

Urinalysis and Body Fluids 09

Unit 2; Session 6

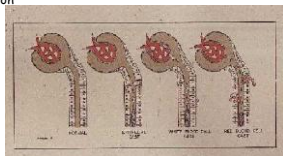
Urine Casts

Urine Casts

- Overview of Urinary Cast Formation
- Hyaline Casts
- Cellular Casts
- Granular Casts
- Waxy Casts
- Pseudo Casts

Microscopic Sediment - Casts

- Definition: Cylinder-like structures with parallel sides, formed from gelled muco/glyco protein (Tamm-Horsfall protein).
- Cast formation
 1. normal nephron
 2. epithelial cell cast formation
 3. WBC cast formation
 4. RBC cast formation



Urinary Cast: Formation

- Formed in lumen of the kidney distal convoluted tubules and Loop of Henle.
- Molded in the shape of the tubules
- Tamm-Horsfall mucoprotein comprises the matrix
- May contain cells that are present in the tubules at the time of cast formation.

Urinary Cast: Formation

- Factors of cast formation:
 - urinary stasis
 - Acid pH
 - high solute concentration
 - abnormal ionic or protein constituents
 - May be indicated by the presence of urinary protein.
 - However, casts can be present in the absence of protein.
 - Microscopic examination is important.

Urinary Cast: Identification of Casts

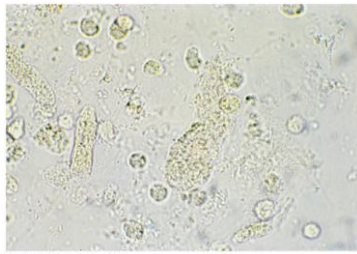
- Casts:
 - have parallel sides with rounded or blunted ends
 - vary in size and shape according to the tubules in which they were formed
 - convoluted, straight, or curved
 - are cylindrical in shape with no dark edges

Urinary Cast: Significance of Casts

- Cast are always renal in origin
- Casts often indicate pathologies:
 - glomerular damage
 - tubular damage
 - renal inflammation
 - renal infection
- Cast Size
 - indicates the diameter of the tubule in which it was formed
- Broad casts & Narrow
 - formed in pathologically dilated or atrophied tubules or in collecting tubules
 - indicate renal trauma / failure

Urinary Cast: Broad & Narrow

Fine granular casts and WBCs

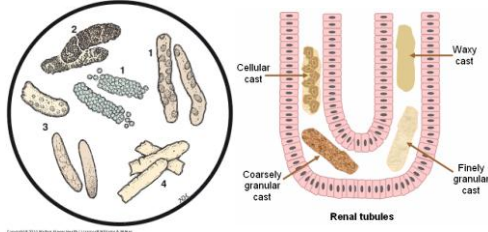


Urinary Cast: Classification

- Based on appearance and contents:
 - hyaline
 - red cell
 - white cell
 - epithelial cell
 - granular (coarse and fine)
 - Waxy
 - Fatty
 - mixed

Urinary Cast: Sequence of Degeneration

Sequence of urinary cast degeneration



Urinary Casts: Detection

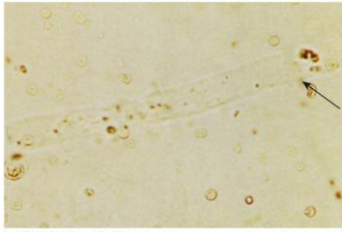
- Low power and low light to find;
- high power to identify
 - must use low level of light or will look right through them
- Cylindrical body with parallel sides and rounded ends.
- May be confused with cylindroids, mucous threads, and rolled up squamous epithelial cells, also artifacts such as fibers.
 - ****cylindroids** - have the same clinical significance

Urinary Cast: Enumeration

- Counted on low-power (100x)
- If using the slide & coverslip sediment preparation method, casts are more frequently seen along the edges of coverslip
- Reported according to type and range seen
 - Follow Urine Standardization Guide (rare, occasional, 0-2, 3-5, etc.)
 - Example:
 - Hyaline casts 6-10/LPF
 - Granular casts 2-5/LPF

Urinary Casts: Hyaline Casts

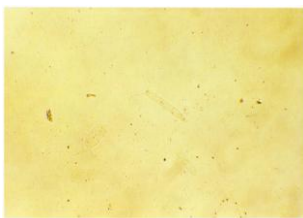
Hyaline cast and red blood cells.



Urinary Casts: Hyaline Casts

- Can be seen in even the mildest kind of renal disease.
- A few hyaline casts may be found in the normal urine.
- Frequently present
 - following physical exercise
 - physiologic dehydration

Urinary Casts: Hyaline Casts



Urinary Casts: Hyaline Casts

Hyaline casts. Viewed with an 80A filter



Urinary Casts: Hyaline Casts

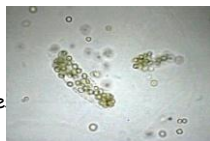
- Hyaline casts using phase contrast microscopy



Microscopic Sediment - Casts

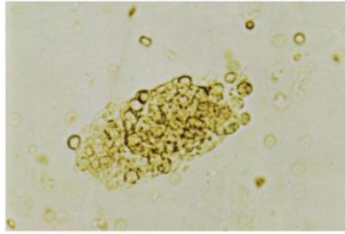
Cellular Casts

- Very significant
- Is there a matrix?
- Can you identify the structures within?
- Support?
 - Patient history / diagnosis
 - Physical & chemical results
 - Other microscopic structure



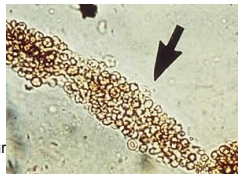
Urinary Casts: Red Blood Cell Casts

Red cell cast and RBCs



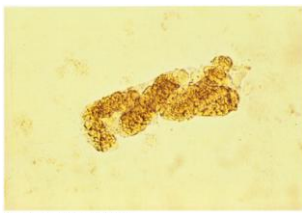
Urinary Casts: Red Blood Cell Casts

- Always pathologic
- Hematuria is present
- Conditions include:
 - acute glomerulonephritis
 - lupus nephritis
 - Goodpasture syndrome
 - subacute bacterial endocarditis
 - renal trauma
 - renal infarction
 - severe pyelonephritis
 - right-sided congestive heart failure
 - renal vein thrombosis
 - periarteritis nodosa



Urinary Casts: Red Blood Cell Casts

Convoluted red blood cell cast

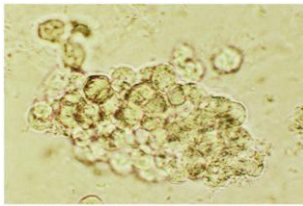


Urinary Casts: Red Blood Cell Casts



Urinary Casts: White Blood Cell Casts

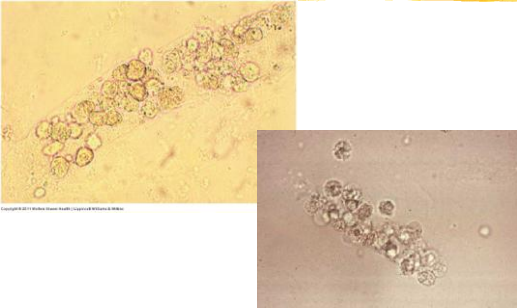
White cell cast and WBCs



Urinary Casts: White Blood Cell Casts

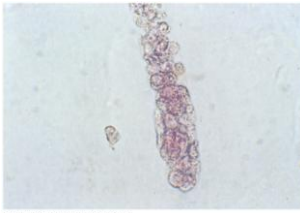
- Can be present during renal infection and inflammation.
 - acute pyelonephritis
 - interstitial nephritis
 - lupus nephritis
 - glomerular disease

Urinary Casts: White Blood Cell Casts



Urinary Casts: White Blood Cell Casts

SM-stained WBC cast



Urinary Casts: Epithelial Cell Casts

- What kind of epithelial cells are found in epithelial cell casts?



Urinary Casts: Epithelial Cell Casts

- May be present after exposure to:
 - nephrotoxic agents
 - viruses (e.g., cytomegalovirus, hepatitis virus)
- Due to damage that accompanies glomerular injury
- Also present in the rejection of a kidney allograft

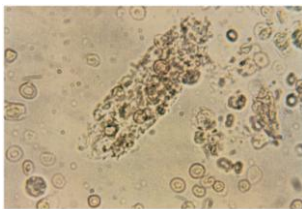
Urinary Casts: Epithelial Cell Casts

- Formed in DCT = small, round cells
- Fibrils forming cast pull cells from damaged tubules
- Majority of cells are on the cast matrix
- Differentiate from WBCs: stain to show single nucleus



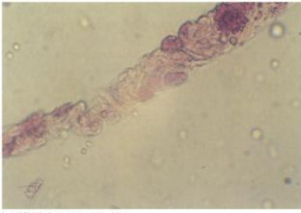
Urinary Casts: Mixed Cell Casts

Mixed cell cast, WBCs, and RBCs.



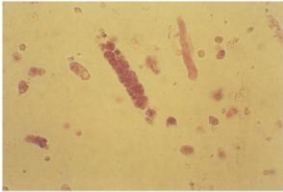
Urinary Casts: Mixed Cell Casts

SM-stained mixed cellular cast.



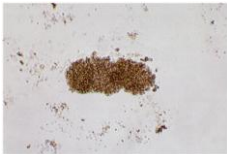
Urinary Casts: Mixed Cell Casts

SM-stained hyaline cast, granular cast, mixed cellular cast, and partially degenerated renal tubule epithelial cells

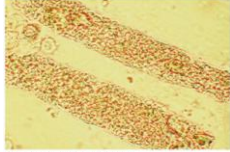


Urinary Casts: Granular Casts

Broad coarsely granular



Finely granular casts

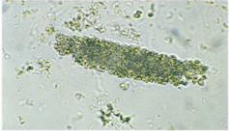


Urinary Casts: Granular Casts

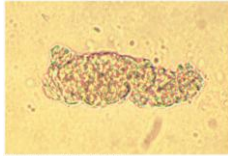
- Usually indicate renal disease.
- But may be briefly present after strenuous exercise.
- These casts have remained in the tubule for enough time to allow for the degeneration of cellular components.
- May be confused with casts containing bacteria or crystals.

Urinary Casts: Granular Casts

Coarse granular cast

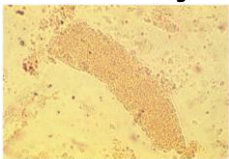


Coarse granular cast

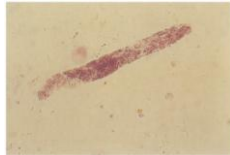


Urinary Casts: Granular Casts

Bilirubin-stained granular cast

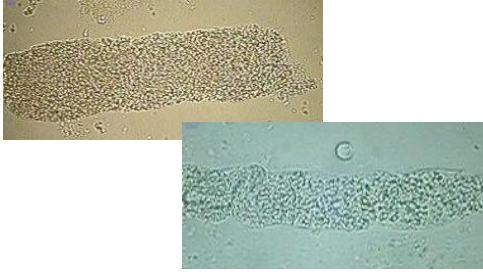


SM-stained granular cast

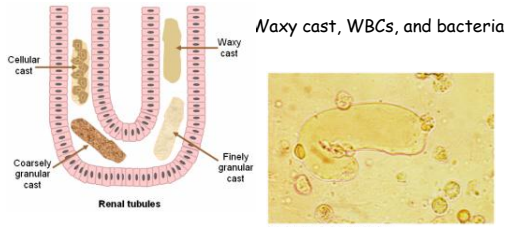


Microscopic Sediment - Casts

Granular casts



Urinary Casts: Waxy Casts

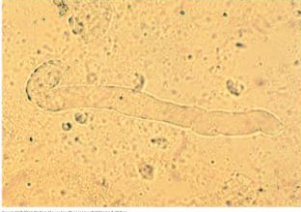


Urinary Casts: Waxy Casts

- Found in urine from patients with:
 - severe chronic renal failure
 - malignant hypertension
 - renal amyloidosis
 - and diabetic nephropathy
 - acute renal disease
 - tubular inflammation and degeneration
 - and during renal allograft rejection.

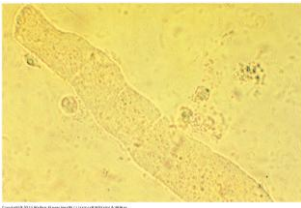
Urinary Casts: Waxy Casts

- Waxy cast and amorphous urates.



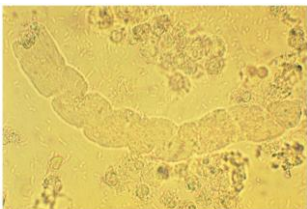
Urinary Casts: Granular to Waxy transformation

Fine granular cast becoming a waxy cast.



Urinary Casts: Waxy Casts

Convoluted waxy cast.



Urinary Casts: Fatty Casts

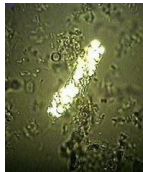


Urinary Casts: Fatty Casts

- Present during fatty degeneration of the RTE cells
 - *degenerative tubular disease
 - nephrotic syndrome
 - diabetic glomerulosclerosis
 - lipoid nephrosischronic
 - Glomerulonephritis
 - Kimmelstiel-Wilson syndrome
 - Systemic Lupus Erythematosus
 - toxic renal poisoning

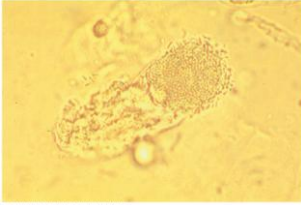
Microscopic Sediment - Casts

⚙ Fatty casts



Urinary Casts: Other Casts

- Mixed cast.

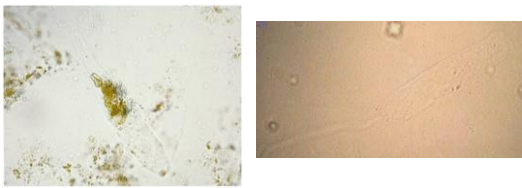


Urinary Casts: Other Casts

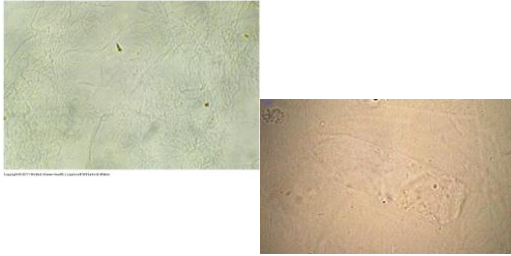
- Bacterial Casts
 - May be pure bacteria or mixed with WBCs
 - Resemble granular casts
 - Look for free WBCs and bacteria
 - Confirm with Gram stain
 - Seen in pyelonephritis

Urinary Casts: Pseudo Casts

Cylindroids.



Urinary Casts: Confusing Artefacts-Mucous Threads

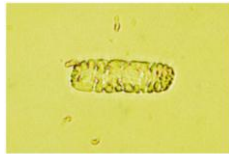


Urinary Casts: Confusing Artefacts-Fibers

Fibers

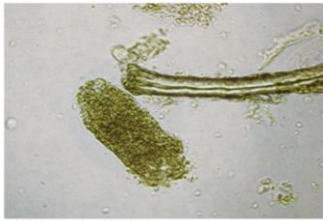


Debris from a diaper



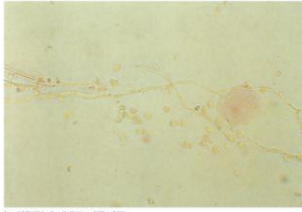
Urinary Casts: Confusing Artefacts-Hair

Hair and a coarsely granular cast



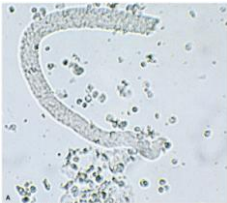
Urinary Casts: Confusing Sediment - Yeast

SM-stained yeast with pseudohyphae and WBCs

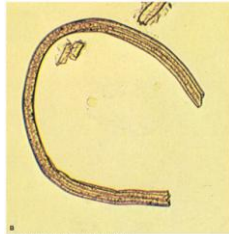


Urinary Casts: Confusing Comparison

A. Fine granular cast



B. Fiber.



Summary

- Casts, comprised of a Tamm-Horsfall mucoprotein matrix are formed in lumen of distal tubules.
- Casts are classified by their contents.
- Several artifacts may be misidentified as casts.
- Reagent strip tests for protein may or may not be positive when casts are present.
- Casts may be present in physiologically normal conditions.
- Casts usually accompany renal disorders.

References

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- > Susan Strassinger & Marjorie Di Lorenzo, Urinalysis and Body Fluids, 5th Ed.
- > Mery Haber, MD, A Primer of Microscopic Urinalysis, 2nd Ed.
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- > Simerville, J.A., Maxted, W.C., & Pahira, J.J., Urinalysis: A Comprehensive Review. American Family Physician. AAFP. 2005, March 15, 71 (6): 1153-11562.
 - > <http://www.aafp.org/afp/2005/0315/p1153.html>
- > <http://library.med.utah.edu/WebPath/TUTORIAL/URINE/URINE.html>
