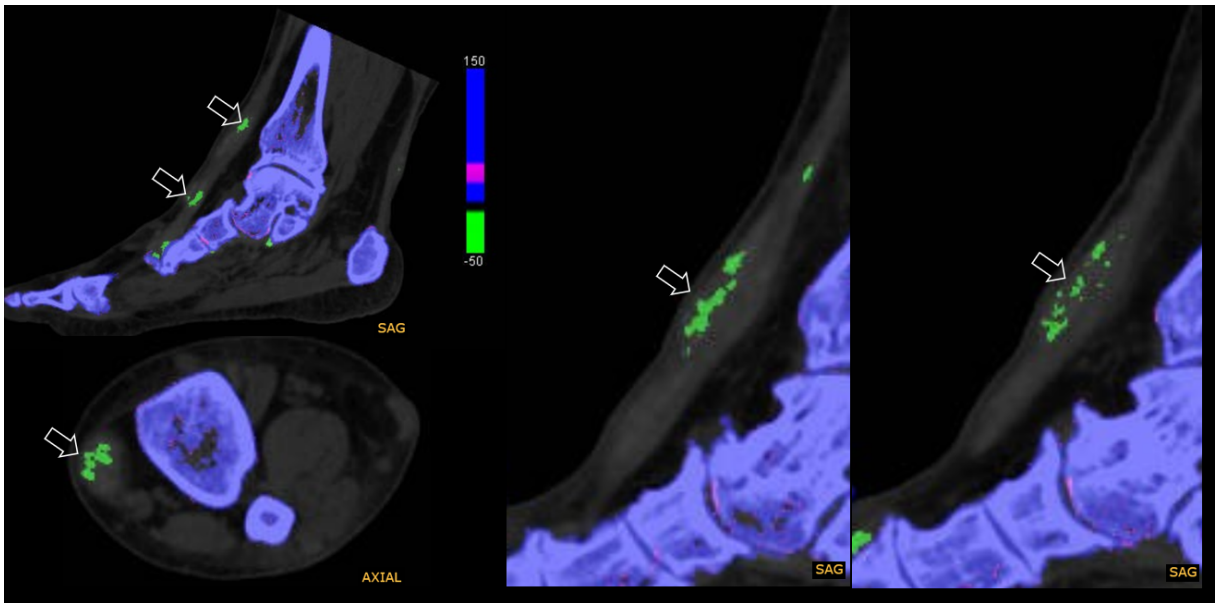
SFA, synovial fluid analysis.



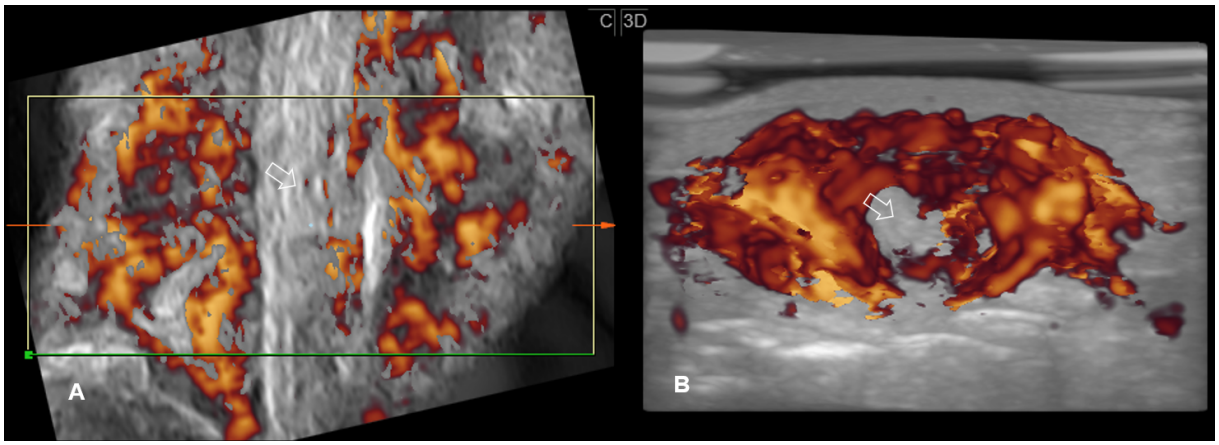
Supplementary Figure 1. A) Posterior transverse view of the knee (B-mode) showing a non-specific semimembranosus gastrocnemius bursa in a patient with gout consisting of a combination of anechoic effusion (white asterisks) and isoechogenic synovial proliferations (void arrows); B) corresponding magnetic resonance imaging illustrating the Baker's cyst (void arrows).



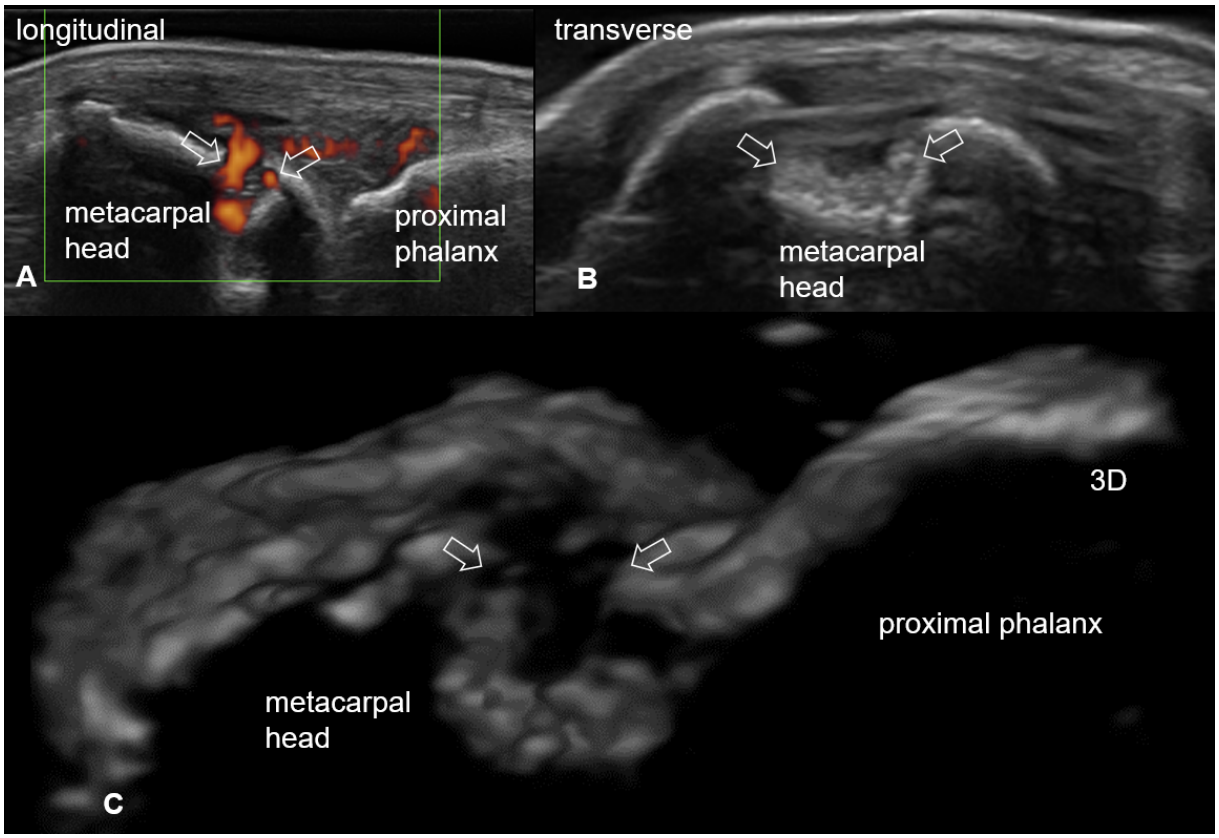
Supplementary Figure 2. Tibialis anterior tendon (longitudinal plane) in B-mode (A) and power Doppler mode (B) showing urate aggregates (void arrows) within the tendon.



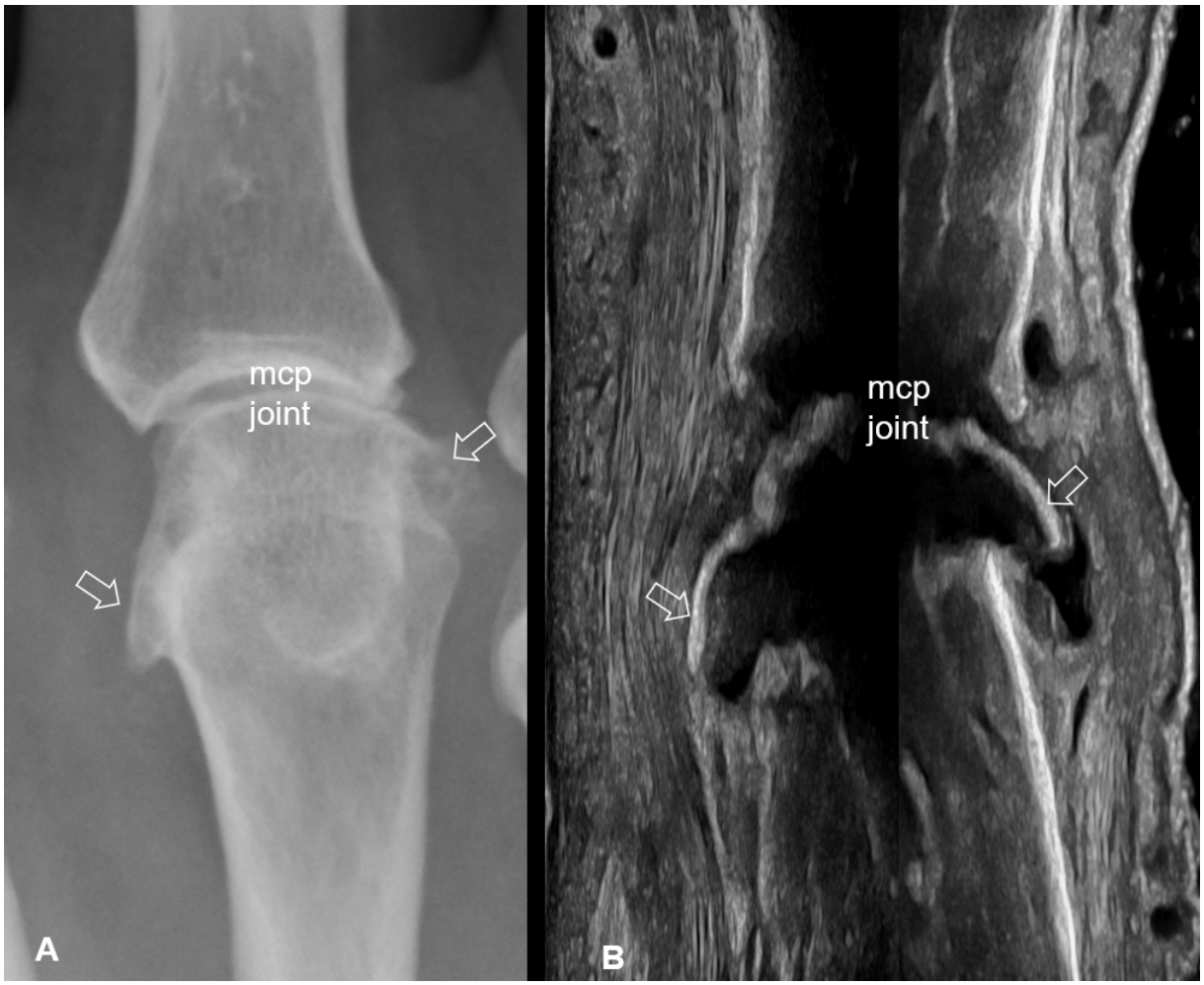
Supplementary Figure 3. Tibialis anterior tendon. DECT with evidence of urate crystals (void arrows).



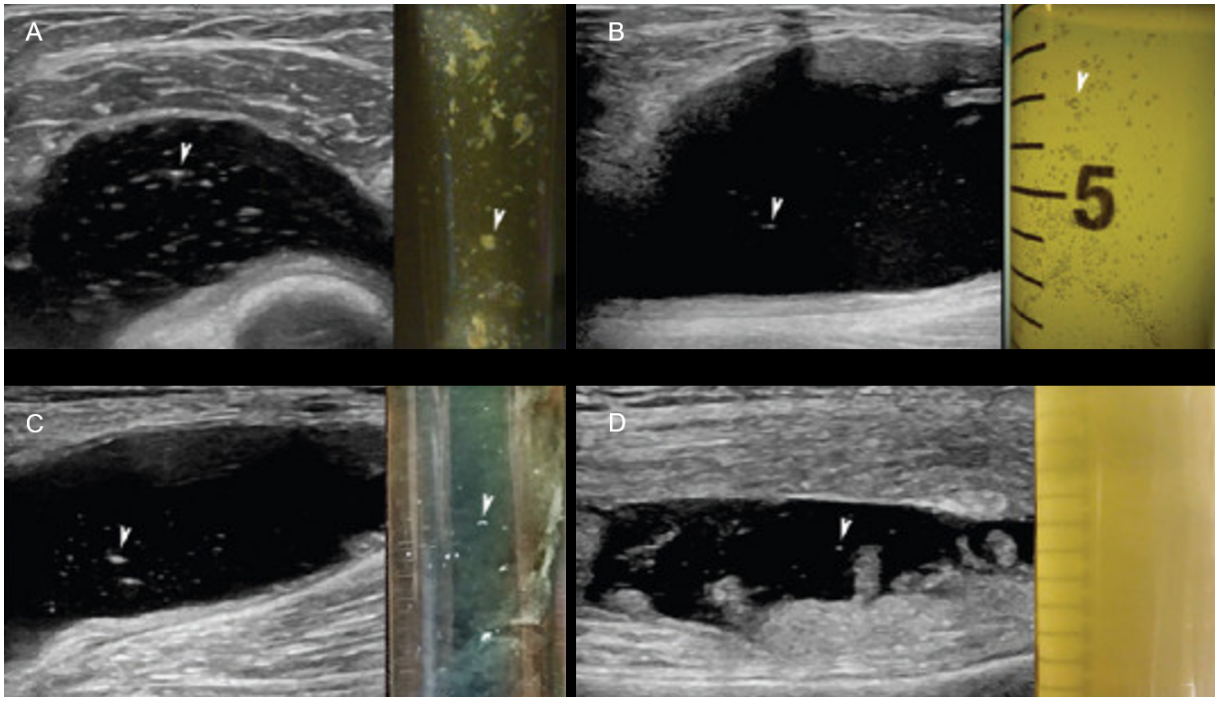
Supplementary Figure 4. Tibialis posterior tendon (arrows), coronal (A) and 3D power Doppler mode (B) showing hyperemia within the tenosynovial proliferations in chronic gout.



Supplementary Figure 5. Metacarpophalangeal joint dorsal longitudinal power Doppler mode (A), B-mode (B) and 3D-mode (C), showing an "active" (Doppler sign positive) erosion (void arrows) of the metacarpal head in CPPD.

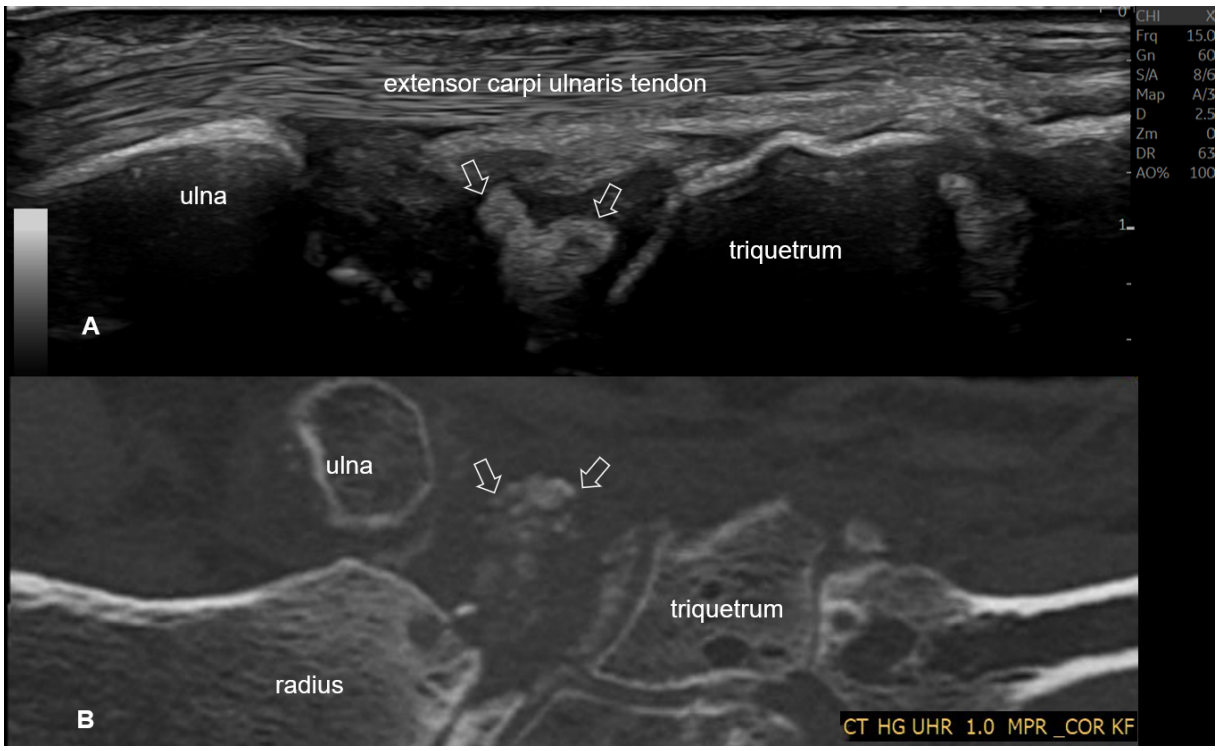


Supplementary Figure 6. X-ray (A) and ultrasound image (B) in B-mode (combined dorsal and palmar longitudinal image) showing osteophytes (void arrows) in CPPD.

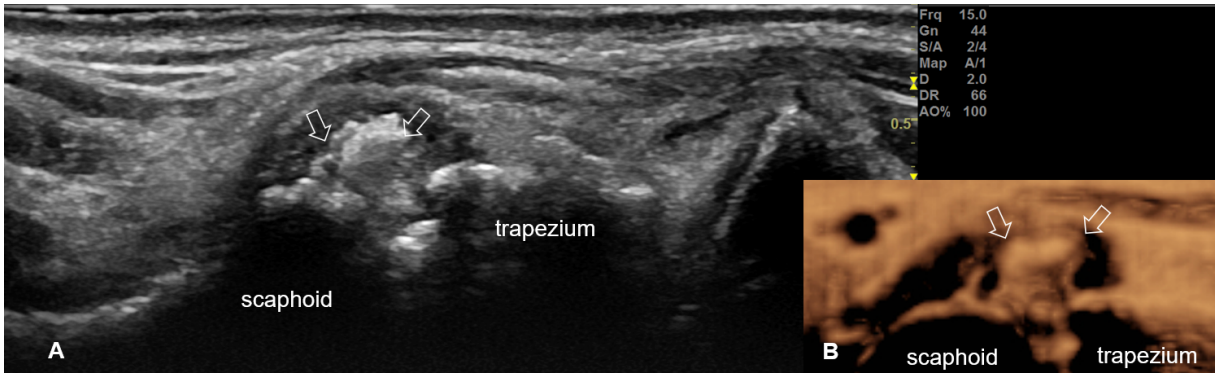


Supplementary Figure 7. Ultrasound images of the knee joint and corresponding synovial fluid. A) Fibrin aggregates in a patient with rheumatoid arthritis; B) hyperechoic physiologic gas

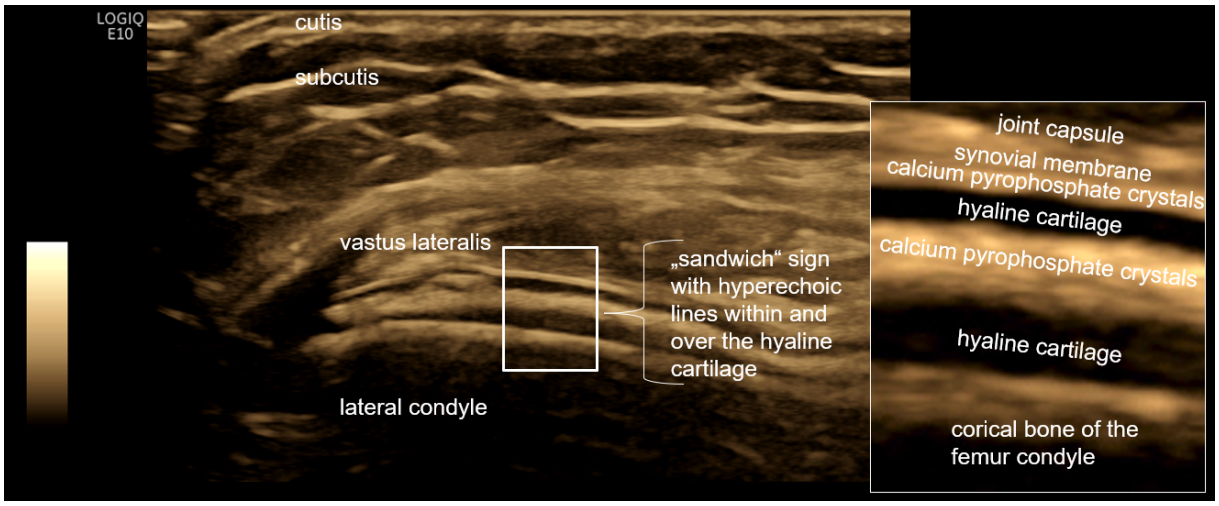
bubbles in viscous synovial fluid; C) calcium pyrophosphate aggregates; D) urate crystals. Reproduced from Persons and Kissin (2020) with permission.



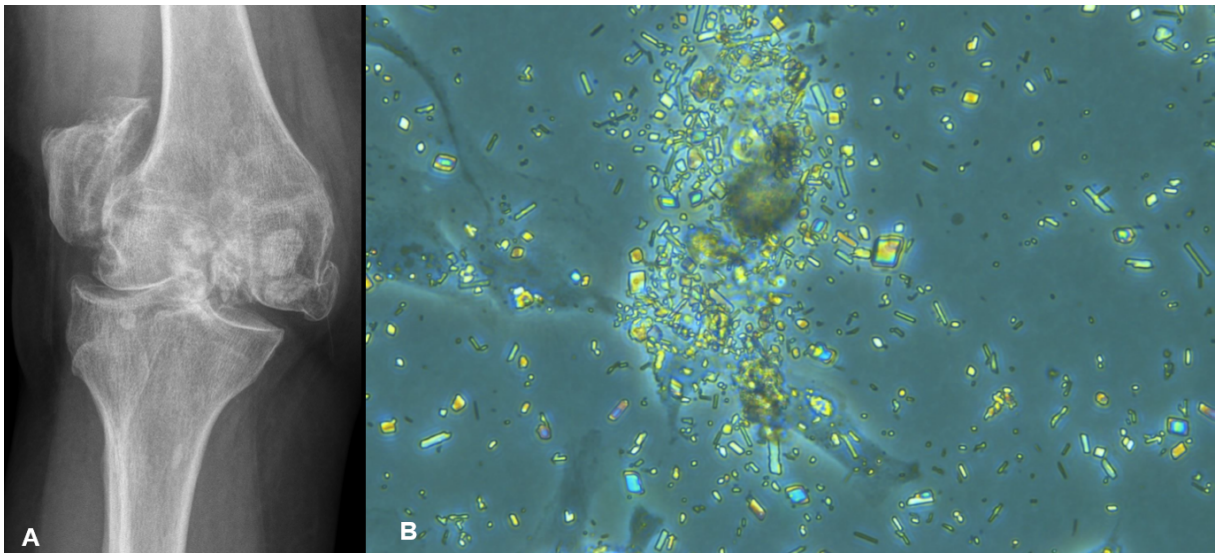
Supplementary Figure 8. Ulnar wrist longitudinal, B-mode (A) and computed tomography image (B) showing triangular fibrocartilage complex calcification (void arrow) in calcium pyrophosphate deposition arthropathy.



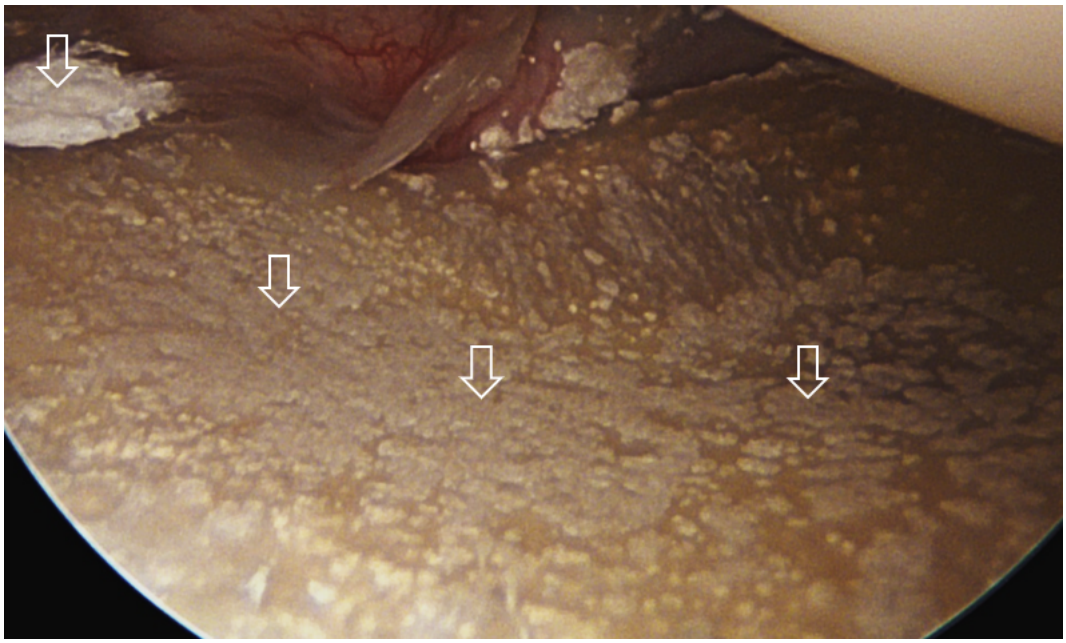
Supplementary Figure 9. Scapho-trapezio-trapezoidal (STT) osteoarthritis joint, longitudinal, B-mode (A) and 3D (B), STT osteoarthritis with calcifications (void arrows) in calcium pyrophosphate deposition arthropathy (CPPD) (*i.e.*, the "volcanic" sign). The "volcanic" sign has not been published yet. The authors have observed this ultrasound sign in this form and expression in CPPD only in the STT joint.



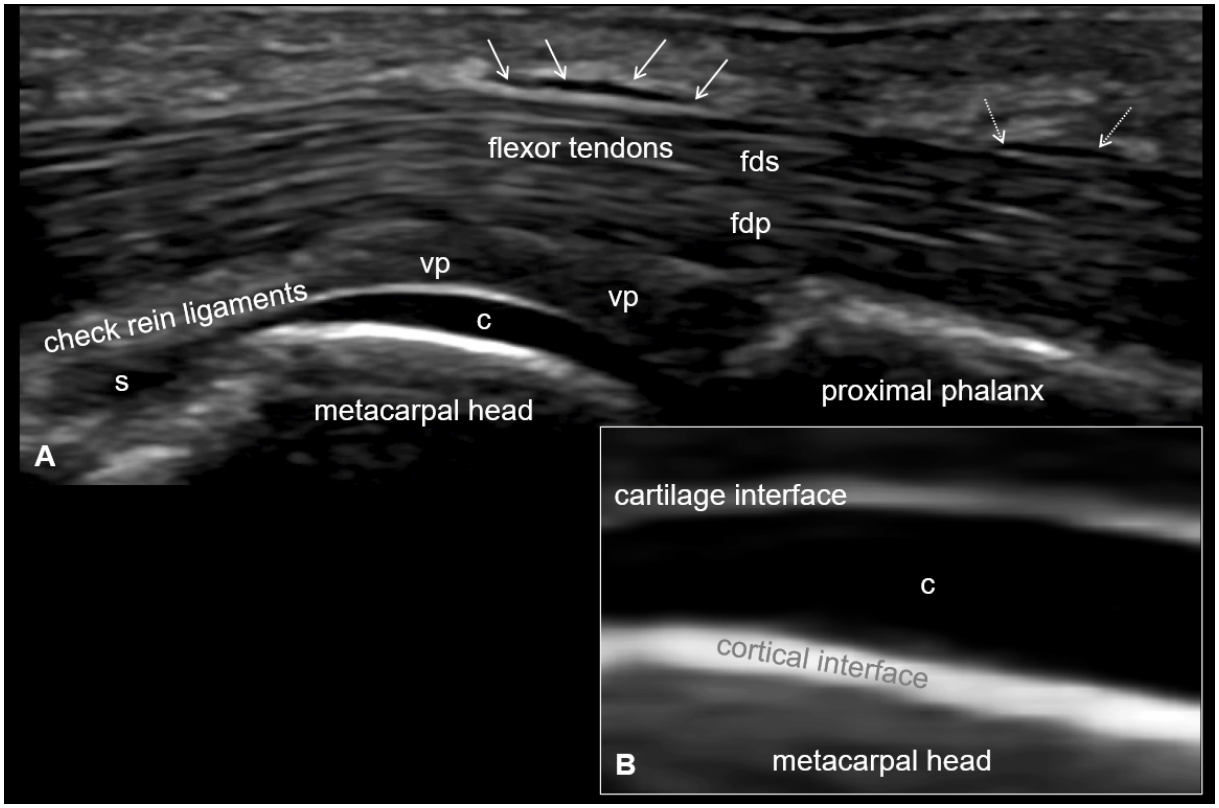
Supplementary Figure 10. Knee, suprapatellar lateral region, knee flexed. “Sandwich” sign with hyperechoic lines within and over the hyaline cartilage in calcium pyrophosphate deposition arthropathy.



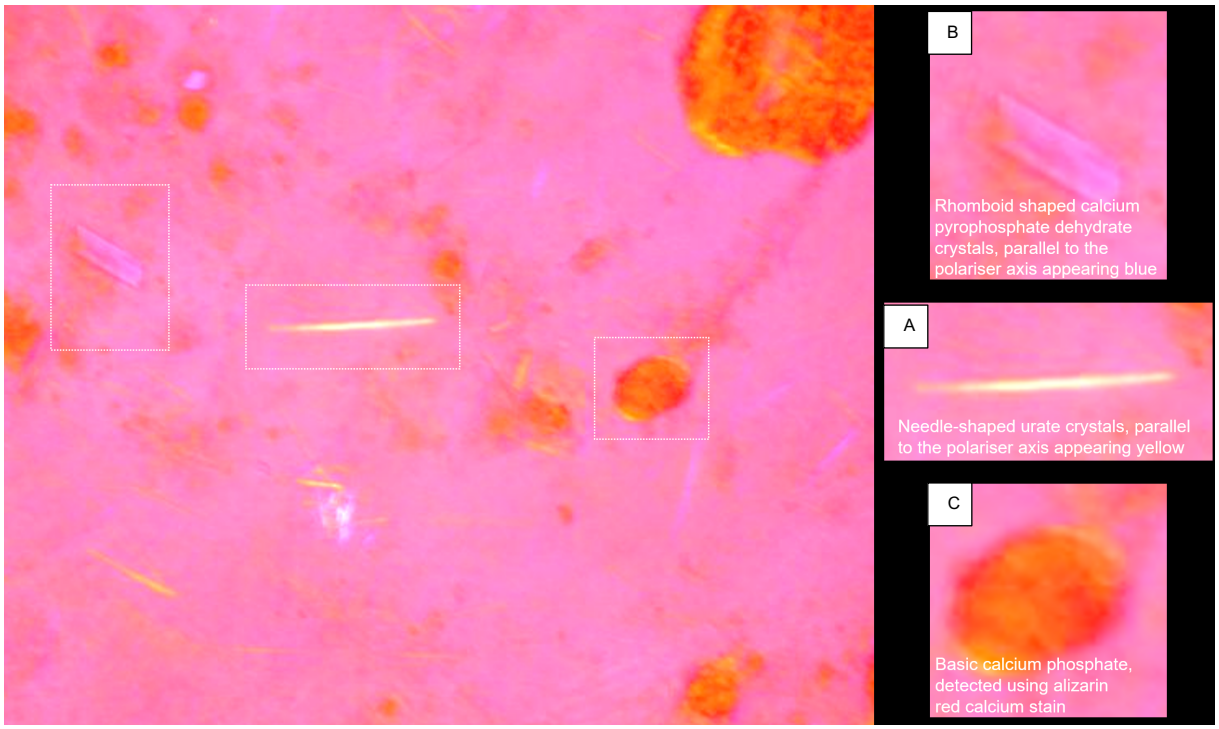
Supplementary Figure 11. A) X-ray of knee joint with severe osteoarthritis (A), no crystals were found in the joint puncture; B) histological image, cartilage tissue was obtained during joint replacement, cells were separated with collagenase and taken in culture. Images are taken without fluorescence through the inverted microscope and show masses of calcium pyrophosphate crystals in the hyaline cartilage. Courtesy of Dr. Sonia Nasi, Lausanne, Switzerland.



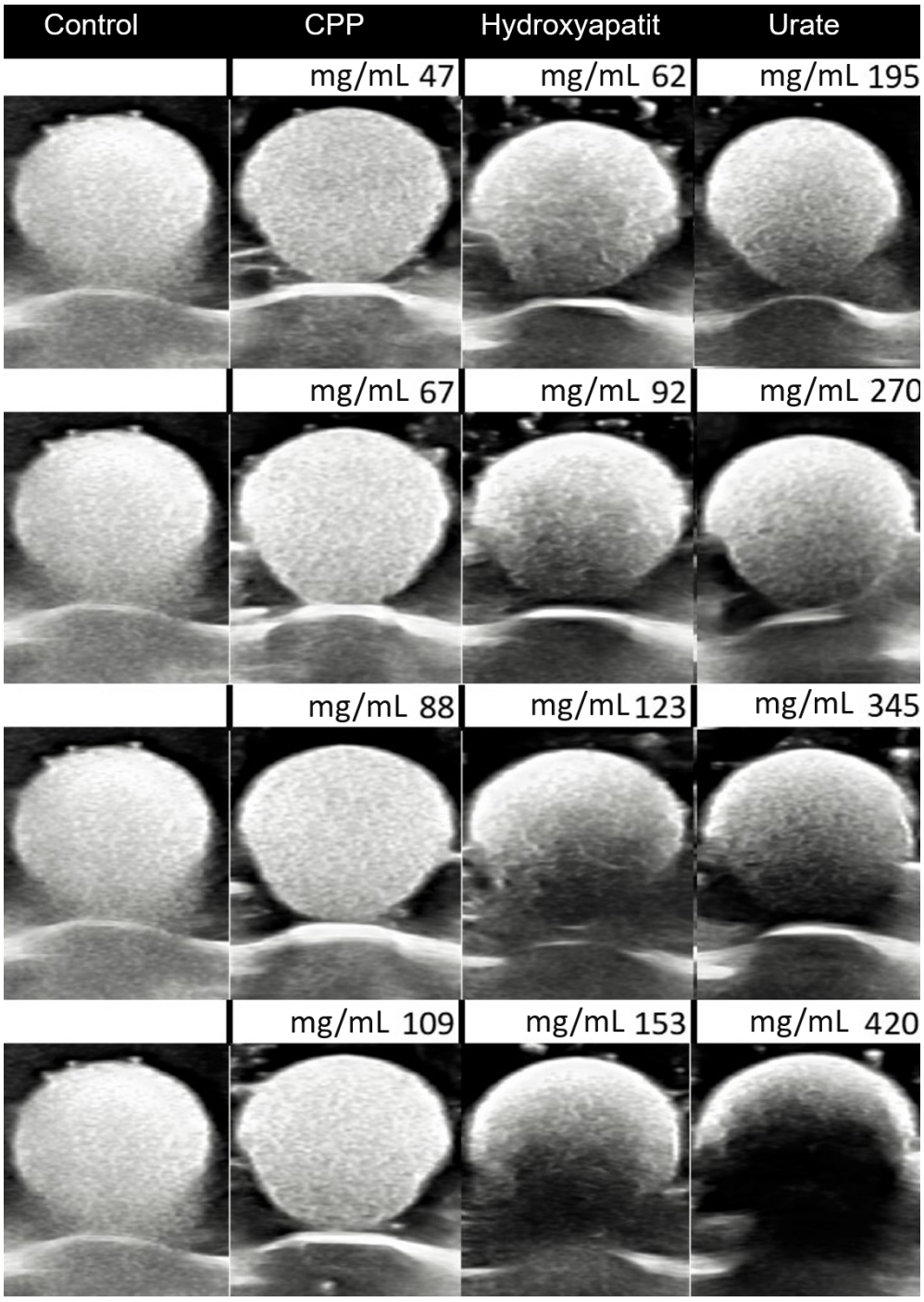
Supplementary Figure 12. Shoulder, arthroscopic image. Urate deposits on the hyaline cartilage (void arrows).



Supplementary Figure 13. Metacarpophalangeal joint palmar longitudinal B-mode (A), zoomed view (B). Normal findings showing the anechoic interface (cartilage interface) between the volar plate and the hyaline cartilage (c) of the metacarpal head. The cortical interface is hyperechoic in this example. Arrows - a1 annular ligament (= pulley); dotted arrows - a2 annular ligament. vp, volar plate; c, hyaline cartilage; s, synovial proximal palmar recess; fds, tendon of flexor digitorum superficialis muscle; fdp, tendon of flexor digitorum profundus muscle.



Supplementary Figure 14. Analysis of synovial fluid under polarizing microscope showing three types of crystals. A) needle-shaped urate crystals (parallel to the polarization axis, yellow); B) rhombic calcium pyrophosphate dehydrate crystals (parallel to the polarization axis, blue); C) basic calcium phosphate (hydroxyapatite) detected with the special alizarin red stain.



Supplementary Figure 15. **Short-axis views of crystal suspensions. In these synthetic crystal suspensions with known concentrations of calcium pyrophosphate (26-109 mg/mL), hydroxyapatite arthropathy (31-153 mg/mL), and monosodium urate (90-500 mg/mL) crystals, ultrasound scans were performed with imaging of the extent of ultrasound beam attenuation and the presence of acoustic shadowing.**