

# HEMATURIA



Salim SATAR, MD.

Adana Numune Education and Research Hospital

Department of Emergency Medicine

Adana, Turkey

# Definition

Hematuria is defined as the abnormal presence of red blood cells in the urine

Two types of hematuria:

- \***Gross:** 1 mL of blood in 1 L of urine

- \***Microscopic:** 3 RBCs/HPF on microscopic examination



# Causes of Hematuria

## Renal

### Glomerular

- Thin basement membrane disease
- IgA nephropathy
- Alport's syndrome
- Other glomerulonephritides

### Nonglomerular

- Polycystic kidney disease
- Medullary sponge kidney
- Papillary necrosis
- Pyelonephritis
- Sickle cell disease
- Renal cell carcinoma
- Renal vascular disease

## Extrarenal

### *Upper urinary tract*

- Nephrolithiasis
- Ureteral cancer

### *Lower urinary tract*

- Cystitis
- Bladder cancer
- Bladder stones
- Prostate cancer
- Schistosomiasis

### **Other**

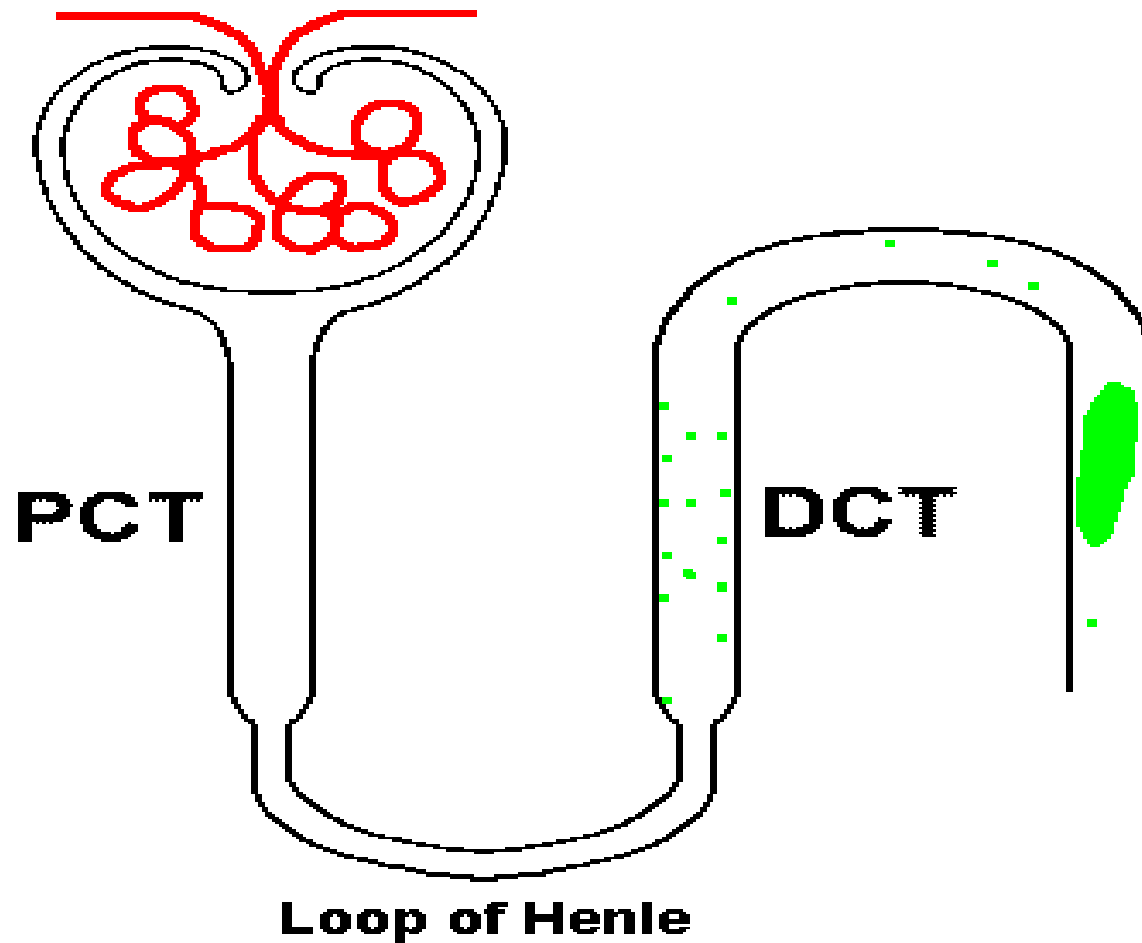
- Vigorous exercise
- Coagulation related
- Factitious
- False hematuria
- Trauma

# Prevalance

- Prevalence of asymptomatic hematuria in adults varies widely.
- Rates of less than 1% to as high as 16%.

# Pathophysiology

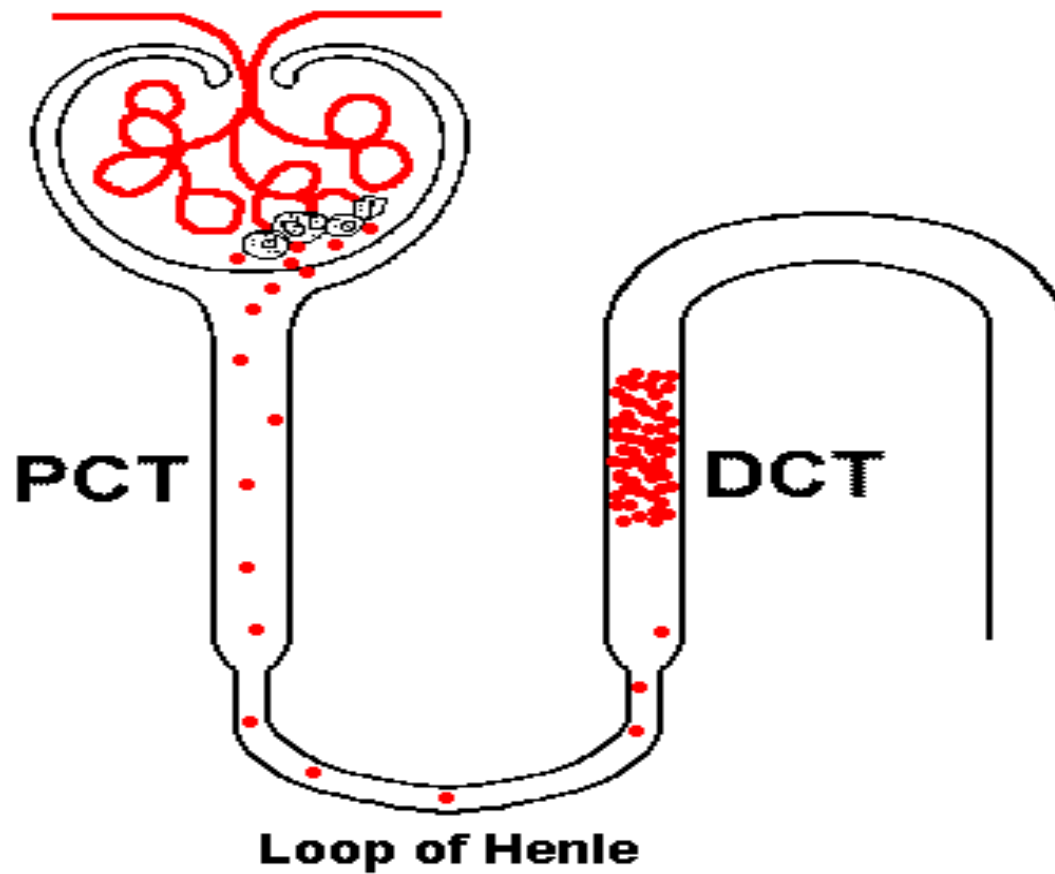
- It depends on the anatomic site in the urinary tract from which blood loss occurs.
- A distinction has conventionally been drawn between glomerular and extraglomerular bleeding.
- Blood originating from the nephron is termed *glomerular* or *nephronal hematuria*.
- RBCs can enter the urinary space from the glomerulus or, rarely, from the renal tubule.
- RBCs can be trapped in Tamm-Horsfall mucoprotein and will be manifest in the urine by RBC casts.
- Finding casts in the urine represents significant disease at the glomerular level.



Urinary casts are formed only in the distal convoluted tubule (DCT) or the collecting duct (distal nephron).

The proximal convoluted tubule (PCT) and loop of Henle are not locations for cast formation.

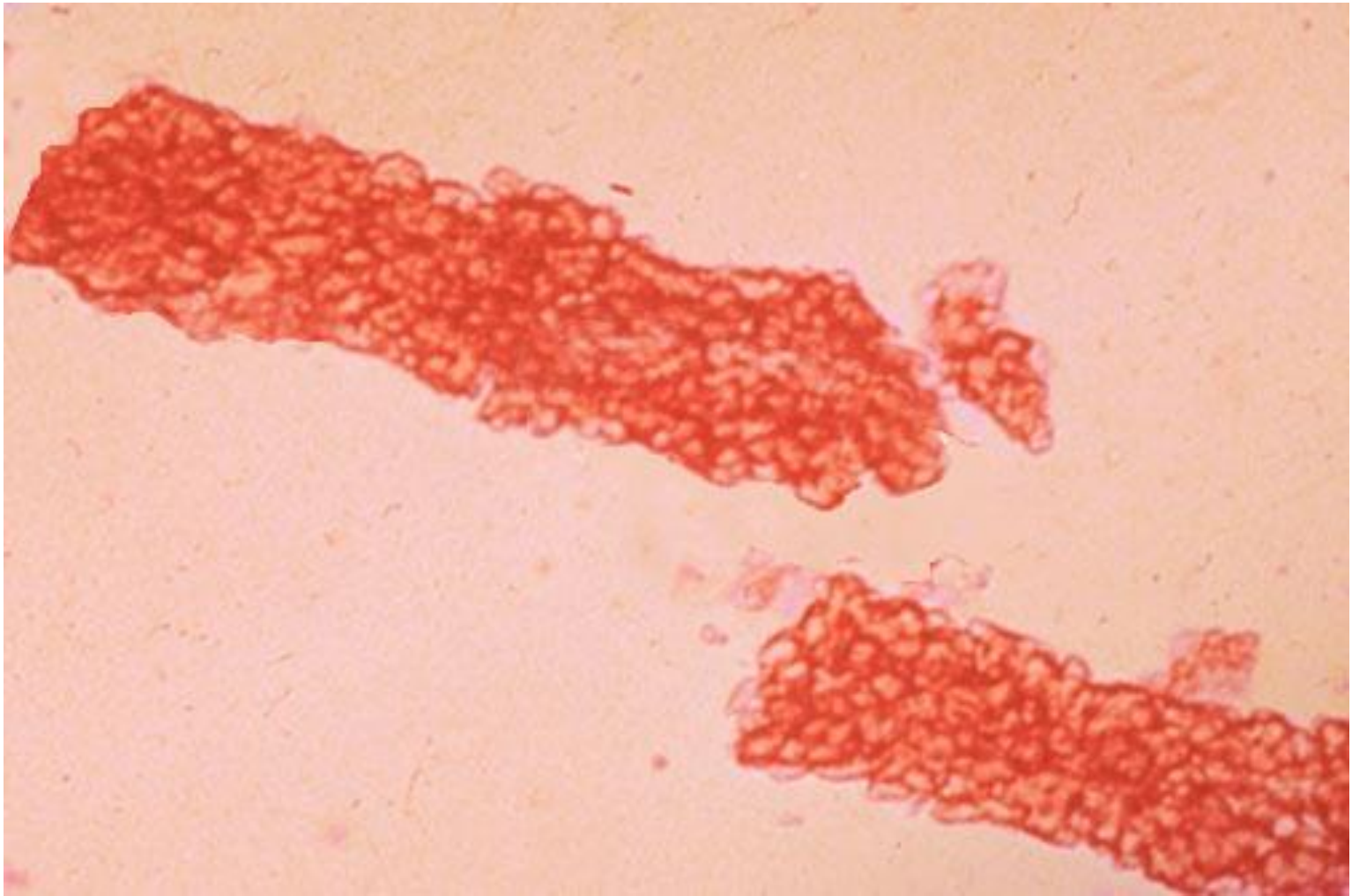
Hyaline casts are composed primarily of a mucoprotein (Tamm-Horsfall protein) secreted by tubule cells.



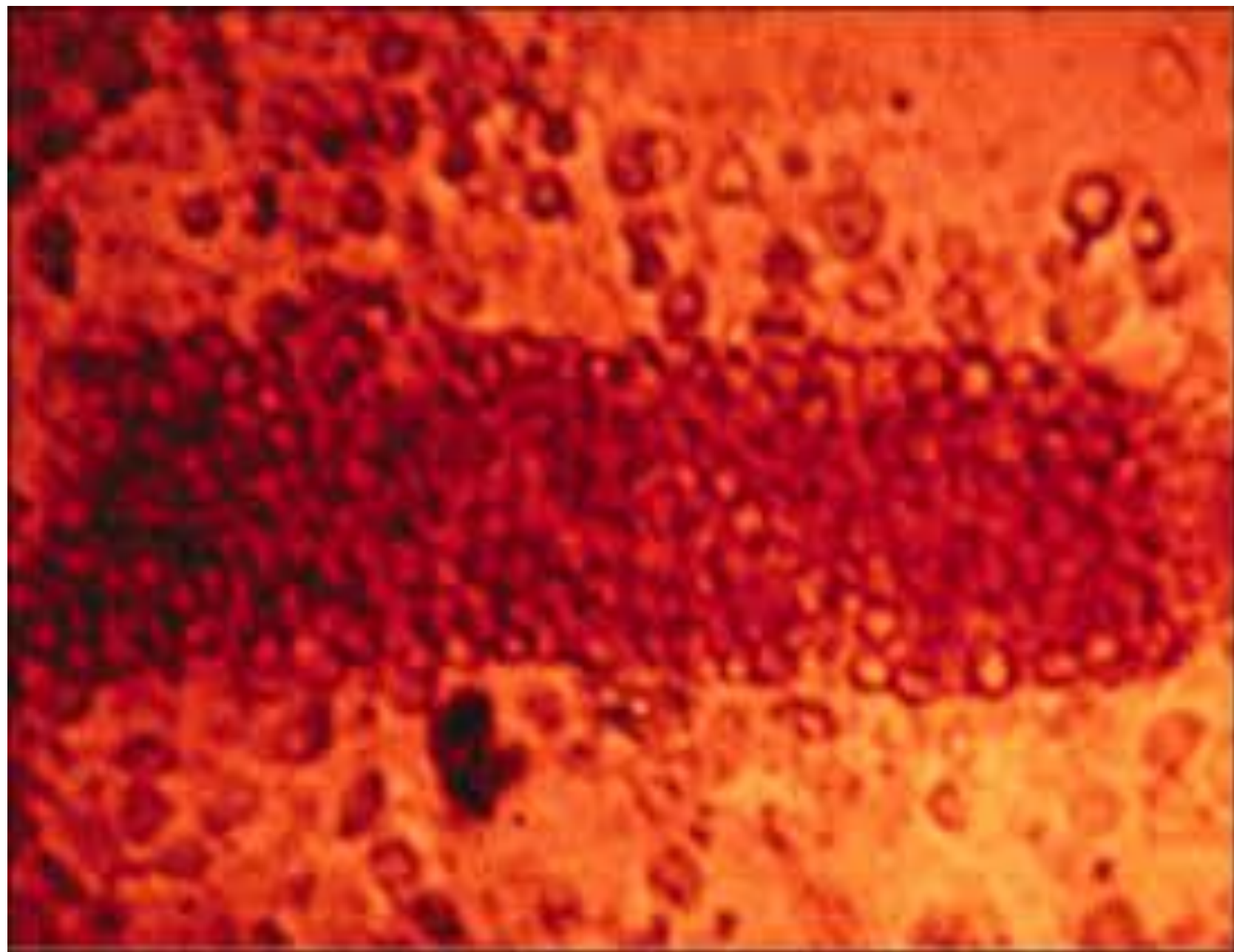
Glomerular injury causing increased glomerular permeability to plasma proteins with resulting proteinuria, most matrix or "glue" that cements urinary casts together is Tamm-Horsfall mucoprotein, although albumin and some globulins are also incorporated.

# Pathophysiology

- Hematuria without proteinuria or casts is termed *isolated hematuria*.
- This is more consistent with extraglomerular bleeding.
- Anything that disrupts the uroepithelium, can result in normal-appearing RBCs in the urine.
- Nonglomerular renal causes of blood loss, can cause blood loss into the urinary space.



RBC cast in on urine microscopic analysis suggests a glomerular or renal tubular injury



# Extraglomerular vs Glomerular

	<b>Extraglomerular</b>	<b>Glomerular</b>
Color	Red or pink	Red, smoky brown, or "Coca-Cola"
Clots	May be present	Absent
Proteinuria	<500 mg/day	May be >500 mg/day
RBC morphology	Normal	Dysmorphic
RBC casts	Absent	May be present

# Evaluation

## Age and Hematuria

Age (yr)	Common	Uncommon
0 to 15	Glomerulopathy (IgA, Alport's syndrome, thin BM disease, APSGN) Hypercalciuria with stones Congenital obstructive anomalies UTIs Sickle cell disease Viral infection	Factitious Fever HUS Hemophilia HSP Schistosomiasis
15-50	Calculi Menstrual contamination Exercise UTIs PKD Sickle cell disease Papillary necrosis	AVMs or fistulae DIC Goodpasture's syndrome Loin pain-hematuria syndrome Renal infarction Renal vein thrombosis Schistosomiasis Medullary sponge kidney
>50	BPH Cancer (renal, ureteral, bladder, prostate) Over anticoagulation PKD Prostatitis	AVMs or fistulae Cyclic hematuria in women Endometriosis TTP Renal vein thrombosis Toxins

# Evaluation

When does the blood appear during urination ?

- at the start of urination suggests a problem in the urethra distal to the urogenital diaphragm
- throughout urination suggests upper urinary tract or upper bladder disease
- at the end of urination suggests a problem in the bladder neck or the prostatic urethra
- In woman, if menstruating

# Evaluation

Do you have to urinate often? Does it hurt?

- increased frequency and dysuria, may point to a urinary tract infection or uroepithelial malignancy
- colicky pain suggests a stone
- without pain suggests something other than nephrolithiasis, infection, or papillary necrosis

# Evaluation

Have you lost weight or been sick?

- weight loss, extrarenal manifestations suggest a variety of systemic illnesses,
- recent sore throat or skin infection is consistent with poststreptococcal glomerulonephritis

# Evaluation

Do you take any medications?

- many drugs can cause either hematuria or discoloration of the urine
- heavy or surreptitious use of analgesics may be associated with analgesic nephropathy
- use of oral contraceptives has been associated with loin-pain hematuria syndrome
- bladder cancer treated with cyclophosphamide

# Evaluation

Family history, travel history?

- any history of hematuria, sickle cell disease, polycystic kidney disease, or other renal disease
- travel to areas where schistosomiasis or malaria is endemic.

# Laboratory

- Many urine specimens are first tested by dipstick
- Dipstick records a reaction between hydrogen peroxide and chromagen; catalyzed by hemoglobin
- This reaction results in a green color change of the chromagen
- The sensitivity to detect hematuria of more than 3 RBCs/HPF is more than 90%.
- Many factors can result in false-positive and false-negative results
  - vitamin C ingestion
  - urine pH lower than 5.1
  - prolonged exposure to air
  - contamination of t with menstrual blood
  - myoglobinuria, and bacterial peroxidases

# Causes of Heme-Negative Red Urine

## **Medications**

Doxorubicin

Chloroquine

Deferoxamine

Ibuprofen

Iron sorbitol

Nitrofurantoin

Phenazopyridine

Phenolphthalein

Rifampin

## **Food dyes**

Beets

Blackberries

Food coloring

## **Metabolites**

Bile pigments

Homogentisic acid

Melanin

Methemoglobin

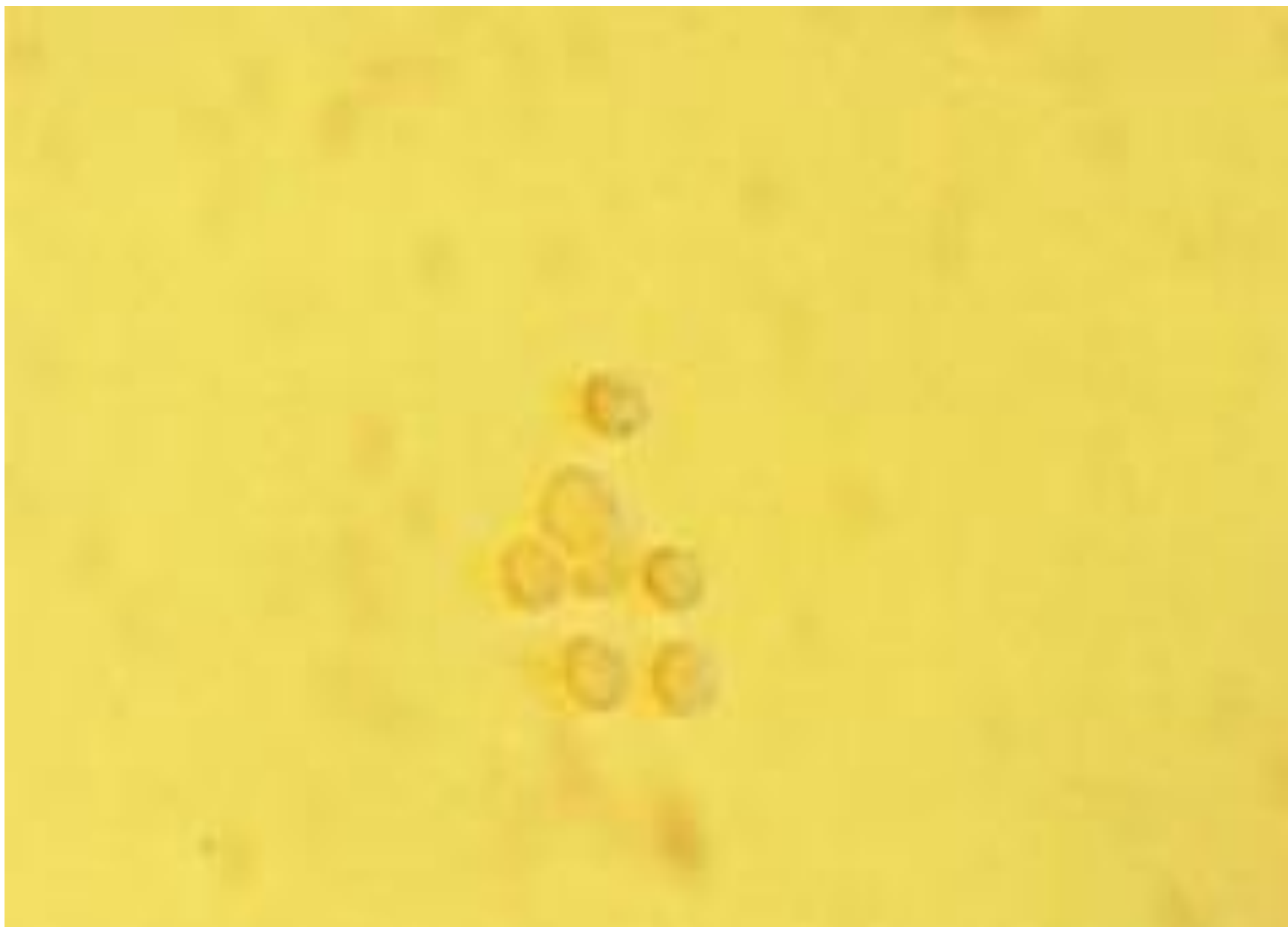
Porphyrin

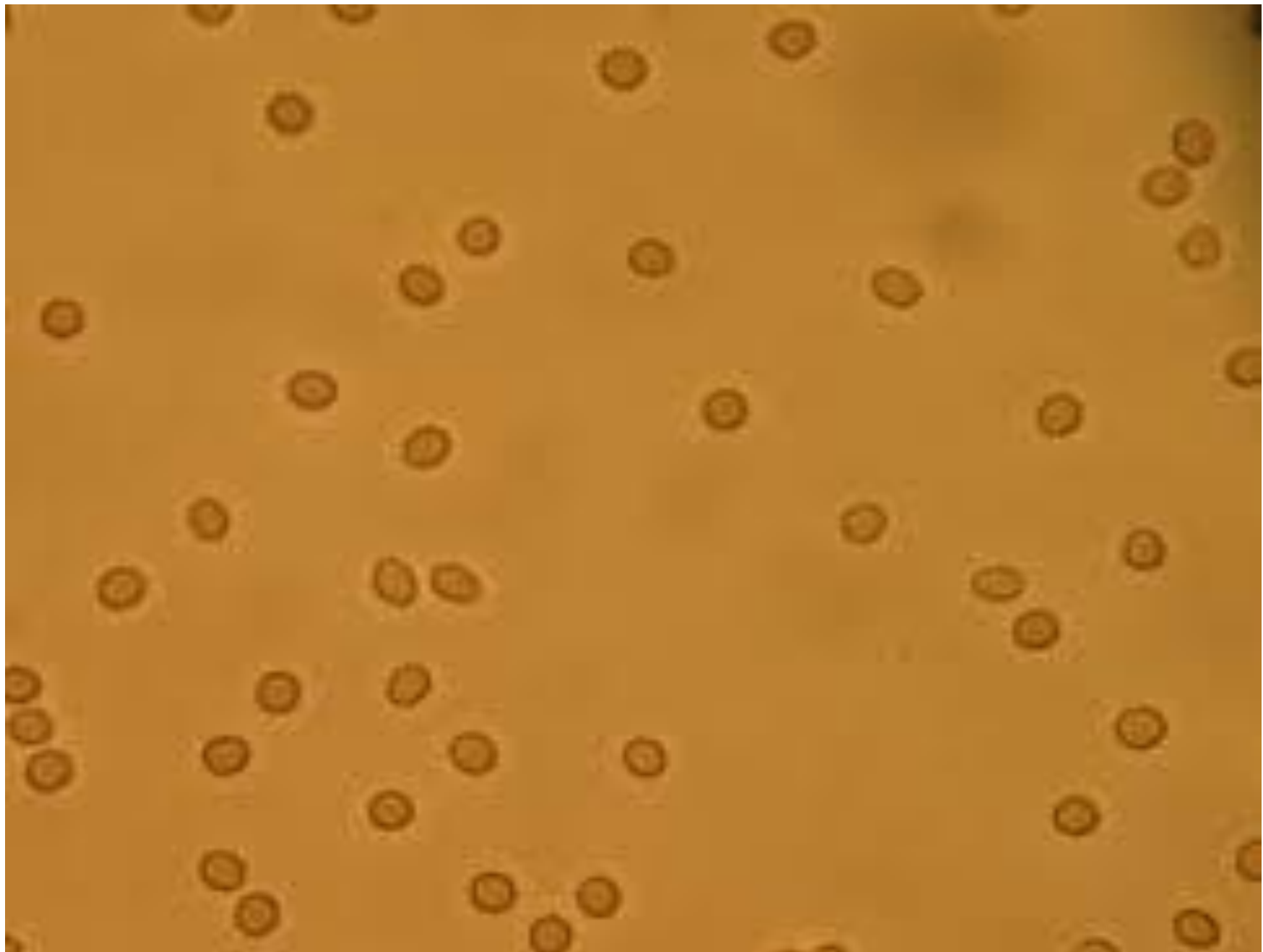
Tyrosinosis

Urates

# Laboratory

- dysmorphic red blood cells may be detected with phase-contrast microscopy.
- > 20% of cells are dysmorphic, suggests a glomerular origin of the bleeding.
- red blood cell casts, which are usually diagnostic of glomerulonephritis.
- pyuria with hematuria necessitates testing to rule out urinary tract infection



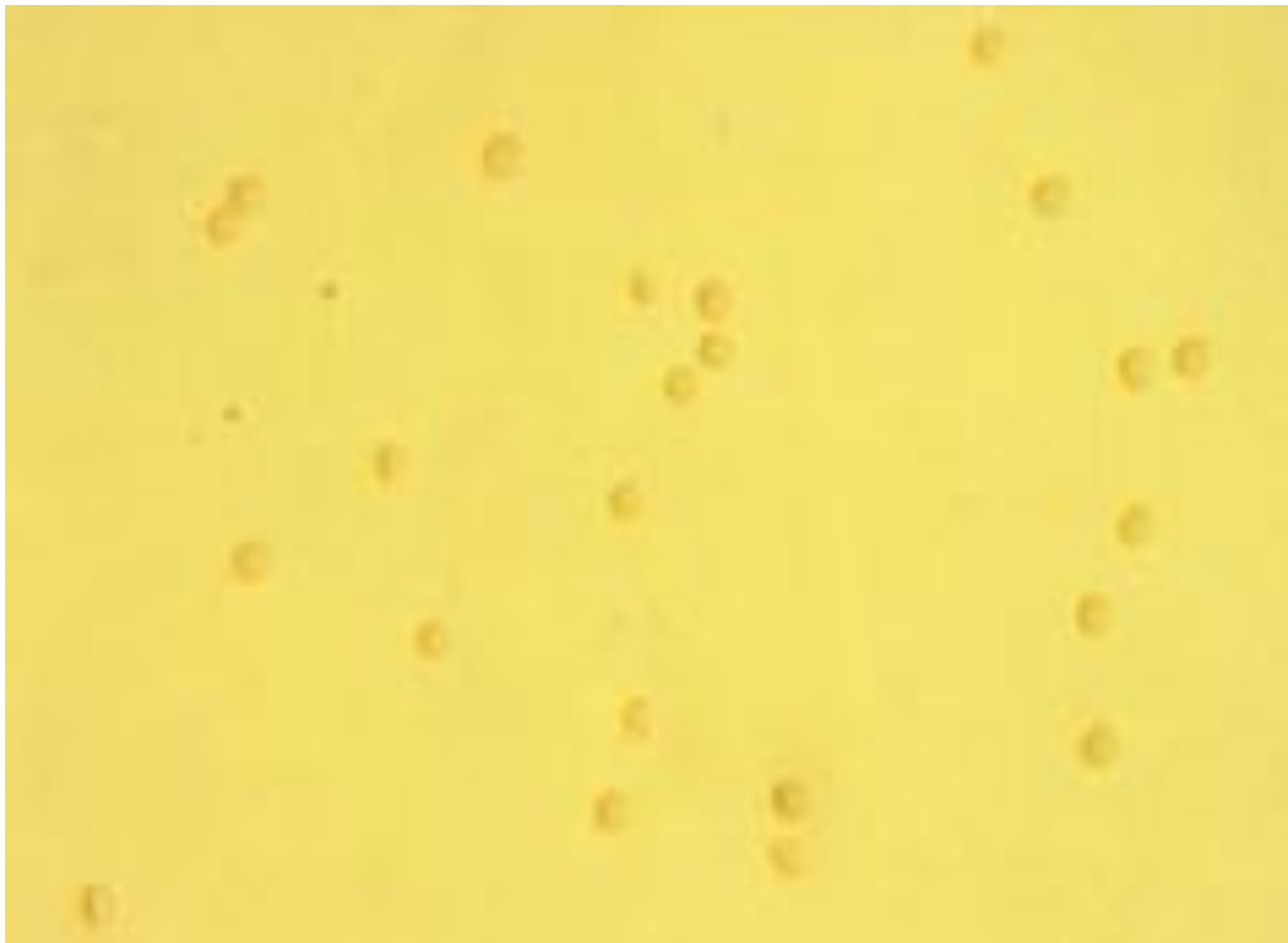


# Laboratory

Hematuria without formed elements or proteinuria is called “isolated hematuria”.

- Tests for a bleeding diathesis
- Voiding urinary cytologic testing





# Radiologic and Other Tests for the Evaluation of Hematuria

Test		Advantages	Disadvantages
Intravenous pyelogram (IVP)	Excellent visualization of the kidney, collecting system, and ureter		May miss bladder lesions; can cause nephrotoxicity, idiosyncratic reactions (1/10,000)
Cystoscopy	Best way to examine the bladder, which is not as well visualized by IVP or ultrasound		Invasive, uncomfortable and expensive
Ultrasound	If of good quality, as sensitive as IVP for renal lesions, with less morbidity and cost		Less sensitive than IVP for ureter and bladder
Retrograde pyelography	The best test for examining the ureters, can be combined with cystoscopy		Invasive, not useful for examining other parts of the urinary collecting system
Urinary cytology	Sensitivity 67 percent, specificity 96 percent for uroepithelial cancer		Useful only for cancer, mainly of the bladder
CT scan	Excellent for examining the renal parenchyma		Expensive
Angiography	Useful for gross hematuria when other tests have not revealed the cause; the only good test for vascular malformations		Invasive, expensive

# Risk Factors for Significant Disease in Patients With Microscopic Hematuria

- Smoking history
- Occupational exposure to chemicals or dyes (e.g., benzenes, aromatic amines)
- Age older than 40 years
- History of urologic disorder or disease
- History of irritative voiding symptoms
- History of urinary tract infection
- Analgesic abuse
- History of pelvic irradiation

# Conclusion

- Microscopic and macroscopic hematuria may represent serious underlying disease.
- Gross hematuria needs full evaluation.
- Microhematuria needs confirmation as it can be intermittent.
- Hematuria can be divided into glomerular and extraglomerular (nephrologic and urologic) diseases.
- The presence of proteinuria and red cell casts suggests glomerular involvement.
- The presence of clots suggests urologic involvement.

# Conclusion

- 45% of cases are attributed to infection and nephrolithiasis.
- Evidence of renal parenchymal disease should prompt nephrology referral.
- The frequency of significant urologic disease found in patients without renal parenchymal disease, infection, or stones
- Increases with age, with a predominance in men.
- Most patients with an initial negative workup should have follow-up, specially if in a high-risk population.

Thank you