# CLINICAL DIAGNOSIS AND MANAGEMENT BY LABORATORY METHODS

## URINALYSIS

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# Preoperative urinalysis

Urinalysis is recommended as a screening tool preoperatively by the American Society of Anesthesiologists in patients in Class I and II physical status with hepatic or renal disease, diabetes, or in the elderly.

# Urinalysis

- Urine is normally light yellow and clear.
- If red or brown color, centrifuge and examine supernatant.  If supernatant clear, hematuria is cause.
- If supernatant red, urine dipstick is positive, is myoglobinuria (plasma light yellow) or hemoglobinuria (plasma has reddish tint).
- White urine may be due to chyluria, phosphate crystals, or pyuria.
- Black urine likely alkaptonuria.
- Purple urine likely infection with Providence or Klebsiella speices, Proteus vulgaris as they degrade indole.

# Urinalysis

- Specific gravity is the most sensitive test of renal concentrating ability. A specific gravity >1.025 expected in first morning (concentrated) specimen.
- The presence of glucose or radio-contrast material in the urine may raise the specific gravity but do not alter osmolality.
- A specific gravity of 1.010 is that of a protein free plasma filtrate.
- Inability to concentrate urine suggests ADH deficiency. If no concentration with water deprivation, is nephrogenic.

# Urinalysis

- pH of urine usually acid, below 5.0.
- Urine pH >6.0 suggests renal tubular acidosis. A pH of 7.0 is seen with vegetarian diets, however.
- Infection with Proteus species may raise the urine pH to >8.0.

# Urinalysis

- The presence of glucose is not diagnostic of diabetes mellitus but should lead to that work-up.
- Urine dipsticks are specific for glucose. They do not screen for other sugars.  Vitamin C does not interfere with the determination.
- A urine that tests negative for glucose on dipstick but tests positive for reducing substances is found in galactosemia.

# Urinalysis

- Protein measured in the urine is principally albumin. It is measured as a change in dye binding (also associated with a change in pH). Urine dipsticks are sensitive to 200mg/day protein loss.
- Sulfosalicylic acid (SSA) turbidity test measures all proteins. It is more accurate than the dye binding assay.
- Dilute urine under estimates protein loss; concentrated urine over estimates protein loss.

# Urinalysis

- The urine dipstick is not a good screen for myeloma protein; that requires electrophoresis. (Negative dipstick but positive SSA is likely myeloma protein).
- Microalbumin determination by microalbumin dipstick is sensitive. Microalbuminuria is a good predictor of nephropathy in diabetics.
- Creatinine may also be measured by dipstick. Copper creatinine complexes are measured by a peroxidase reaction

# Urinalysis

- Hematuria requires a work-up.
- Hemoglobin dipstick detects 1-2 rbc/hpf and is as sensitive as microscopic examination.
- Hematuria is usually associated with urinary tract infection.
- Hematuria with proteinuria suggests glomerular injury.
- Myoglobinuria may also give a positive test.
- False positive associated with semen  in urine.

# Urinalysis

- Painless hematuria may present in sickle cell disease.
- Thin glomerular basement membrane a common cause of painless hematuria.
- Dipstick hemoglobin determination is an effective screen for bladder cancer. Generally associated with painless hematuria.

# Urinalysis

- Urobilinogen is product of heme metabolism. Major route of excretion is intestinal.
- Elevated levels of urobilinogen in the urine are associated with common duct obstruction. Bilirubin will also be found in the urine.
- Bilirubin alone in the urine is associated with hepatic disease or hemolysis and reflects poor hepatic clearance.

# Urinalysis

- In the presence of elevated levels of bilirubin, the presence of nitrate as determined by dipstick is not associated with an increased probability of infection in the genitourinary tract.
- In the presence of elevated bilirubin, epithelial cells may be found in the urine and do not suggest acute tubular necrosis.

# Urinalysis

- pH >8.0 usually found with presence of urea splitting micro-organisms (Proteus speices, Citrobacter species, Enterobacter cloacae).
- Presence of Nitrate also suggests presence of Nitrogen producing micro-organisms.
- Leucocytes may also be present.
- Urine culture appropriate.
- Empiric therapy should reflect Klebsiella, Enterobacteraciae, Serratia, Proteus, Enterococcus species.

# Crystals

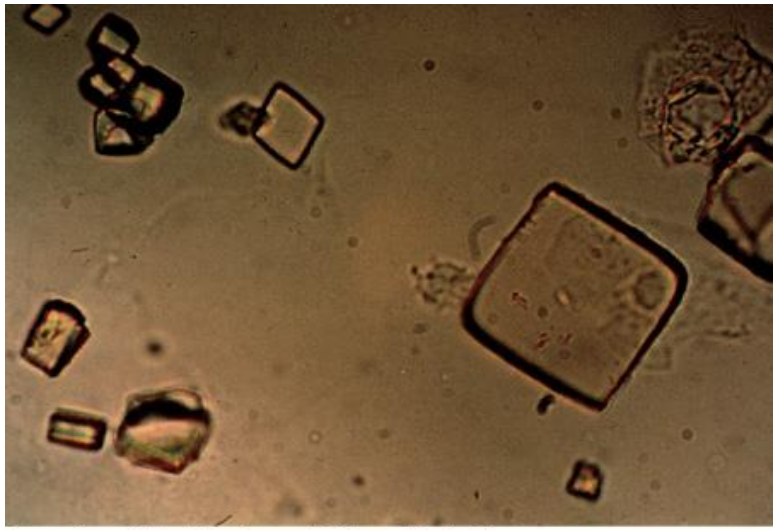
**Found in acid urine.**

Uric acid (rhomboid)  Calcium oxalate (octahedral)

Monosodium urate crystals

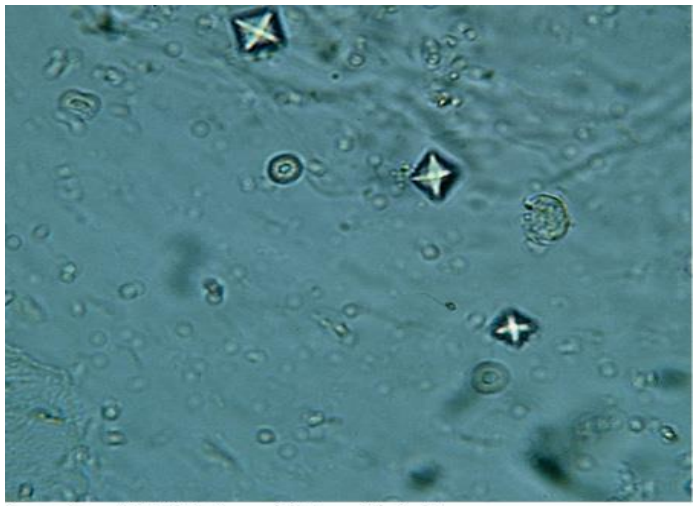
(needles, rods; negatively birefringent)

Figs. 25-2, 25-1 Accessed 02/01/2010





Vitamin C, ethylene glycol

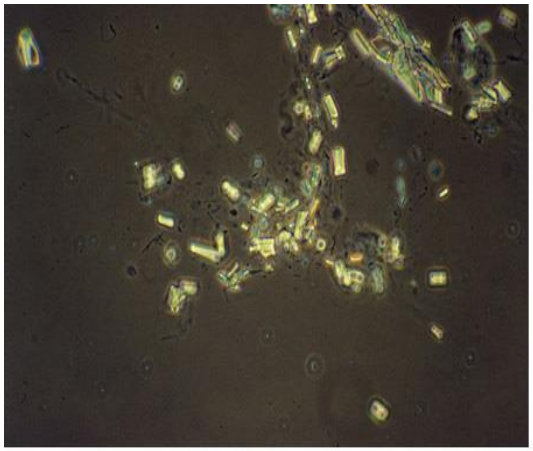


# Crystals

- **Found in acid urine.**
- Cystine crystals are hexagonal. Found in acid urine. Seen with cystinuria.
- Leucine crystals are shaped like bicycle wheels. Seen with severe liver disease.
- Tyrosine crystals are sheaf like. Seen with severe liver disease.
- Sulfa drugs as well as indinavir may also precipitate in urine.
- Calcium pyrophosphate crystals are monoclinic or biclinic and weakly polarize (seen in joints).

# Crystals

- **Found in alkaline urine.**
- Calcium monophosphate crystals. Rods. Weakly birefringent.
- Ammonium biurate crystals. “Thorn apple” stones.
- Magnesium ammonium monophosphate (triple phosphate) crystals are shaped like coffin lids. Struvite stones.



**Triple phosphate crystals**

ABF/Vanderbilt collection

Fig. e9-33 Accessed 02/01/2010

# Casts

- All casts are composed of Tamm-Horsfall protein.
- Hyaline casts are not indicative of  disease.
- Red cell casts are compatible with glomerulonephritis or vasculitis.

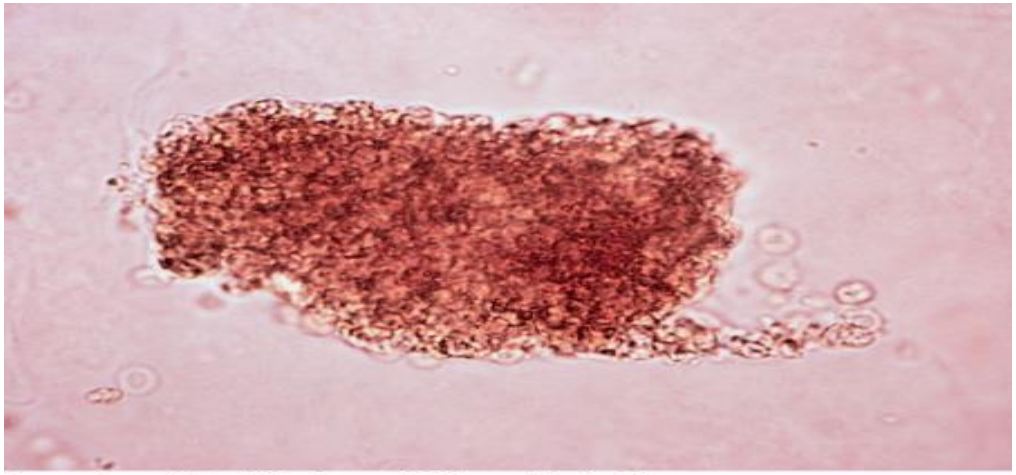
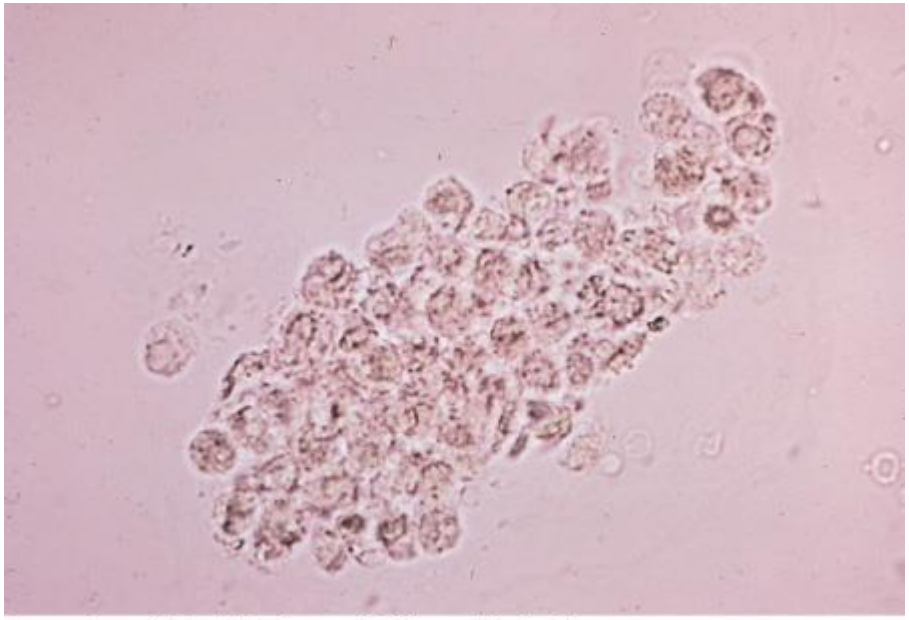




Fig. 25-4 Accessed 02/01/2010

# Casts

- White cell casts generally reflect tubulointerstitial disease.



Source: Knoop KJ, Stack LB, Storrow AB, Thurman RJ: *The Atlas of Emergency Medicine, 3rd Edition:* http://www.accessmedicine.com



Fig. 25-3 Accessed 02/01/2010

# Renal tubular epithelial cell cast



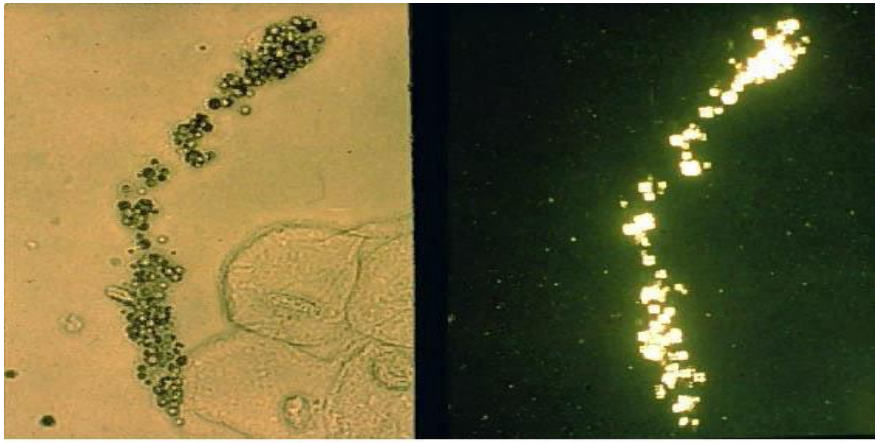
**Epithelial cell casts may be seen with acute glomerulonephritis or acute tubular necrosis. The epithelia cell is larger than a white cell.**

(Reproduced from WebPath, with permission from Edward C. Klatt, MD.)

Accessed 03/02/2010

# Casts

- Pictured with polarized light to demonstrate lipid.



Source: McPhee SJ, Papadakis MA: *Current Medical Diagnosis and Treatment 2010*, 49th Edition: http://www.accessmedicine.com


Fig. Accessed 02/01/2010

# Casts

- Granular and Waxy casts are degenerative stages of cellular casts.
- Fatty casts are found in the urine of patients with significant proteinuria.  They are composed of cholesterol and cholesteol esters. Cholesterol crystal  is rectangular and notched. The fatty acids show a Maltese cross pattern when examined with polarized light.

# Urinalysis

- A normal or near-normal urinalysis in a patient with acute renal failure suggests pre-renal disease, urinary tract obstruction, hypercalcemia.