Crystals Found in the Urine
Microscopic Examination - Part D, Abnormal Crystals

CAUTION

- Abnormal crystals
  - should not be reported haphazardly
  - are rarely encountered
  - should have the approval of a clinical pathologist
  - may need a confirmatory chemical test.

Abnormal Crystals of Metabolic Origin

- Cystine
- Tyrosine
- Leucine
- Cholesterol
Abnormal Crystals of Metabolic Origin

• Cystine crystals
  • Acidic urine
  • Metabolic disorder: Cystinosis / Cystinuria
    • Inherited amino acid transport disorder affecting cystine
    • Inability to reabsorb cystine
    • May form cystine stones - kidney damage - may fill renal collecting system, resulting in staghorn calculi causing stasis, etc.

Cystine

Usually exhibit characteristic shape: colorless, refractile hexagonal plate
May be confused with some forms of uric acid
Abnormal Crystals of Metabolic Origin

- Tyrosine crystals
- Acidic urine
- Metabolic disorder
  - familial tyrosinemia (tyrosinuria)
  - severe liver disease.

Abnormal Crystals of Metabolic Origin

- Tyrosine crystals
  - Appearance
    - Very fine delicate, pointed needles
    - Dark brown or black in color
    - Aggregates or as a cluster
  - Solubility
    - Dissolves in HCl, NaOH & when heated.
    - Insoluble: acetic acid, alcohol and ether

Tyrosine

Colorless needles in bundles or sheaves
Abnormal Crystals of Metabolic Origin

- Leucine crystals
  - Acidic urine
  - Severe liver disease.
    - Leucine,
    - Tyrosine
    - Bilirubin

Abnormal Crystals of Metabolic Origin

- Leucine crystals
  - Appearance
    - yellow, oily spheres
    - Highly retractile
    - Contain concentric circles with radial striations.
    - Will produce Maltese cross pattern with polarized light.
  - Solubility
    - Dissolves in NaOH & when heated
    - Insoluble in Acetic acid, HCl, and Ether

Leucine

Yellow, oily-looking spheres with striations and a thick outer boarder
Can resemble “grapefruit sections”
Abnormal Crystals of Metabolic Origin

- Bilirubin crystals
  - Appearance
    - Clumped granules or needles
    - Characteristic orange-yellow color
    - Viral hepatitis with tubular damage
  - Positive reagent strip for bilirubin
  - Solubility
    - Dissolve in acetic acid, HCl, Acetone, Chloroform & ether
    - Insoluble in alcohol

Bilirubin Crystals

- Bilirubin
  - The crystals sometimes adhere to cells
  - Should expect positive bilirubin on dipstick
  - Should expect to see other sediment stained

Abnormal Crystals of Metabolic Origin

- Cholesterol
  - Acidic pH
  - Free fat from degradation of RTE cells
  - May be present in fatty casts in cases of nephrotic syndrome along with oval fat bodies
  - Refrigerated specimens
  - Rectangular plates with characteristic notched corners
  - Highly birefringent / polarizes
**Cholesterol**

- Polarizes light
- Dissolves in
  - Chloroform
  - Ether
  - Hot alcohol
- Insoluble in
  - Dilute acids
  - Dilute alkali

**Abnormal Crystals of Iatrogenic Origin**

- Suppliments
  - Ascorbic acid / vitamin C
- Drugs
  - Salisilates (aspirin)
  - Ampicillin crystals
    - Colorless needles that form bundles after refrigeration
    - high dosage, ↓ hydration

Characteristic shape is the colorless, large, flat, rectangular plate with one or more corners notched

May be mistaken for radiologic dyes - Renografin & Hypaque
**Sulfonamide Drugs**
- Acids pH
- Renal damage as these precipitate out in the nephron
- Yellow - brown needles, but many shapes have been noted
- Polarize light, demonstrate birefringence
- Dissolve in
  - Acetic acid
  - NaOH
- Insoluble in
  - Dilute acetic acid
- Confirmatory test — Lignin test

**Abnormal Crystals of Iatrogenic Origin**
- Drugs
  - Indinavir
    - Antiviral agent often used in treatment of HIV
    - Seen in the urine as a rosette plate which is birefringent under polarized light similar to the color dispersion seen with uric acid. Unlike uric acid, indinavir is seen more in neutral pH.

**Radiologic Contrast Media**
- Needles or elongated rectangles
- Some varieties may look similar to cholesterol crystals
Radiologic Contrast Media

- X-ray dye crystals under polarized light

Confusing Artifacts: Starch

Round or oval and refractile.
Hexagonal but usually have an indentation
Polarize light into Maltese cross

Confusing Artifacts: Talc and Glass Fragments

Talcum powder particles
Glass fragments
References

- Lillian Mundt & Kristy Shanahan, Graff's Textbook of Urinalysis and Body Fluids, 2nd Ed.
- Susan Strassinger & Marjorie Di Lorenzo, Urinalysis and Body Fluids, 5th Ed.
- Mary Haber, MD, A Primer of Microscopic Urinalysis, 2nd Ed.