Policy and Procedure
Dignity Health Central Coast Service Area

SUBJECT: Synovial Fluid Crystal Analysis
7500.H.CC.54

Central Coast Service Area North:		
☒ Santa Maria Campus, Marian Regional Medical Center	☒ Arroyo Grande Campus, Marian Regional Medical Center	☐ French Hospital Medical Center
Central Coast Service Area South:		
☐ St. John's Pleasant Valley Hospital	☐ St. John's Regional Medical Center	

I. Purpose:

Detection and accurate identification of crystals in synovial fluid

II. Clinical Complexity:

High Complexity

III. Clinical Utility:

Examination of synovial fluid for the presence of crystals is used to aide in the diagnosis and subsequent treatment of joint inflammation, pain, and/or swelling. Identifying monosodium urate (MSU) and calcium pyrophosphate dehydrate (CPPD) crystals allows for a definitive diagnosis of both gout and CPPD arthritis.

IV. Principle:

Acute episodes of gout or pseudo-gout can be distinguished in synovial fluid using shape, appearance and birefringent properties of crystals. Under compensated polarized light, MSU crystals appear yellow when aligned parallel to the axis of slow and blue when aligned perpendicular to the axis of slow. Whereas CPPD crystals are usually identified based on their rhomboid shape and only the needle shaped forms require differentiation using compensated polarized microscope.

V. Specimen Collection:

Sample Type	Container	Minimum Volume	Stability Max Storage Temp
Synovial Fluid	Sodium Heparin Tube EDTA tube Sterile tube no additive	0.25 ml	2 Hours at Room Temperature

VI. Specimen rejection criteria:

A. Insufficient specimen for preparation of at least one slide
B. Mislabeled or unlabeled specimen
C. Specimen received unrefrigerated for more than four hours after collection

D. Specimen refrigerated for more than 24 hours

VII. MATERIALS:

Reagents / Media	Supplies / Materials	Equipment
	● Slides and coverslips ● Prepared Crystal Quality Control Slides ● Disposable pipette	●Light Microscope ●Polarizer/Red Compensator

VIII. MAINTENANCE: N/A

IX. CALIBRATION: N/A

X. QUALITY CONTROL:

A. Crystal Quality Control Material

a. Prepare and examine three QC slides using Cell-Chex® control material before viewing patient slide(s); one slide is positive for MSU and another is positive for CPPD. One slide is negative (no crystals present)

b. Quality control results are considered acceptable if the results correspond to the control results listed in the product insert.

		A
		A
		A

c. Record QC results in LIS under patient accession number as ‘Acceptable’ or ‘Not Acceptable’.

XI. Procedure:

A. Perform the crystal analysis as quickly as possible after collection. Examination should be performed within two hours. Fresh synovial fluid decays quickly and the detection of intracellular crystals may be lost due to cellular deterioration if analysis is delayed.

B. On a clean slide free of scratches, dust and other contaminants, prepare a fresh wet mount by placing a drop of synovial fluid on a pre-cleaned glass slide and cover with a clean coverslip.

C. In addition to wet preparation, prepare an unstained slide using a cytocentrifuge to maximize amount of crystals present if needed. Note: cytospin may increase the amount of debris present on slide.

D. Scan the slide specimen for the presence of crystals under the 10X objective with both brightfield light and also with the polarizing filter. Do NOT insert the color compensator (U-GAN Analyzer) into place (see diagram below).

E. Change to 40X objective and refocus. CPPD crystals may appear rhomboidal, diamond, or square shaped but also may be needle shaped. Whereas, MSU crystals are usually rod or needle shaped. To differentiate CPPD when appearing similar to MSU crystals, insert the U-GAN Analyzer with labeled surface up into place and tighten the clamping knob (see diagram below).

F. Set the rotation lever of the U-GAN to the center position (·). Look into the eyepiece and rotate the polarizer to the darkest position (see diagram below).

G. Orient the specimen so that the longitudinal direction of the crystals is in parallel with the axis of slow (γ) (see diagram below).

H. Gout (MSU) crystals will appear yellow when their orientation is parallel to the axis of slow, and blue when perpendicular. Pseudo Gout (CPPD) crystals will appear blue when their orientation is parallel to the axis of γ, and yellow when perpendicular. CPPD crystals are weakly birefringent.

I. The result can be confirmed by reversal of the color.

J. A second Clinical Laboratory Scientist must confirm the presence or absence and identification of crystals.

XII. Interpretation of Results:

A. Monosodium urate crystals-Diagnostic for gout. Crystals may be intracellular or extracellular or both, are needle-like with pointed ends and measure 1-20 µm in length. MSU crystals are strongly birefringent (they appear bright against a dark fully polarized background) and are yellow and parallel to axis of slow.

B. Calcium Pyrophosphate dehydrate crystals-Diagnostic for pseudo-gout. Crystals are rhomboid, diamond, or square-shaped and measure 1-20 µm. CPPD crystals may be needle-shaped and be mistaken for MSU crystals but unlike MSU crystals CPPD crystals are weakly birefringent (crystals appear pale against the dark background of polarized light) and appear yellow when perpendicular to axis of slow.

C. Cholesterol crystals-rectangular and strong birefringence with notched corners.

D. Calcium Oxalate-Octahedral or envelope shaped crystals.

E. Cystine-colorless refractile hexagonal plates with unequal sides

F. Leucine-yellow or brown “oily” spheroids with radial and concentric striations

G. Tyrosine-fine refractile needles in sheaves or clusters

H. Bilirubin-red-brown needles or granules

I. Corticosteroid-Flat variable-shaped plates with strong birefringence and measure 1-40 µm. Determine if patient has received injection of corticosteroids.

J. Aspatite crystals (calcium phosphate)-shiny inclusions in wet preparations or as dark purple neutrophil inclusions in stained slides.

XIII. Result Reporting:

A. Reference Range: Crystals are not normally present in synovial fluid.

B. Report as ‘positive’ or ‘negative’ for crystals and identify MSU, CPPD, or clinically insignificant crystals such as cholesterol, steroid and apatite. The presence of intracellular crystals should be noted under Result Comment. Add under Result Note “Crystal identification confirmed by [the name of the 2nd Clinical Laboratory Scientist]”

XIV. Limitations of Procedure:

A. Low concentrations of crystals or crystals of very small size maybe below the threshold of identification by polarized light microscopy and therefore a negative report does not exclude the presence of MSU or CPPD crystals.

Fluid to which hyaluronidase has been added should not be used for crystal examination

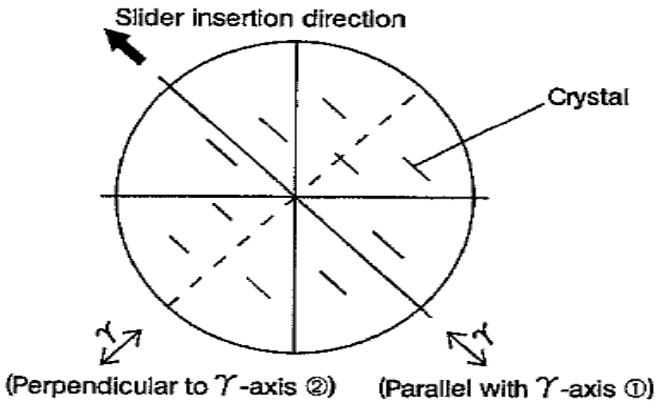
XV. References:

Brunzel, Nancy. Fundamentals of Urine & Body Fluid Analysis. St. Louis, 2013, Elsevier.

Strasinger, Susan and Lorenzo, Marjorie. Urinalysis and Body Fluids. Philadelphia, PA. 2014, F.A. Davis Company

Dieppe,Paul and Swan, Angela. Identification of Crystals in Synovial Fluid. Ann Rheum Dis 1999;58:261-263

XVI



counterclockwise (↕γ)

hate

O

(Blue)

↖ Slider insertion direction
↘ γ (parallel with γ -axis ①)

When the longitudinal direction of crystal is in parallel with the γ-axis, correct determination is possible — sodium urate (urate crystals) turning yellow and calcium pyrophosphate turning blue. However, when the longitudinal direction of crystal is perpendicular to the γ-axis (position marked ✖), the result will be opposite. So be careful.