Microscopic Analysis of Urine

Microscopic examination of urine

Labelling

- Sample container-for identification of sample.
- Cytology requisition form-for identification of individual patient sample.

Centrifugation

Basically of 2 types-

- I Normal.
- II Cytospin-A device that spins cells in a fluid suspension . Drawbacks-distortion of cellular morphology due to air drying artifacts and loss of cells by absorption of fluid into the filter card.

  In this process, urine sample is taken in a conical tube and centrifuge at a rate of 2000rpm for 10-15 minutes.

Microscopic examination of urine

Staining- Papanicolaou Stain

Done by two methods-

1-Automated stainer-

- For large scale slides.
- Takes 30 minutes for staining.

2-Manual staining using copplin jar-

- For small scale slides.
- Takes less than 7 minutes to stain.

Staining objectives-

- Well stained nuclear chromatin.
- Differential counterstaining i.e. staining the cytoplasm

Microscopic Examination- Urine Cytology

Interpretation-

1-Normal-Normal constituents of urine.

2- Abnormal-Any variation from normal-

- Cellular components
- Acellular components

Cells derived from-

- Urothelial and its variants.
- Renal tubules.
- Adjacent organs-like prostrate.
- Cells extragenous to the urinary tract-RBCs.

Microscopic Examination- Urine Cytology

A- Cells

- **Erythrocytes-Hematuria**
- **Leucocytes-Infective etiology**
- **Epithelial cells**

B- Casts

Hyaline cast **Red cell cast** **White Cell Cast** **Granular cast**
Epithelial cast **Waxy cast** **Fatty cast**

C- Crystals

- **Some are common in Acidic urine**
- **Some are common in Alkaline urine**

D- Bacteria-Normal urine is free from bacteria.

E- Yeast

F- Malignant cells.

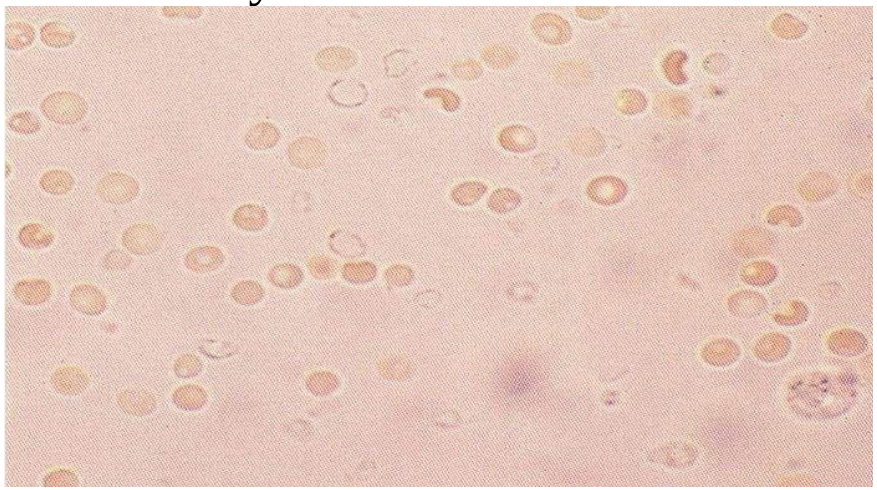
G- Artifacts

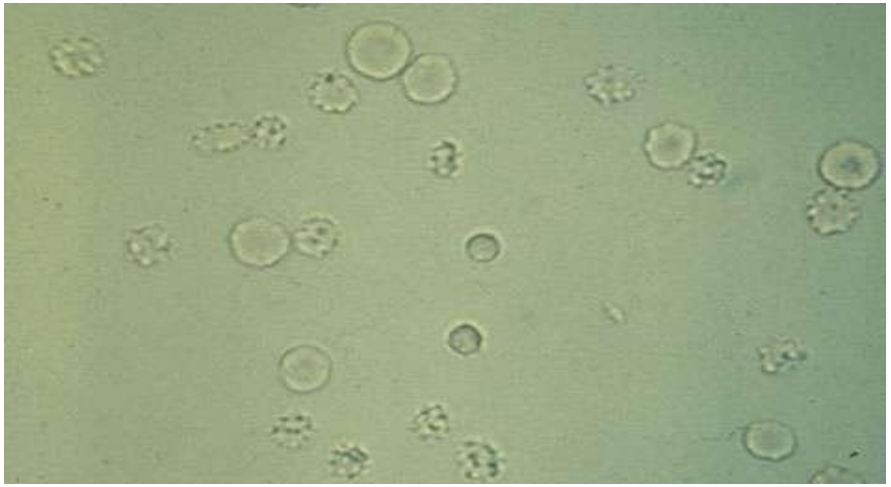
Microscopic Examination- Urine Cytology

A- Cells

Erythrocytes

- Usually appear as hourglass appearance. Presence of red cells 1-2RBCs/HPF is not considered abnormal.
- In hypotonic urine red cells swell up causing lysis -releasing Hb in urine-lysed cells are referred as *ghost cells.*
- When the red cells are swollen/crenated sometimes mistaken for WBCs and yeast cells.





Microscopic Examination- Urine Cytology

A- Cells

Leucocytes

- **Normal up to 1-2 WBCs/HPF.**
- **Larger than red cells and smaller than renal epithelial cells.**
- **Usually spherical- singly/clumps.**
- **Mostly neutrophils-presence of characteristics granules and lobulation.**
- **Addition of 2% acetic acid to slide accentuate the nuclei of cells.**
- **Presence of many white cells in clumps is strongly suggestive of acute urinary tract infection.**

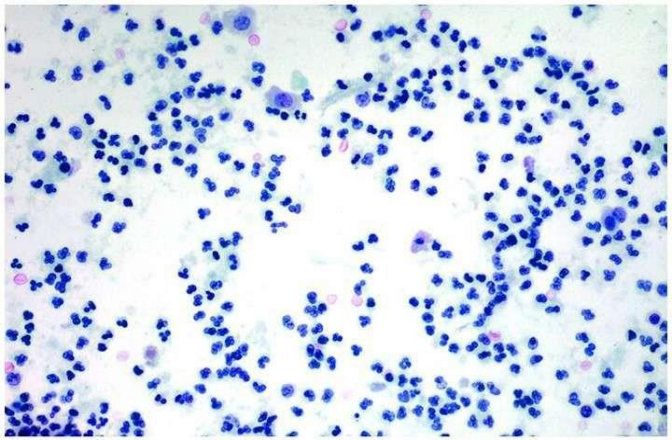


Figure 22-14A Urine sediment in inflammation. A low-power view of urine sediment containing numerous leukocytes.

Microscopic Examination- Urine Cytology

A- Cells

Epithelial Cells

- Any site in genitourinary tract from PCT to the urethra or from the vagina.
- Normally a few cells from these sites can be found.
- A marked increase indicates *inflammation* of that proportion of urinary tract from which the cell is derived.

Types

- *Renal tubular*
- *Transitional*
- *Squamous*

Microscopic Examination- Urine Cytology

Epithelial cells

1-Renal Tubular cells

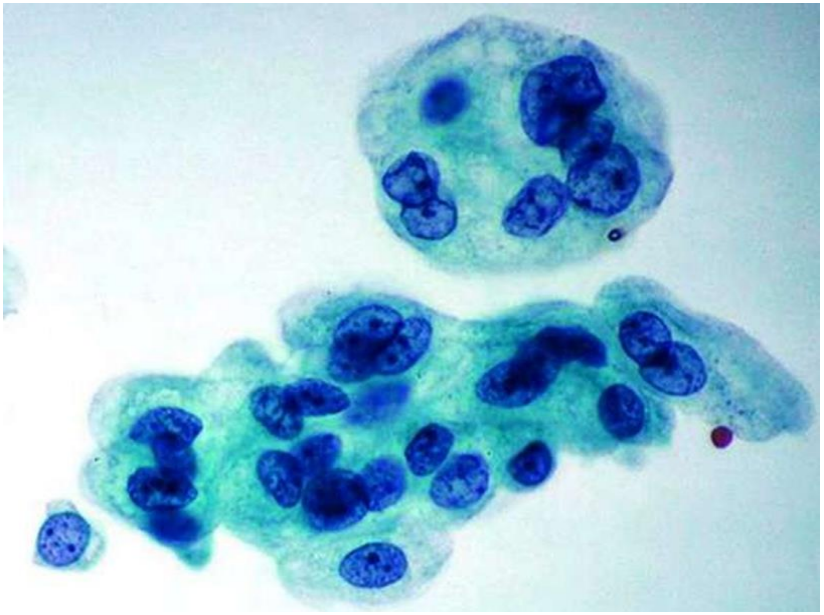
- Larger than white cells
- Large round nucleus.
- May flat/ cuboidal/ columnar
- Increase no indicates tubular damage.

Microscopic Examination- Urine Cytology

Epithelial cells

2-Transitional Epithelial Cells

- 2 to 4 times larger than white cells.
- Round/ pear shaped/ may have tail like projection.
- Line the urinary tract from pelvis of kidney to upper portion of urethra.

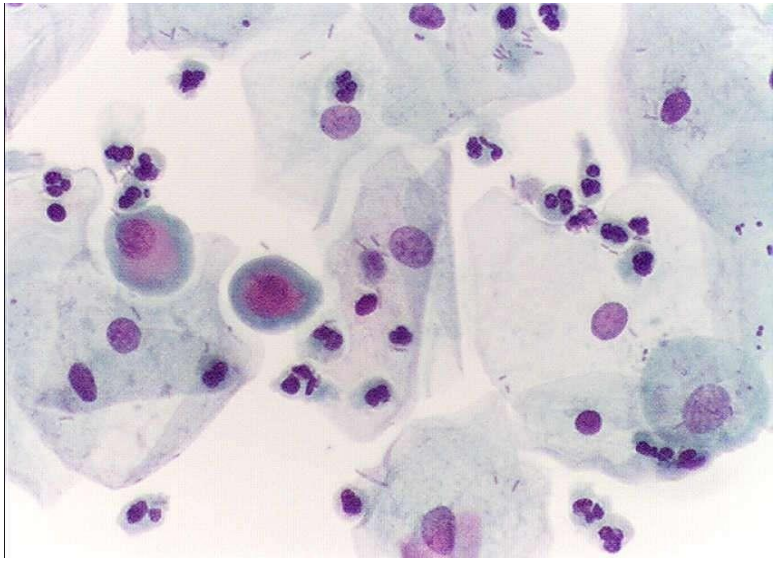


Microscopic Examination- Urine Cytology

Epithelial cells

3-Squamous Epithelial Cells

- Line urethra and vagina.
- Have little diagnostic significance.



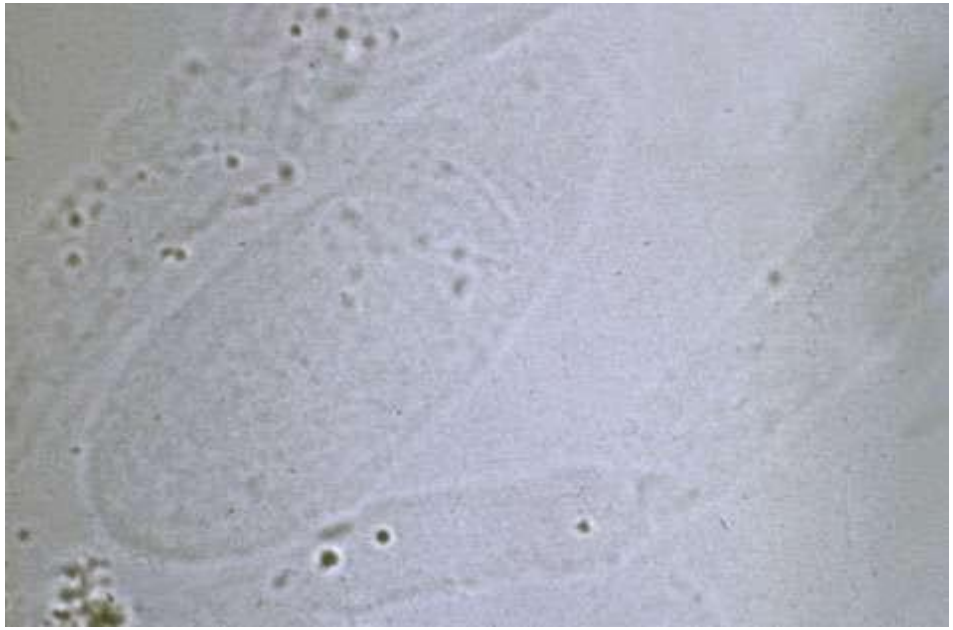
Microscopic Examination- Urine Cytology

B- Casts

- Presence of casts are frequently associated with proteinuria.
- Have nearly parallel sides with rounded or blunts ends.
- Always renal in origin and indicates intrinsic renal disease
- Casts are more or less circular with thicker in middle

1- Hyaline Cast

Found in damage to glomerular capillary membrane, fever, orthostatic proteinuria, and emotional stress or strenuous exercise.

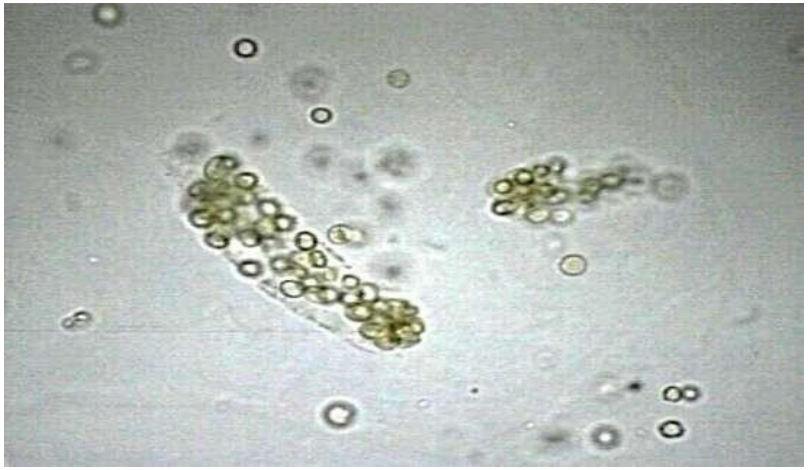


Microscopic Examination- Urine Cytology

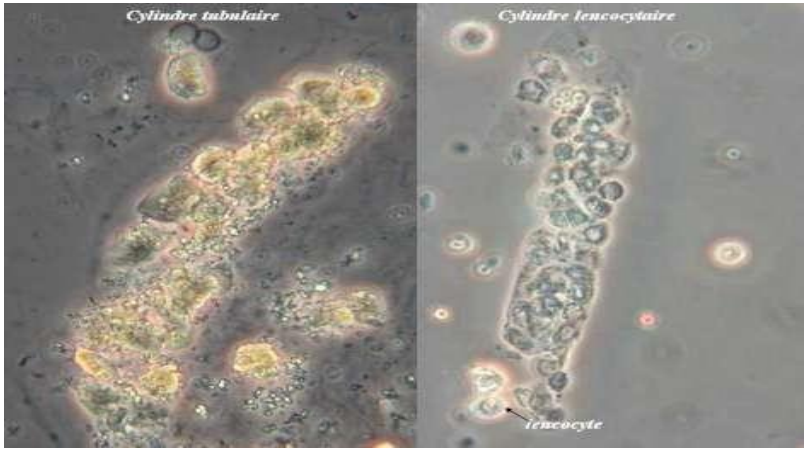
B- Casts

2- Red Cell Cast

- Meaning renal hematuria
- Always pathological



3- White Cell Cast

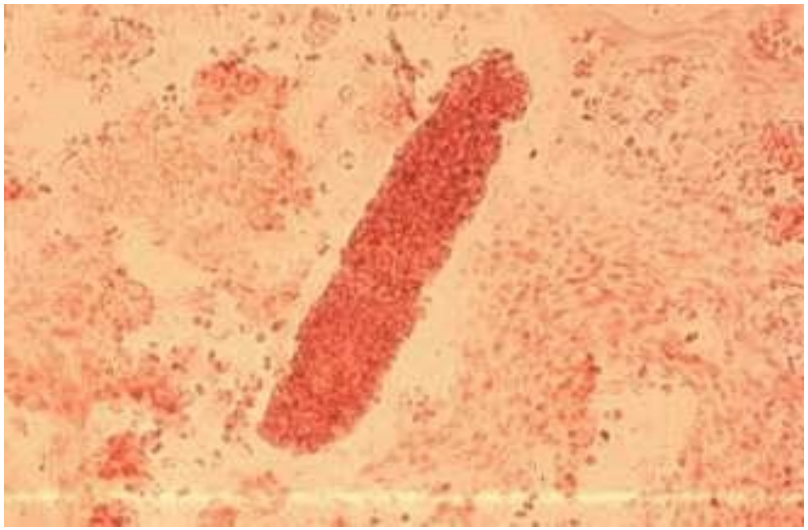


Microscopic Examination- Urine Cytology

B- Casts

4- Granular Cast

- Degeneration of cellular casts or direct aggregation of serum proteins.
- Almost always indicate significant renal disease.
- May be fine granular or coarse granular casts.

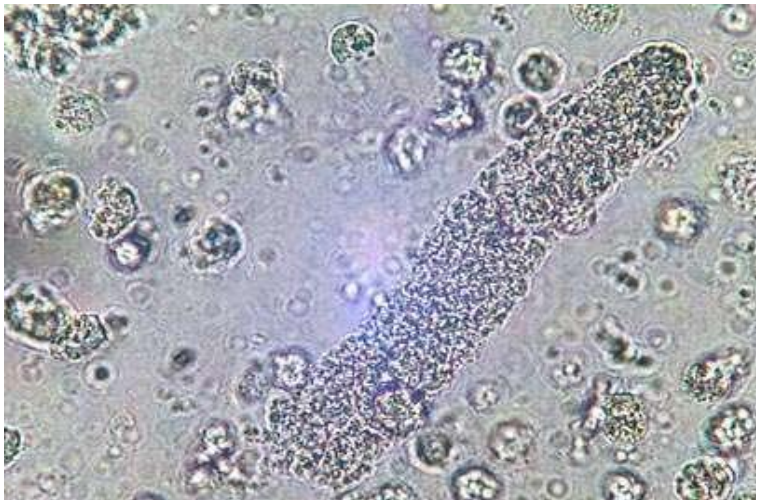


Microscopic Examination- Urine Cytology

B- Casts

5- Epithelial Cell Cast

- Result as statis and desquamation of renal tubular epithelial cells.
- Indicates tubular injury.



6- Waxy Cast

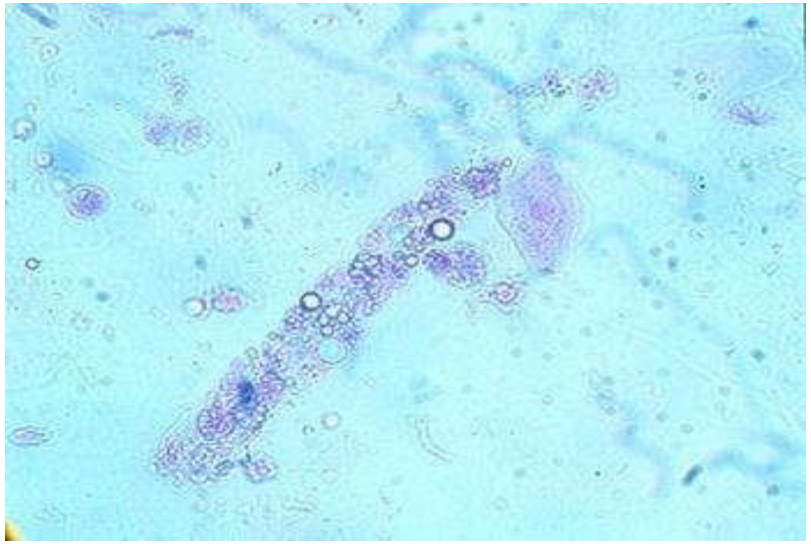
- Smooth homogenous appearance.
- Results from degeneration of granular casts.
- Found in acute and chronic renal disease.

Microscopic Examination- Urine Cytology

B- Casts

7- Fatty Cast

- Appear as a few fat droplets or compose almost entirely of fat droplets of various sizes.
- Found in fatty degeneration of tubular epithelial.



Microscopic Examination- Urine Cytology

C- Crystals

- Usually not found in fresh urine but appear when urine strands for a while.
- Many of crystal found in urine have little clinical significance except in case of metabolic disorders.
- Crystals are identified by their appearance and their solubility characteristics.

Types-

- ***Acidic urine crystals***
- ***Alkaline urine crystals***

Microscopic Examination- Urine Cytology

C- Crystals

- ***Acidic urine crystals***

Uric Acid Amorphous Urates Calcium Oxalate

Cystine Leucine Tyrosine Sulpha

- ***Alkaline urine crystals***

Triple Phosphate Calcium Carbonate Cholestrol

Amorphous Phosphates Ammonium Biurate

Microscopic Examination- Urine Cytology

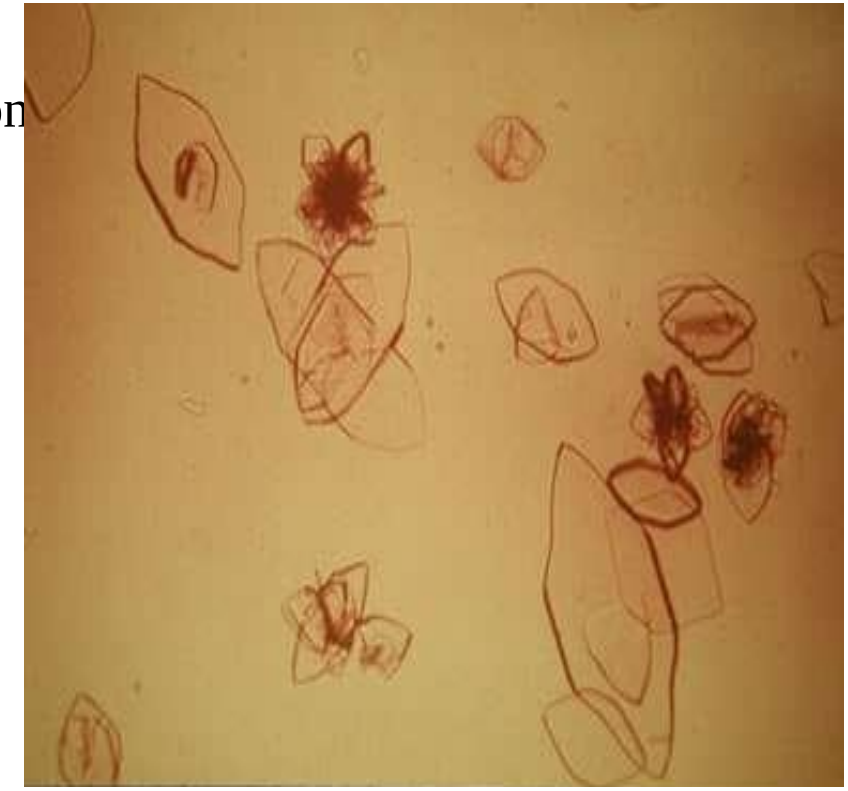
C- Crystals

Uric Acid Crystal

- Most characteristics form are diamon or rhombic prism.
- Presence of uric acid crystals in urine is a normal appearance.

Increase in-

- Gout
- AFI
- Chronic nephritis
- high purine metabolism



Microscopic Examination- Urine Cytology

C- Crystals

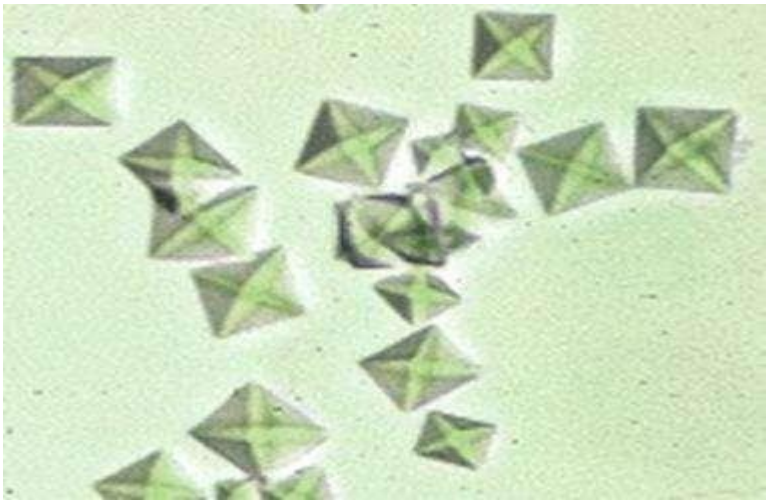
In Acidic Urine

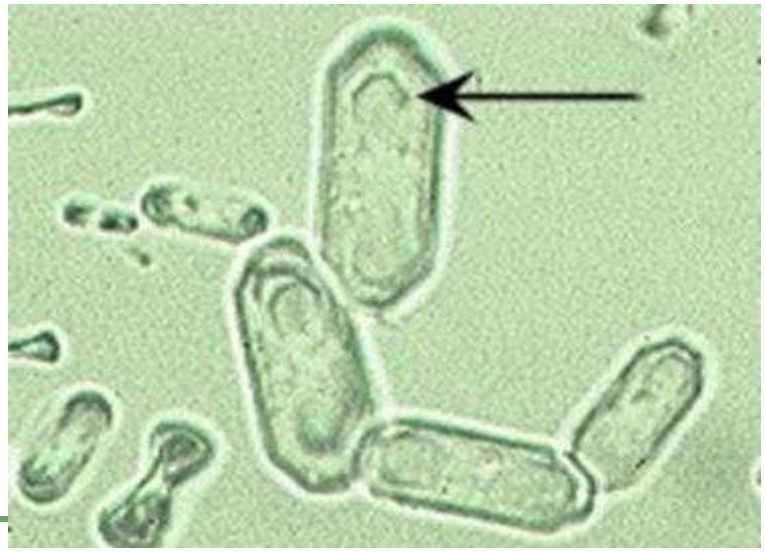
Calcium Oxalate Crystals

- Octahedral or envelope shaped crystal
- Can be present in normal urine after ingestion of various oxalate rich foods.

Found in-

- Diabetes Mellitus
- Liver disease
- Severe chronic renal disease



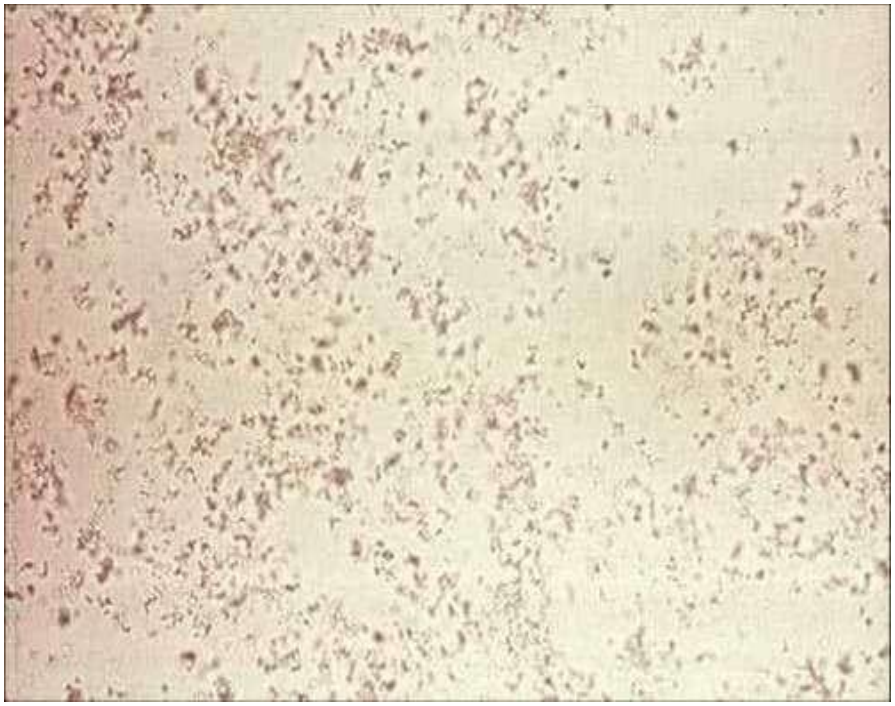


Microscopic Examination- Urine Cytology

C- Crystals

Amorphous Urates Crystals

- Urates salts of sodium, potassium and calcium
- Having a granular appearance
- Present in urine as non crystalline amorphous forms.
- No clinical significance

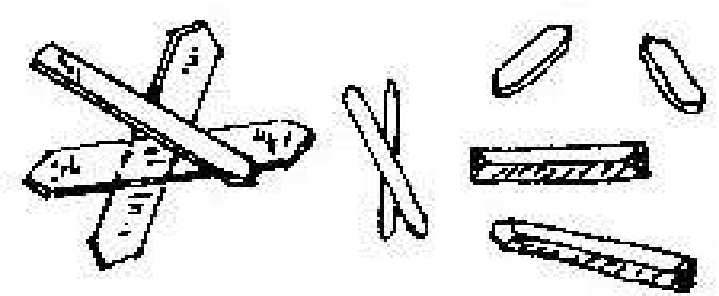


Microscopic Examination- Urine Cytology

C- Crystals

Hippuric Acid Crystals

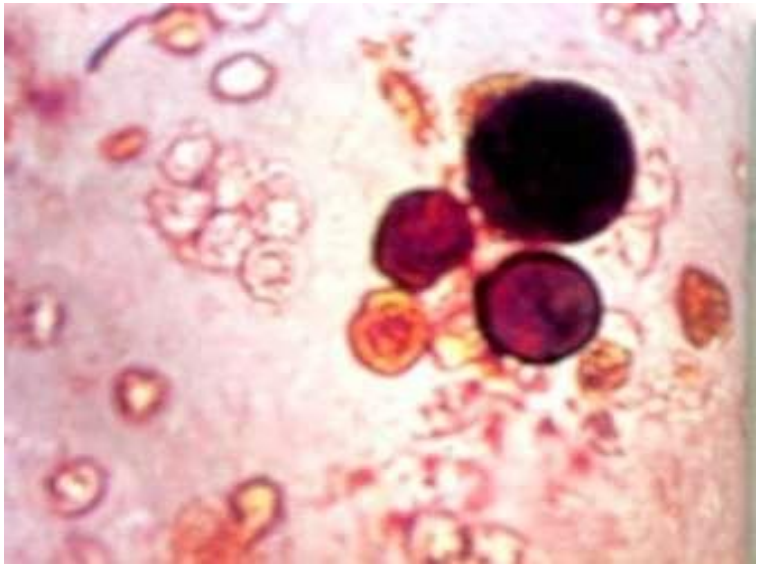
- Elongated prism like.
- Rarely seen in urine.
- No clinical significance.



Hippuric acid

Leucine Crystals

- Highly refractile having spheroid with radical and concentric striations.
- Clinically very significant.
- Maple syrup disease
- Serious liver disease



Microscopic Examination- Urine Cytology

C- Crystals

Tyrosine Crystals

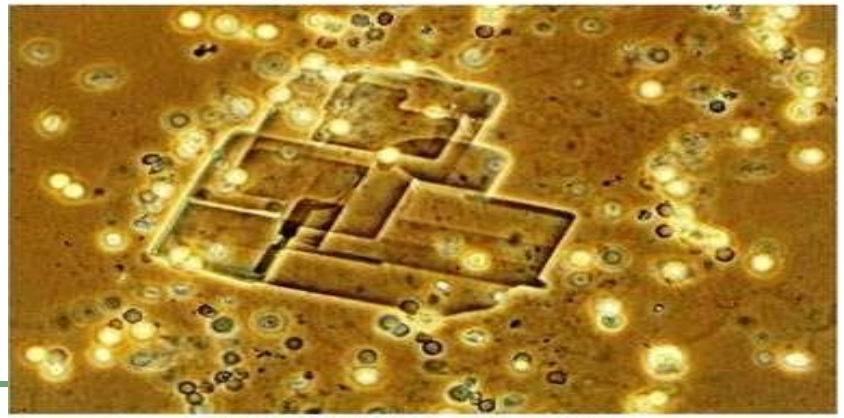
- Very fine needle likes occurring
- in sheaves or clusters.

Found in

- Severe liver disease
- Tyrosinosis

Cholesterol Crystals

- Large or flat plates with notched corners
- Presence of excessive in urine indicates tissue breakdown



CHOLESTEROL CRYSTAL

Microscopic Examination- Urine Cytology

C- Crystals

Sulpha Drug Crystals

- Precipitate as sheets of needles usually with eccentric binding
- May be history of sulfa drugs medication

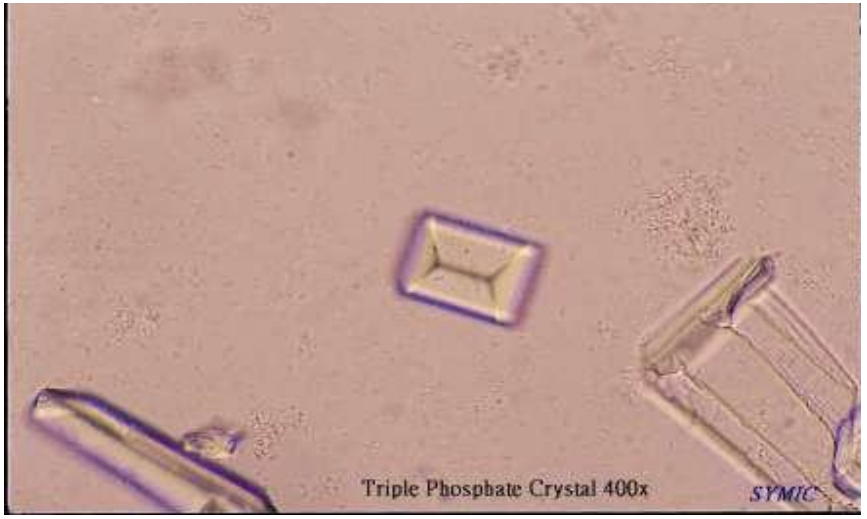
Microscopic Examination- Urine Cytology

C- Crystals

Crystals in Alkaline Urine

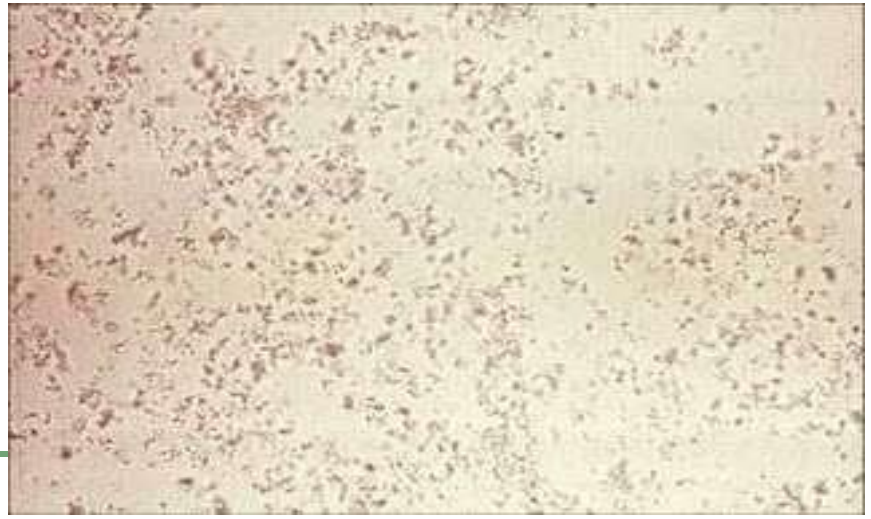
1-Triple phosphates crystals-

- Prism like with three to six sides
- Frequently found in normal Urine
- Found in Chronic pyelitis, cystitis, enlarged prostate



2- Amorphous phosphates crystals

- Granular particles with no definite shape
- No clinical significance



Microscopic Examination- Urine Cytology

C- Crystals

Crystals in Alkaline Urine

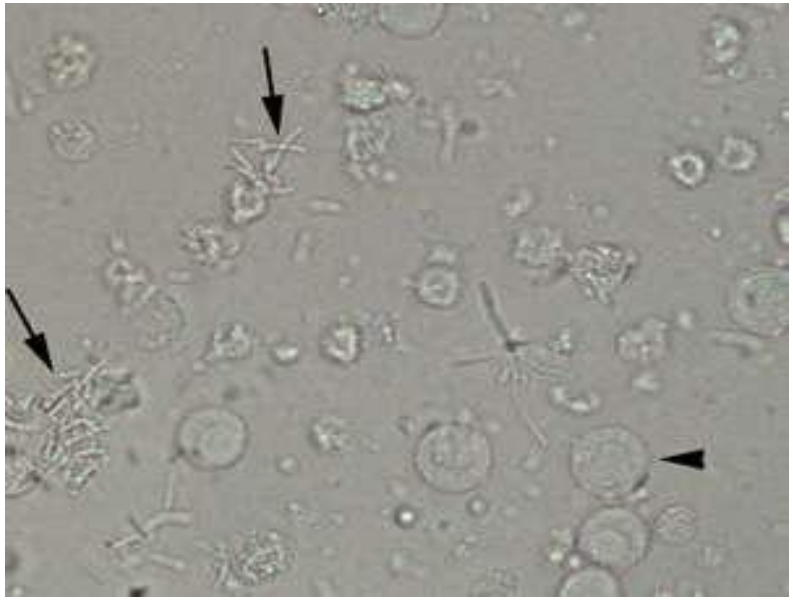
3-Calcium Carbonate crystals

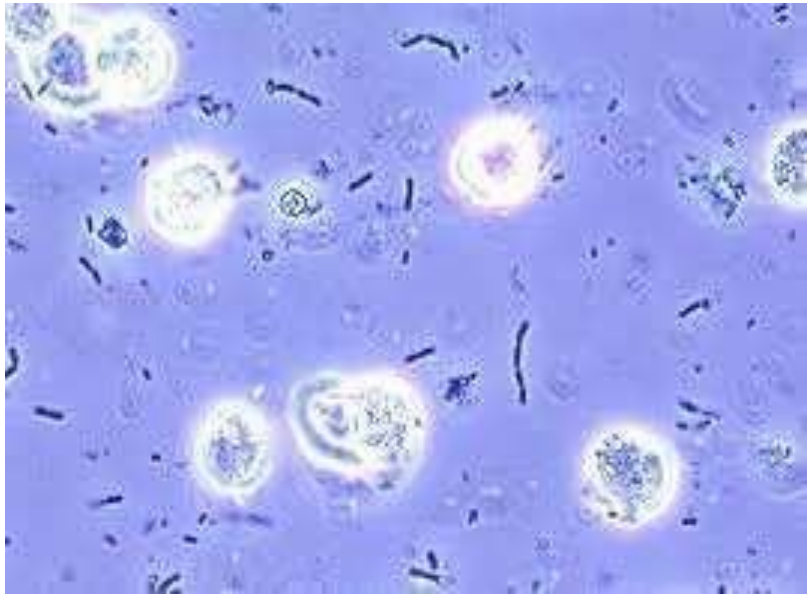
- Appearing as dumbbell or spherical or large granular mass.
- No clinical significance.

Microscopic Examination- Urine Cytology

D- Bacteria

- When accompanied with white cells usually indicates UTI.
- Occurs as rod or chains or cocci.

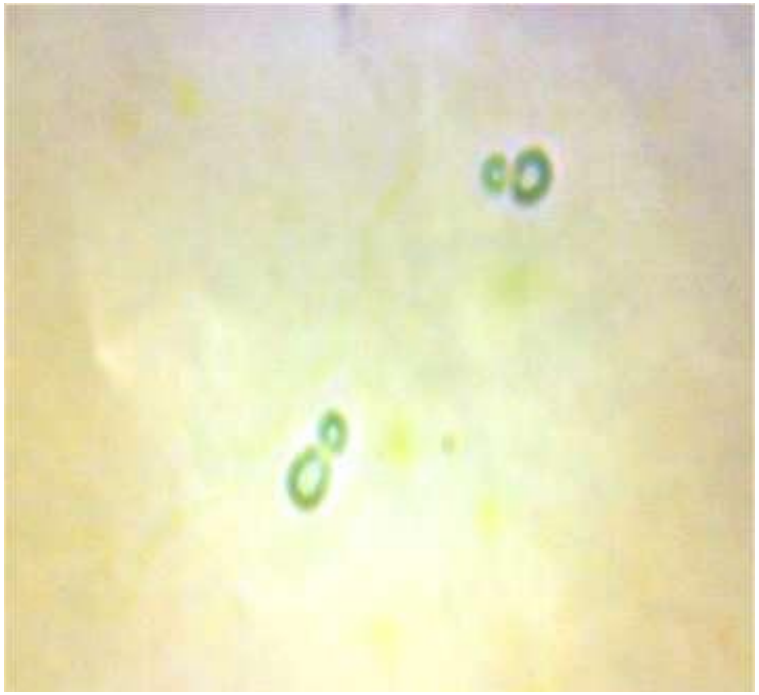


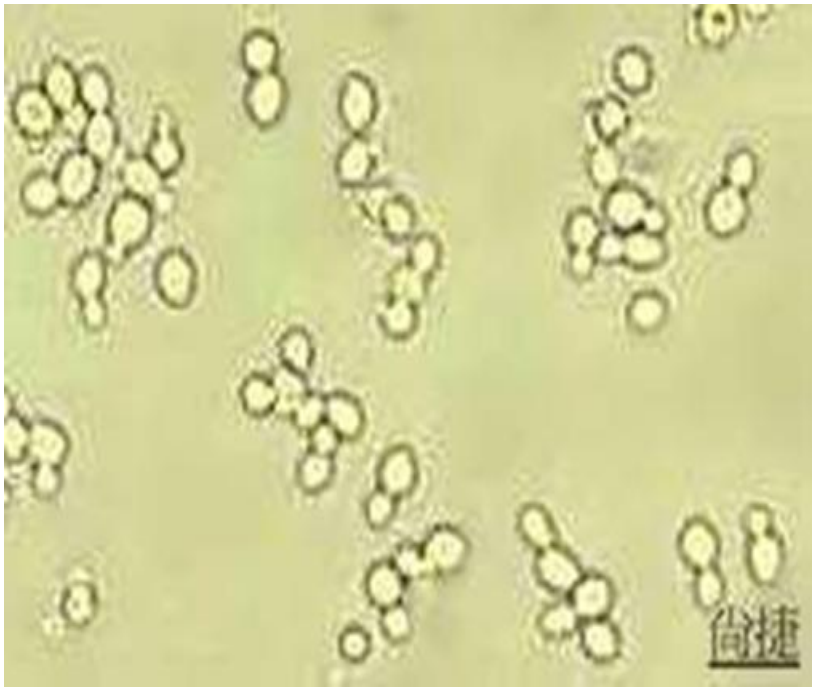


Microscopic Examination- Urine Cytology

E- Yeast

- Usually ovoid cells with budding.
- Not dissolve in 2% Acetic acid solution and not stained with Eosin.



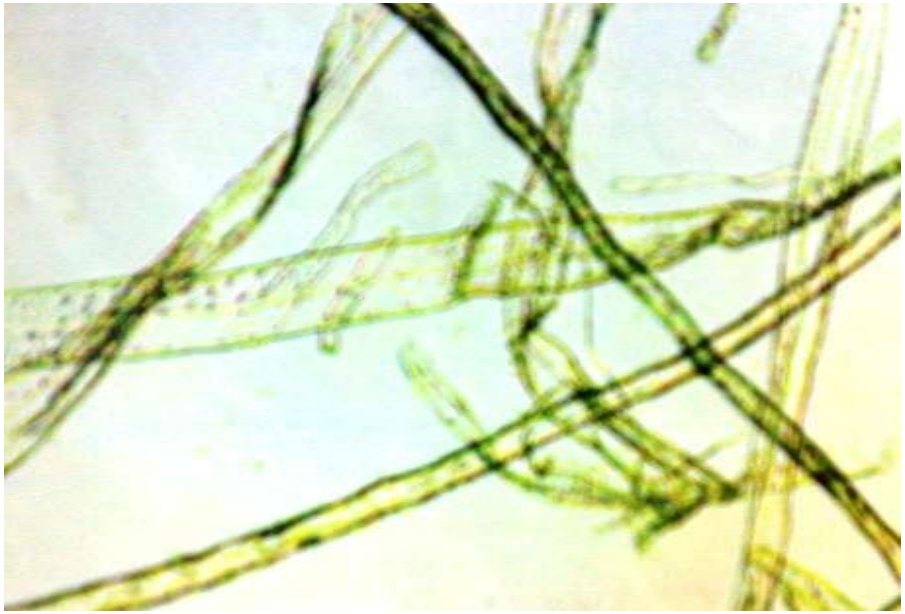


Microscopic Examination- Urine Cytology

F- Artifacts

Starch Crystal

Fibres



Microscopic Examination- Urine Cytology

G- Parasites

Enterobius vermicularis

Schistosoma haematobium

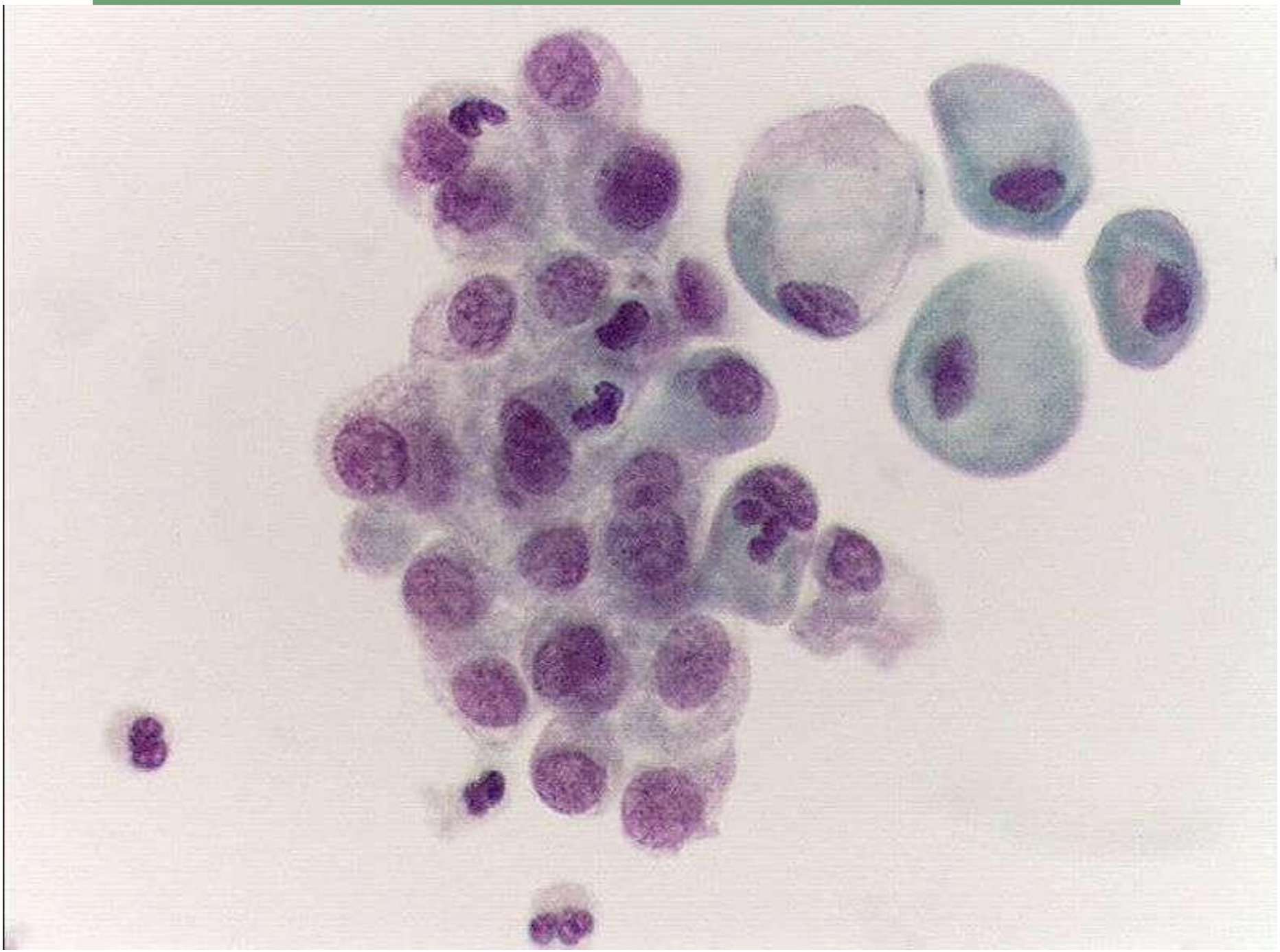
Microscopic Examination- Urine Cytology

H- Malignancy

- Urinary bladder
- Renal pelvis
- Kidney
- Ureter
- Adjacent organs.

Types

- Low grade papillary tumours.
- High grade papillary tumours



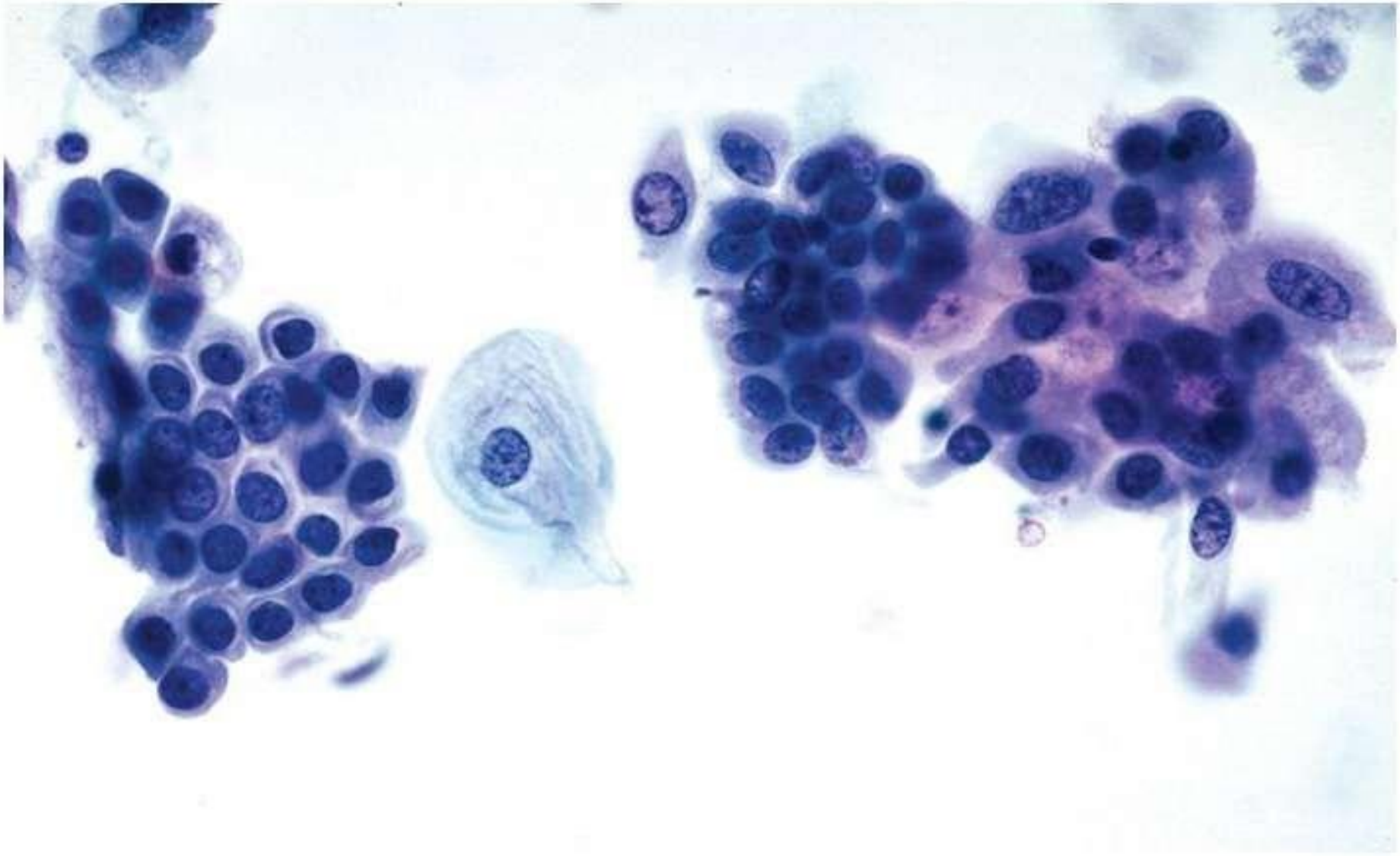


Figure 23-18C Various aspects of low-grade papillary tumors (tumors with low malignant potential) in voided urine sediment. Comparison between two clusters of urothelial cells, one showing normal configuration (left) and one showing slight nuclear enlargement and hyperchromasia (right). (*A–C:* High magnification.)

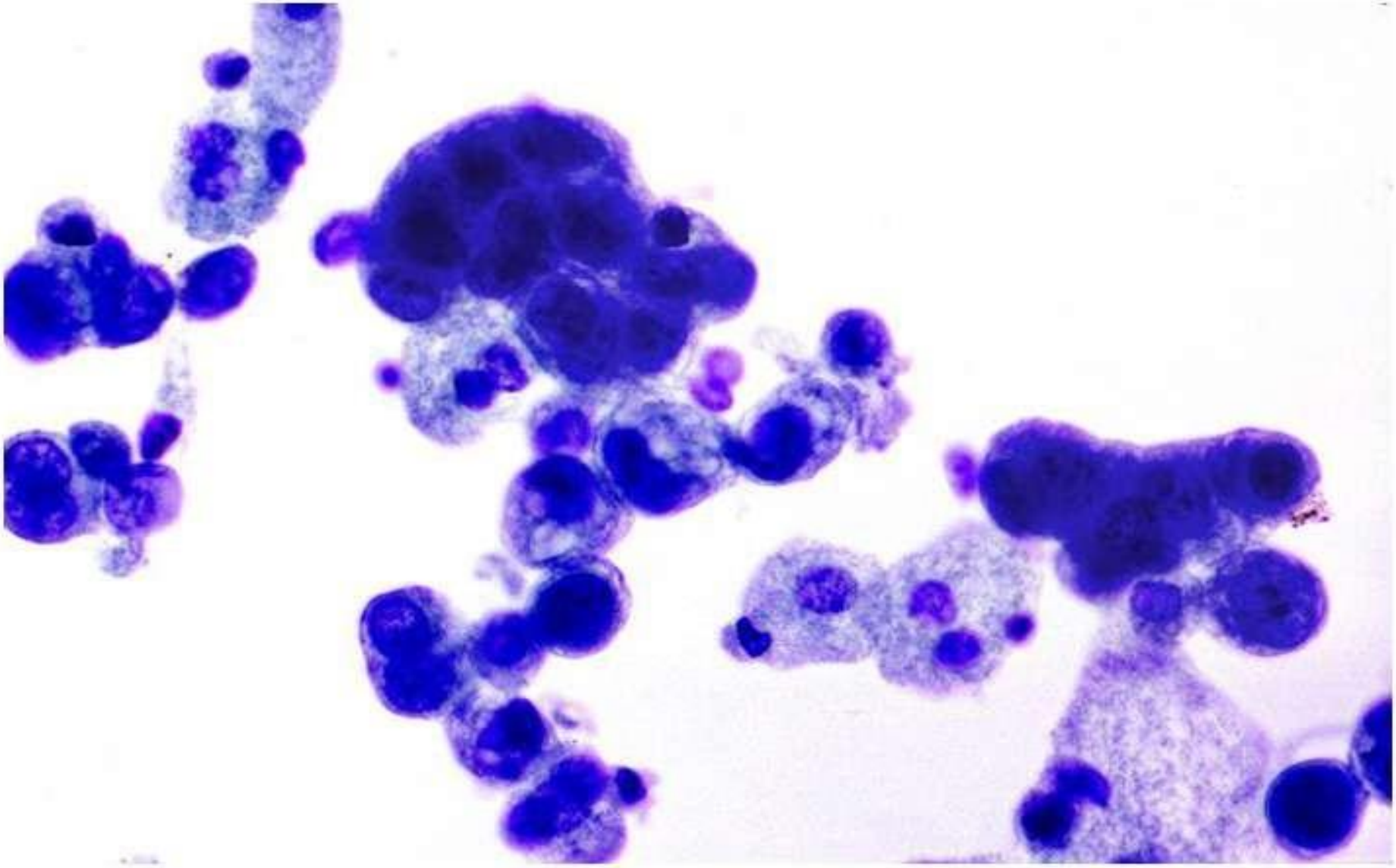


Figure 23-14B Cancer cells in urinary sediment. Cancer cells, appearing singly and in clusters, in voided urine sediment (ThinPrep).

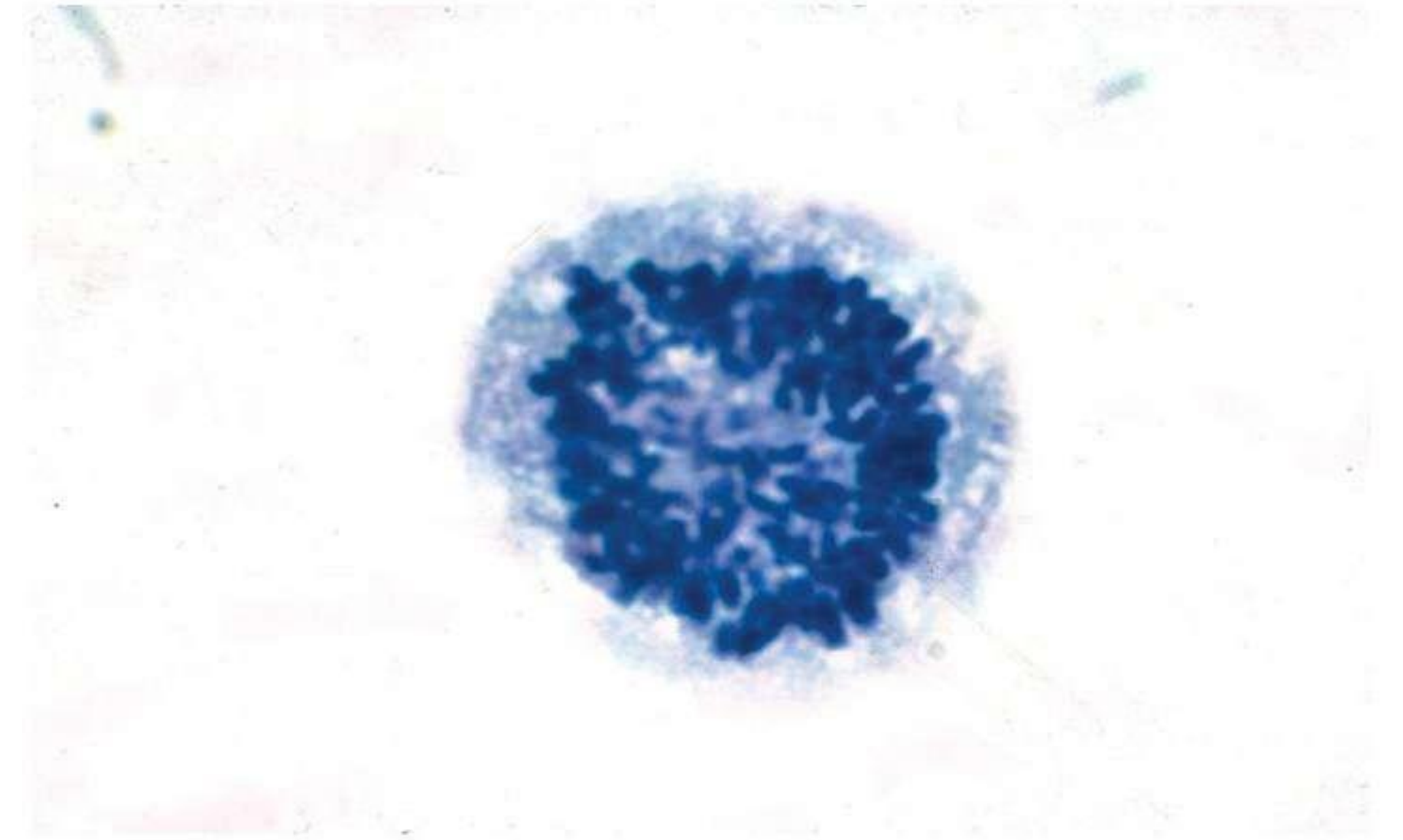


Figure 7-23D Mitotic abnormalities in cancer cells. Carcinoma of bladder, voided urine sediment with a tumor cell metaphase containing numerous chromosomes. (*A,B*: High magnification; *D*: oil immersion.) (*A* and *B* Courtesy of Dr. Carlos Rodriguez, TucumaAAn, Argentina.)

Figure 33-10 Prostatic carcinoma in voided urine. A small cluster of small cancer cells with relatively large, hyperchromatic nuclei. The details of the nuclear structure are not visible. The prostatic origin of the cluster is not secure.

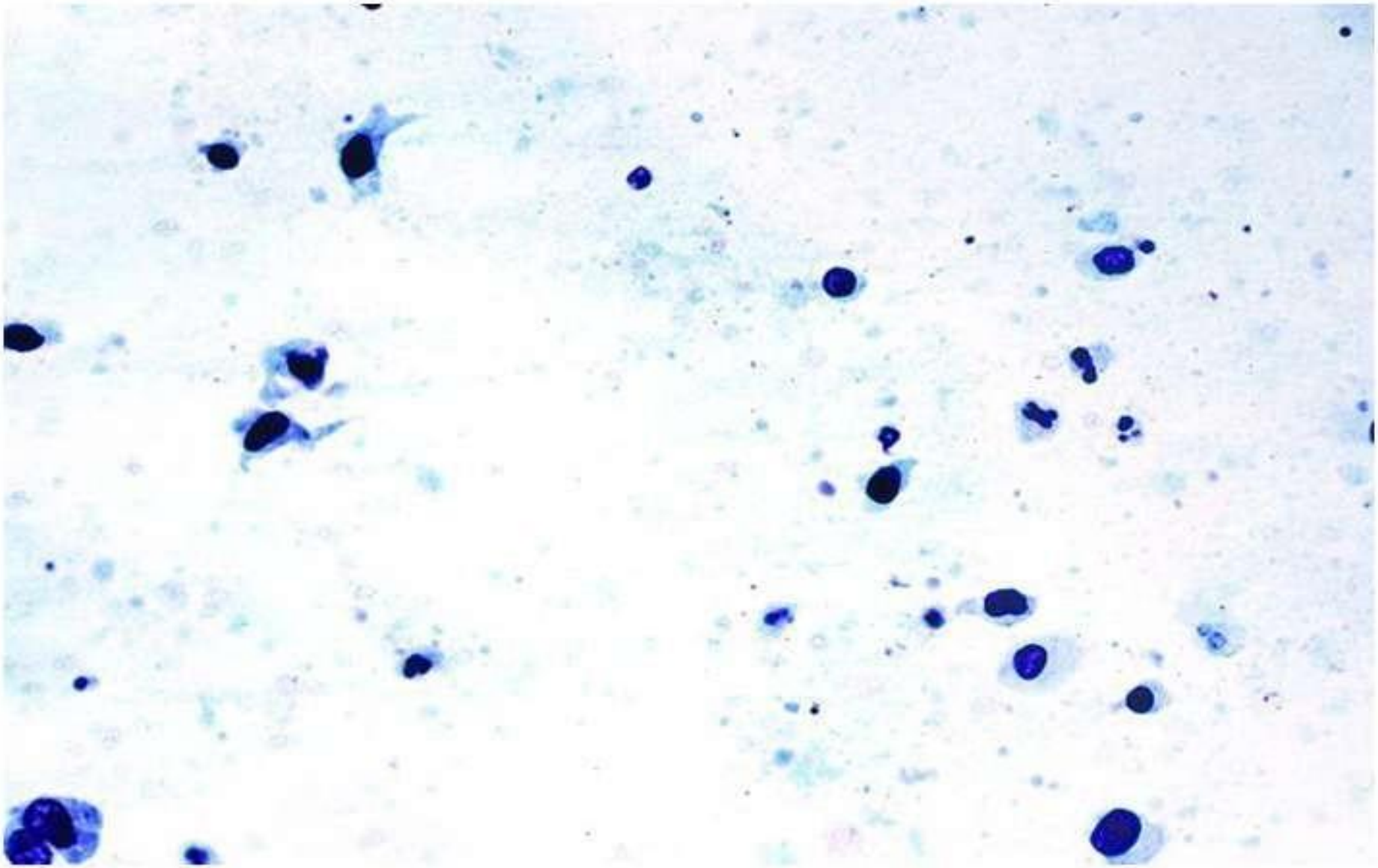


Figure 23-40C Renal pelvic carcinoma. Voided urine sediment (scanning power) containing small cancer cells corresponding to the tumor of renal pelvis shown in *D*.

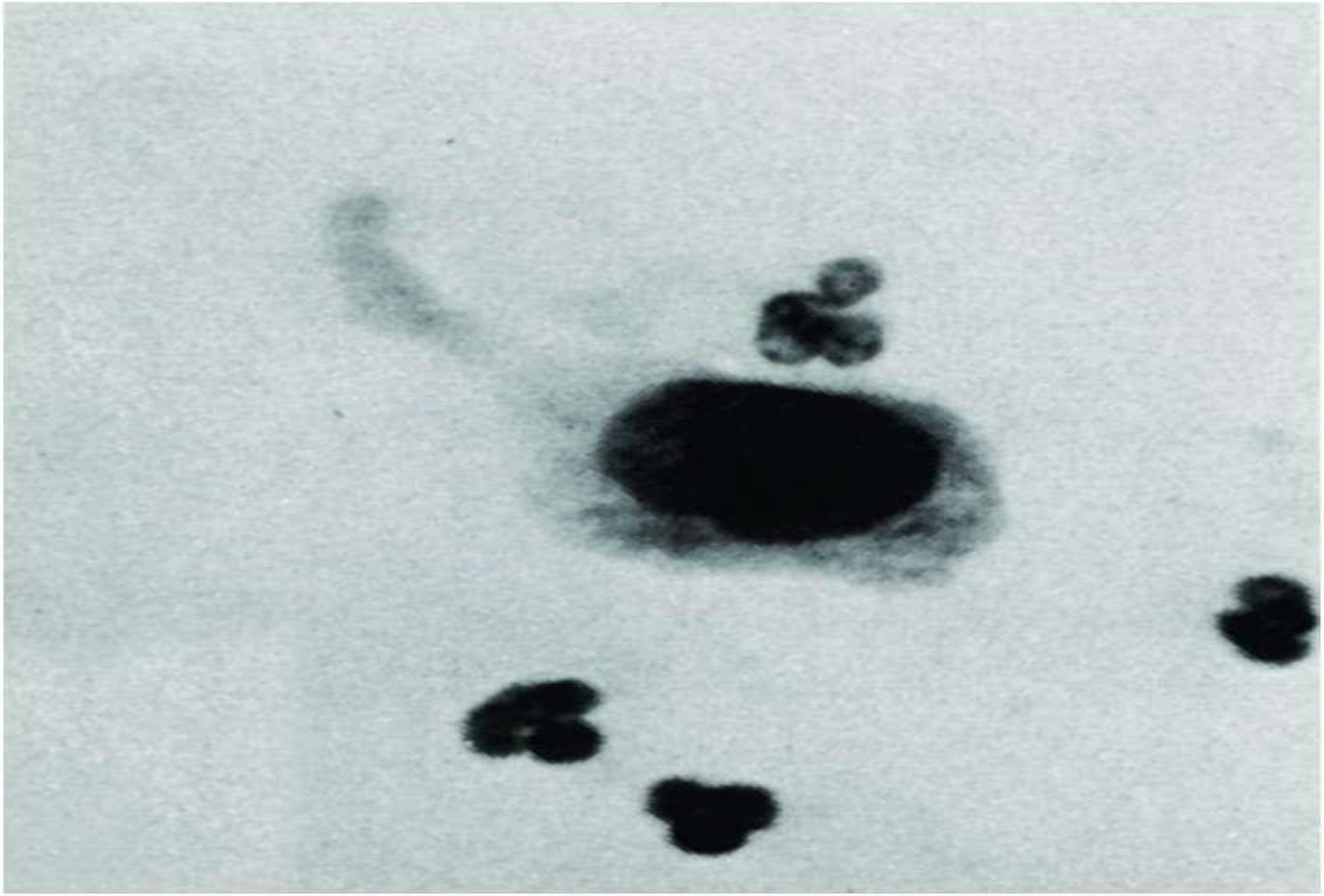


Figure 23-38A Choriocarcinoma of urinary bladder, accompanied by a flat carcinoma in situ (not shown). Cancer cells in voided urine resembling cells of urothelial carcinoma.


Thank
You