

Approach to Hematuria



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URINE COLOR



Very good



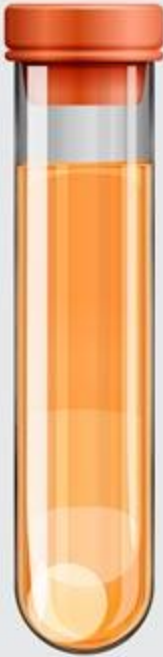
Good



Fair



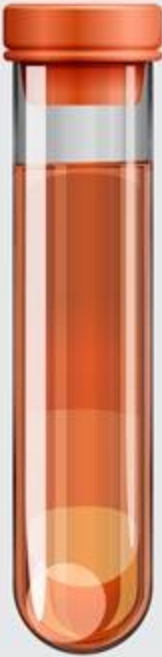
Light Dehydrated



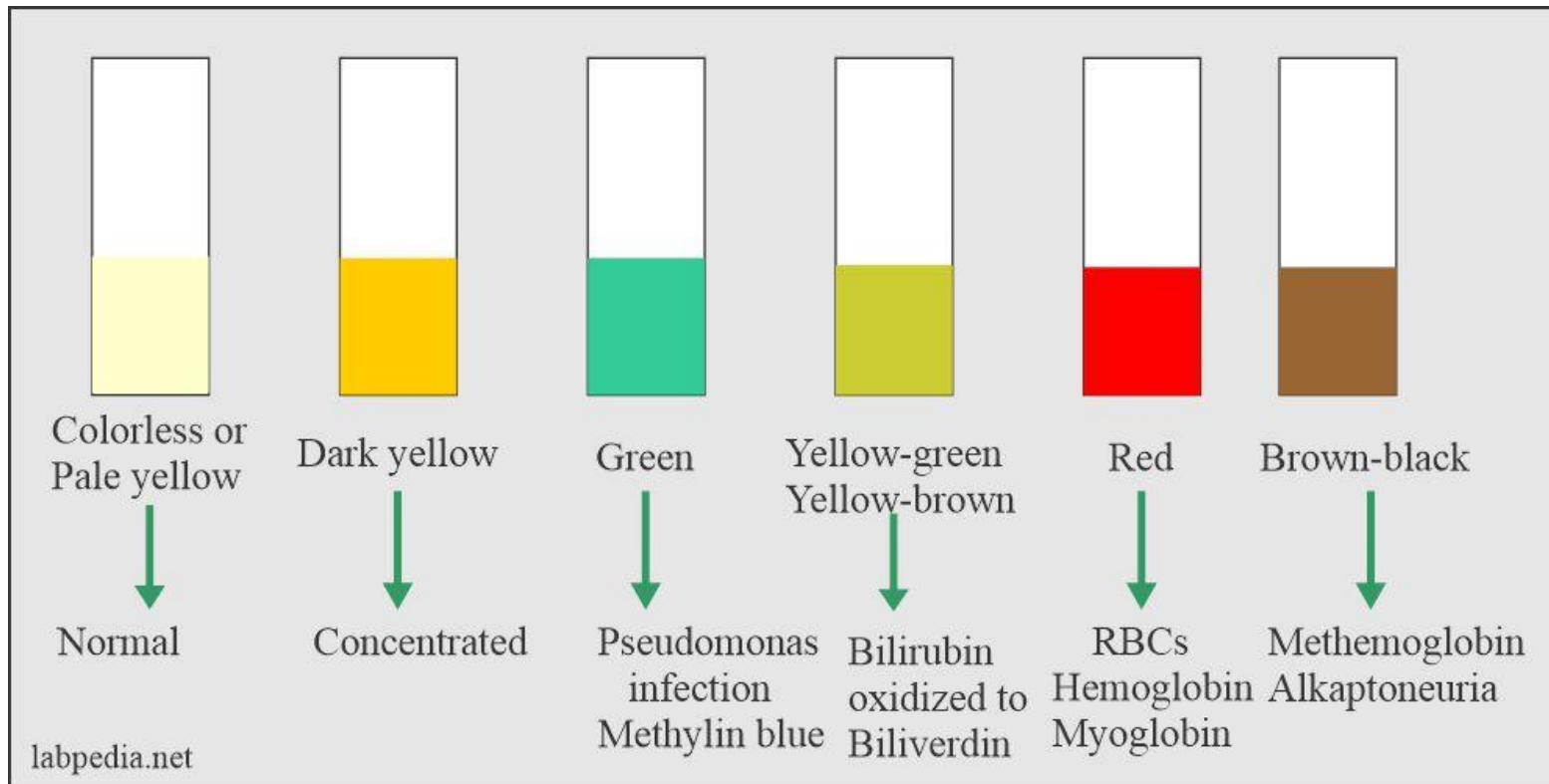
Dehydrated



very Dehydrated



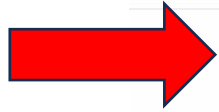
Severe Dehydrated





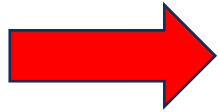
What is Hematuria?

The American Urologic Association (AUA) guideline panel defined hematuria as three or more RBCs/HPF.



According to the amount of RBC in the urine, hematuria can be classified as:

- Gross
- Microscopic



According to Timing (when it occurs during urination):

- **Early (initial) hematuria:** Urethral origin, distal to external Sphincter.
- **Terminal hematuria:** Bladder neck or prostate origin.
- **Diffuse (total) hematuria:** Source is in the bladder or upper urinary tract.



Hematuria types and Classification, cont.

According to its site of Origin, hematuria can be classified as:

- **Nephrologic:** arising from the kidney.
- **Urologic:** arising from the urinary drainage system.
- **Pseudo-hematuria:** arising from outside the urinary system (E.g. menstruation, inflammation from phimosis or balanitis).



Classification of Hematuria

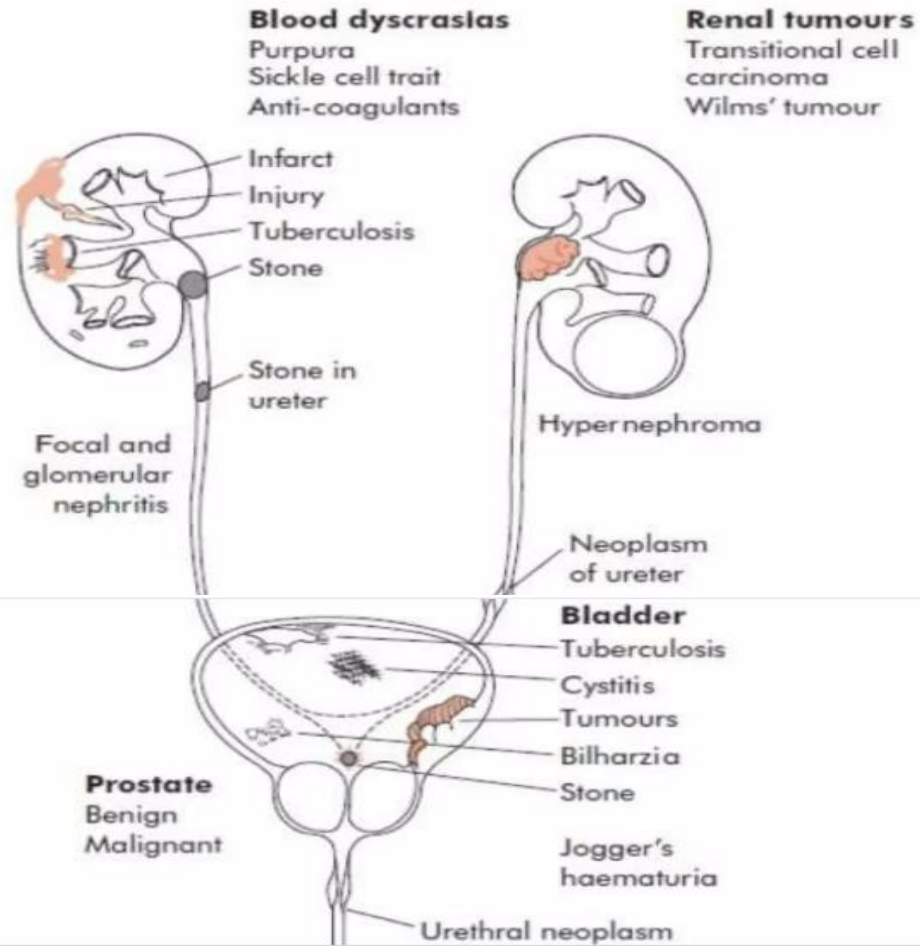
Hematu

Hematuria can be either:

- Painful or Painless.
- Gross or Microscopic.
- Initial, Terminal or Total.
- Transient/Intermittent or Persistent.
- Isolated or associated with proteinuria and other urinary abnormalities.
- Glomerular or Non-Glomerular.



Causes by Anatomical Location



Is that hematuria significant?

A single urine analysis with hematuria is common and can result from menstruation, recent heavy exercise, recent urologic procedure, sexual activity, and the use of agents that can produce red urine without blood.

A single urinalysis with >100 RBCs or gross hematuria is SIGNIFICANT.

Definition of Significant Hematuria

- As few as three red blood cells (RBCs) per hpf in a voided specimen from an adult male is considered significant.

PATHOPHYSIOLOGY OF HEMATURIA

- Any process that results in infection, inflammation, or injury to the kidneys, ureters, bladder, prostate, male genitalia, or urethra may result in hematuria.

IS HEMATURIA RED FLAG?



- Hematuria, whether microscopic or gross, is a red flag that demands careful evaluation and must not be ignored.
- It is the most common presenting sign of urinary tract cancer and parenchymal renal disease.

IS THAT REAL BLOOD?

- False hematuria occurs when the urine appears bloody but dipstick test results are negative for blood and there are no RBCs on microscopic evaluation.
- Free hemoglobin, myoglobin, or porphyrins in the urine result in a positive urine test strip reaction for blood.

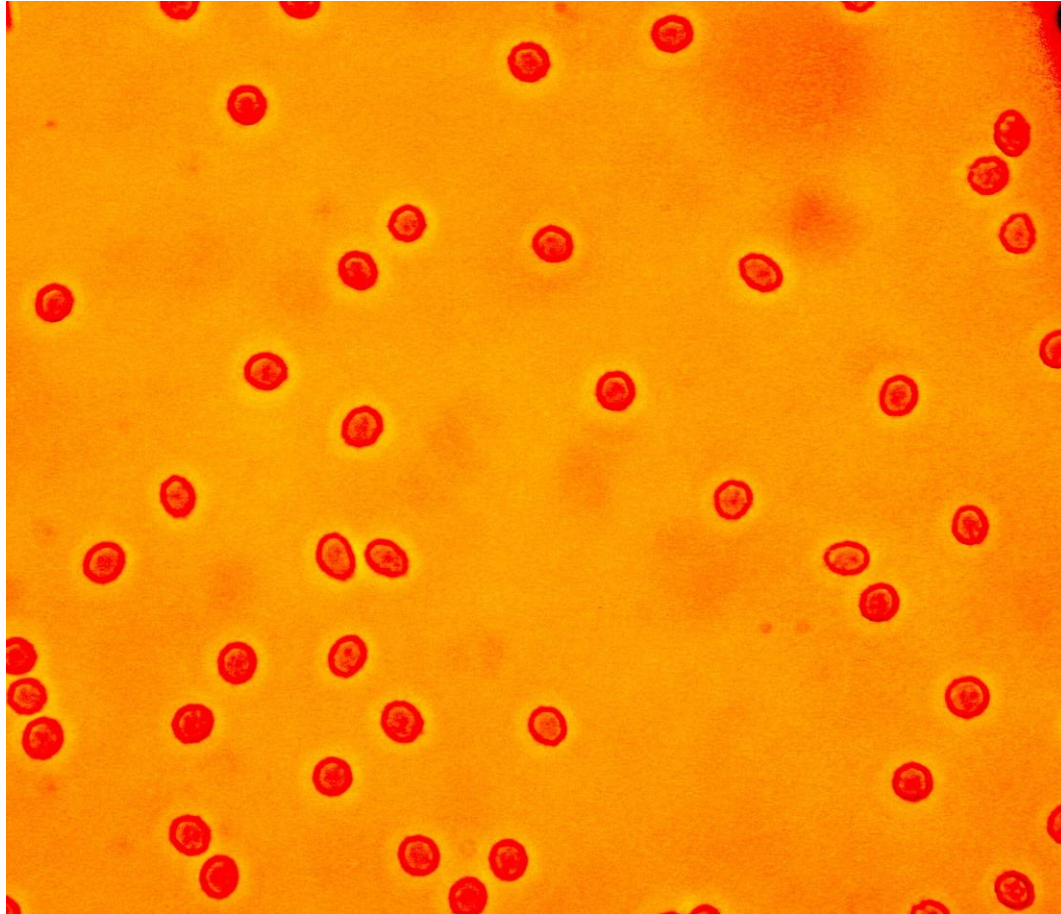
IS THAT REAL BLOOD?

- As little as 1 mL of whole blood in 1 L of urine can produce gross hematuria, turning the urine red.
- A number of other substances and reactions can turn the urine red, and centrifugation of the urine and microscopic analysis differentiate these false-positive results from true hematuria.

CAUSES OF RED COLOUR URINE

Phenazopyridine
Nitrofurantoin
Rifampin
Chloroquine
Hydroxychloroquine
Iodine
Bromide
Food coloring
Beets
Berries
Rhubarb

How to confirm Diagnosis ?



- Gross Inspection
- Urine Dipstick test : High false positive so needs
- .Confirmation by M/E
- M/E Urine examination: Gold standard

ETIOLOGY

Major Diagnosis Groups:

- Cancer
 - Infection
 - Stones
 - Benign prostatic hyperplasia
 - Renal parenchymal lesions
 - Trauma
 - Benign idiopathic hematuria
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NARROWING THE DIFFERENTIALS

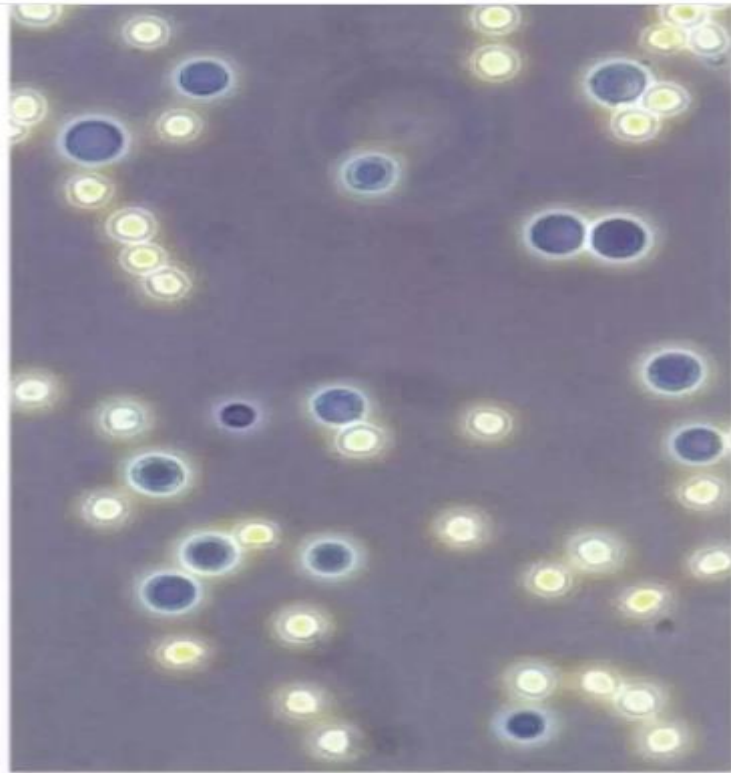
- ★ • Bright red gross, or macroscopic, hematuria is usually of lower urinary tract origin.
- ★ • Whereas renal parenchymal bleeding is usually smoky, hazy, or reddish-brown owing to the formation of acid hematin in urine of low pH.
- ★ • Proteinuria out of proportion to the degree of hematuria (i.e., >2+ protein on dipstick or >1 g/24-hour urine with microscopic hematuria) suggests a renal parenchymal origin (e.g., glomerulonephritis).
- ★ • An active urine sediment (e.g., red cell casts or granular casts) also suggests a renal parenchymal origin.



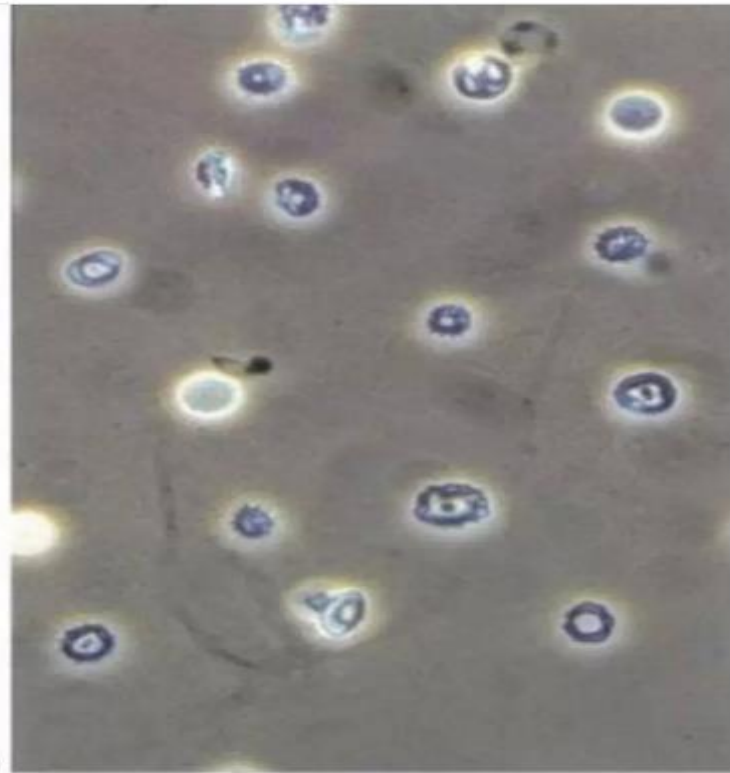
Types of RBCs found in Urine

RBCs found in the urine can be differentiated into two types based on origin:

- 1) Epithelial RBCs
 - 2) Glomerular RBCs
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(a)



(b)

- (a) Isomorphic erythrocytes (dark cells have lost their hemoglobin content)
- (b) Dysmorphic erythrocytes.

Types of RBCs in Urine: Epithelial RBCs

- Epithelial RBCs are regular, with smooth, rounded, or crenated membranes and an even hemoglobin distribution.
- As few as one epithelial RBC per hpf is abnormal and is considered a sign of urologic disease.

Types of RBCs in Urine: Glomerular RBCs

- Glomerular RBCs are dysmorphic with irregular shapes and cell membranes and minimal or uneven hemoglobin distribution.
- The cells become dysmorphic because of the osmotic stresses experienced during passage through the nephron.
- **A level of greater than two RBCs per hpf is abnormal and suggests glomerular disease.**

Approach to Hematuria

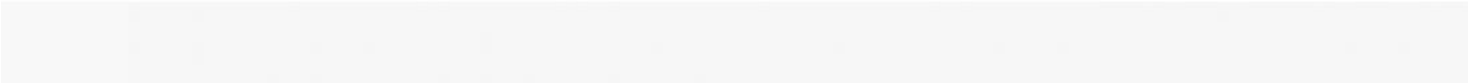
History

- Silent or painless hematuria suggests tumor, vascular causes or renal parenchymal disease.
 - Irritative voiding symptoms (e.g., frequency, urgency, and dysuria) suggest infection; however, a bladder tumor should be suspected if cultures are negative.
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- Colicky pain suggests stone passage or sloughed renal papillae.
 - Brown or Smokey-colored urine usually has a renal source.

History, cont.

- Initial hematuria suggests anterior urethral bleeding, whereas terminal hematuria is more consistent with posterior urethral bleeding (e.g., prostate or bladder neck). Total hematuria indicates bleeding occurring at the level of the bladder or above.
 - Cyclic hematuria occurring with menses in females suggests endometriosis.
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- Hematospermia is generally insignificant in young males; however, it can be associated with carcinoma of the prostate involving the seminal vesicle in older males.

HISTORY CONT.

- Information regarding exercise, menstruation, recent bladder catheterization, intake of certain drugs or toxic substances, or passage of a calculus may also assist in the differential diagnosis.
 - A family history that is suggestive of Alport syndrome, collagen vascular diseases, urolithiasis, or polycystic kidney disease is important.
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PHYSICAL EXAMINATION

- Hypertension occurs with glomerulosclerosis and, in the setting of peripheral edema, suggests nephrotic syndrome.
- Fever of $> 101^{\circ}\text{F}$ (38.3) suggests a serious infection (e.g., pyelonephritis or prostatitis).
- **Abdominal exam for evidence of a mass:**
 - A palpable kidney suggests tumor or hydronephrosis.
 - A palpable bladder may indicate obstruction or retention.
 - A palpable abdominal mass may represent an AAA.

PHYSICAL EXAMINATION(CONT.)

- Careful examination of the genitalia.
- **Skin** examination for Petechiae, rash suggests **coagulopathy, immunological disease, vasculitis.**
- An **irregular heart rate** (A. fib) or **A new heart murmur (endocarditis)** associated with **flank pain** and **hematuria** should raise the possibility of **renal embolic infarction.**



Differential Diagnosis of Hematuria

Mnemonic: "Pee Pee ON THIS – with 4 T's"

P	Period (i.e menses), results in cyclic pseudo-hematuria.		
P	Prostate (Prostatitis, Prostate Ca, BPH).		
O	Obstructive uropathy		
N	Nephritis (glomerulonephritis, interstitial nephritis, etc.)		
T	Trauma to GU system	T	Tuberculosis of GU system
T	Tumor of the GU system	T	Thrombosis (Renal vein thrombosis).
H	Hematologic (anticoagulant, bleeding disorders, sickle cell, etc.)		
I	Infection/Inflammation of the GU system		
S	Stones (Urolithiasis).		

Risk factors for UT Malignancy

BOX 9-1 Common Risk Factors for Urinary Tract Malignancy in Patients with Microscopic Hematuria

- Male gender
- Age older than 35 years
- Past or current smoking history
- Occupational or other exposure to chemicals or dyes (benzenes or aromatic amines)
- Analgesic abuse

- History of gross hematuria
- History of urologic disorder or disease
- History of irritative voiding symptoms
- History of pelvic irradiation
- History of chronic urinary tract infection
- Exposure to known carcinogenic agents or chemotherapy such as alkylating agents
- History of chronic indwelling foreign body

Modified from American Urological Association guidelines.

Labs

- Is there protein in the urine?
- Are there cells or casts in the urine?
- Does the patient have a bleeding diathesis?

CBC

- A complete blood count looking for the presence of anemia or leukocytosis should be considered.

Chemistries

- Routine screening chemistries (Na, K, Cl, CO₂, BUN, creatinine, glucose, and albumin) should be performed to evaluate **renal function** and look for electrolyte abnormalities.
- A serum albumin should only be conducted if significant proteinuria is in question.

Twenty-Four-Hour Urine for Protein

- The presence of proteinuria out of proportion to the degree of hematuria demonstrated by dipstick (i.e., >2+ protein with microhematuria) or a primary picture of glomerular bleeding should be followed by a 24-hour urine collection for quantitative protein.



Urinalysis

- The presence of white cells suggests an inflammatory process (e.g., infection, foreign body reaction, and interstitial nephritis).
 - The presence of casts and proteinuria suggests a medical renal parenchymal disease.
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Urine Culture

- A urine culture should be performed if significant pyuria or bacteriuria is present.

INVESTIGATIONS

Intravenous Urogram

- An intravenous urogram (IVU) is a fundamental diagnostic test for a patient with surgical hematuria.
- It should generally be obtained before cystoscopy in the event that the upper tracts need further delineation by retrograde ureteropyelography.

CT Scan of Kidneys

- Computed tomography has generally replaced the IVU as **the first line of imaging for hematuria.**
 - A computed tomography (CT) scan of the kidneys should be performed first without intravenous contrast, followed by a scan with contrast.
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- Stone disease is best evaluated on the non-contrast images while renal parenchymal tumors are best identified by the contrast-enhanced phase.

Cystoscopy

- Cystoscopy is mandatory to fully evaluate surgical hematuria.
- Small bladder tumors are easily missed on the cystogram phase of the IVU or pelvic CT scan.

Renal Biopsy

- Renal biopsy is indicated for patients with evidence of medical renal parenchymal disease, abnormal renal function, and proteinuria in excess of 250 mg/day.

***Treatment, Disposition
and Follow Up***

Treatment

- Treatment of hematuria is directed at the cause.

DISPOSITION AND FOLLOW UP

- Outpatient management and referral for follow-up are appropriate for patients in hemodynamically stable condition without an apparent life-threatening cause of the hematuria.
- The urgency for follow-up depends on the presence of gross hematuria or risk factors for significant disease.

Risk Factors for Significant Disease in Patients with Microscopic Hematuria

Age >50 y

Male sex

History of gross hematuria

Smoking history

Occupational exposure to chemicals or dyes (benzenes or aromatic amines)

Analgesic abuse

History of pelvic irradiation

Cyclophosphamide use

Pregnancy

Known malignancy

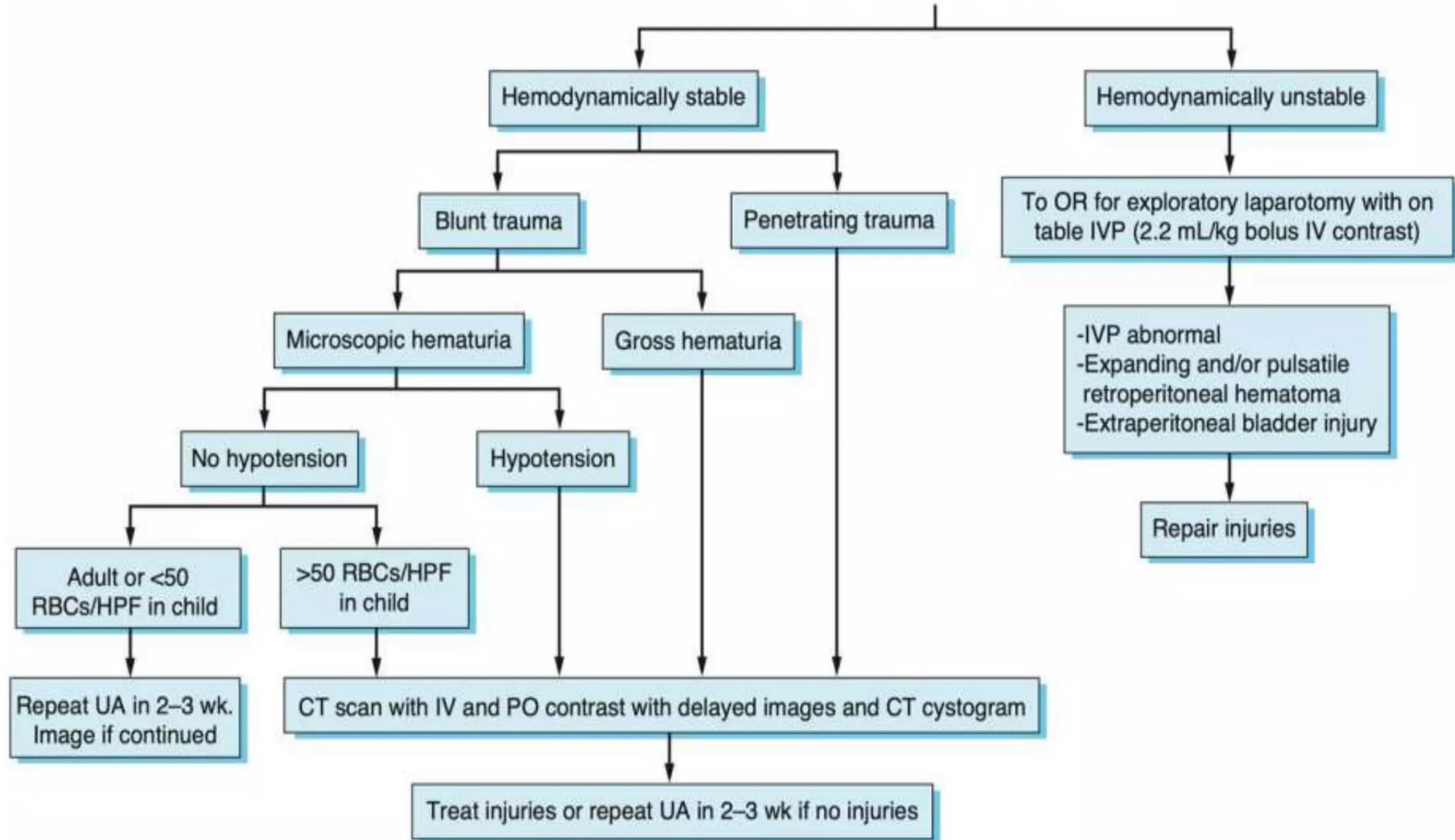
Sickle cell disease

Renal insufficiency

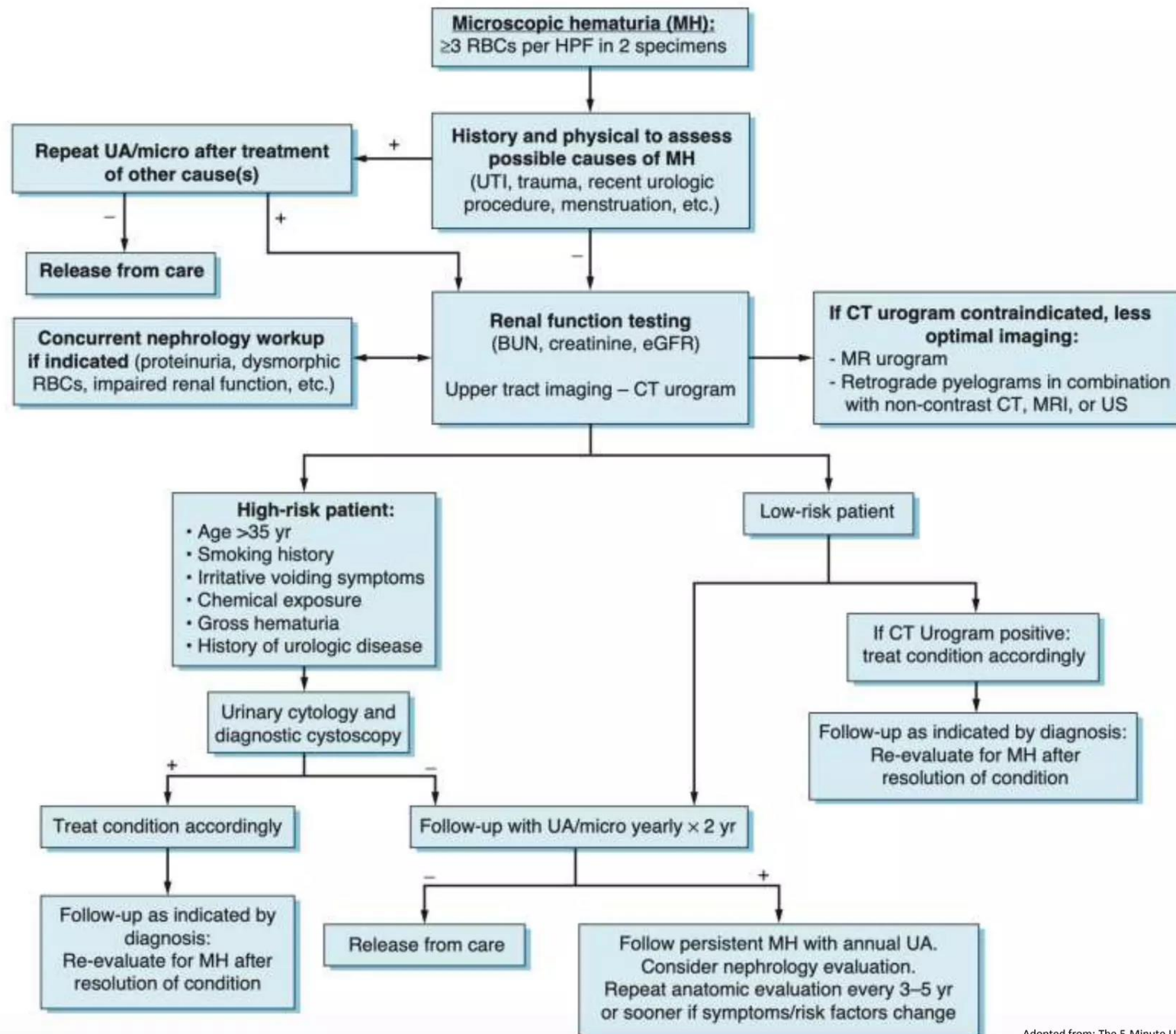
Disposition and Follow Up

- Patients with gross hematuria or listed significant risk factors should ideally be reevaluated at follow-up within 2 weeks.
 - Patients with microscopic hematuria without significant risk factors, a follow-up within 1 month is acceptable.
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- Patients with intractable pain, intolerance of oral fluids and medications, significant comorbid illness, bladder outlet obstruction, evidence of hemodynamic instability, or possible life-threatening causes of hematuria should be admitted, and the appropriate specialist should be consulted.

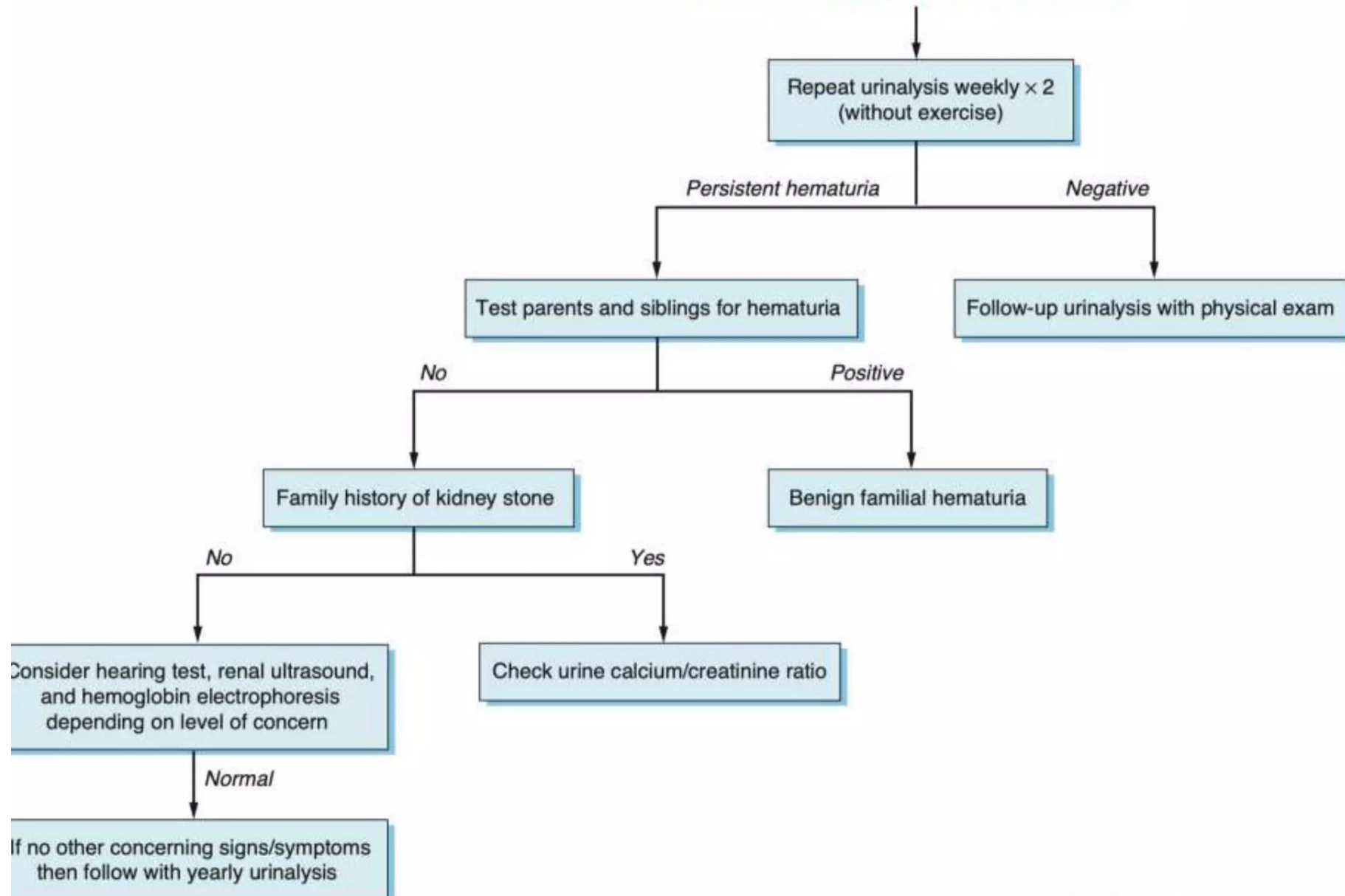
HEMATURIA, TRAUMATIC



HEMATURIA, ADULT



HEMATURIA, PEDIATRIC MICROSCOPIC ISOLATED ASYMPTOMATIC



Take Home Message 1/2

- If positive for blood, urine microscopy should be performed. A negative urine dipstick rules out the presence of hematuria and obviates the need for urine microscopy.
- Causes of a false positive test include:
 - Myoglobinuria, hemoglobinuria, and povidone/iodine contamination.
- High vitamin C intake can cause a false negative test.
- Urologic malignancy is more common in patients with gross hematuria (23%) than in patients with microscopic hematuria (5%).
- The presence of abundant squamous epithelial cells suggests contamination from the skin or vagina.

Take Home Message 2/2

- The presence of RBC casts and dysmorphic RBCs suggest glomerular bleeding.
 - If an obvious benign source of hematuria is present (such as infection, recent urologic procedure, etc.), then repeat the urinalysis after the benign condition has resolved. If repeat urinalysis shows no hematuria, then formal hematuria evaluation is probably unnecessary.
 - Hematuria that is presumed to be from anticoagulants should not be considered an "obvious benign source" and should be evaluated even when it occurs in the setting of anticoagulant excess.
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