

Hematuria

A structured approach for medical students and clinicians

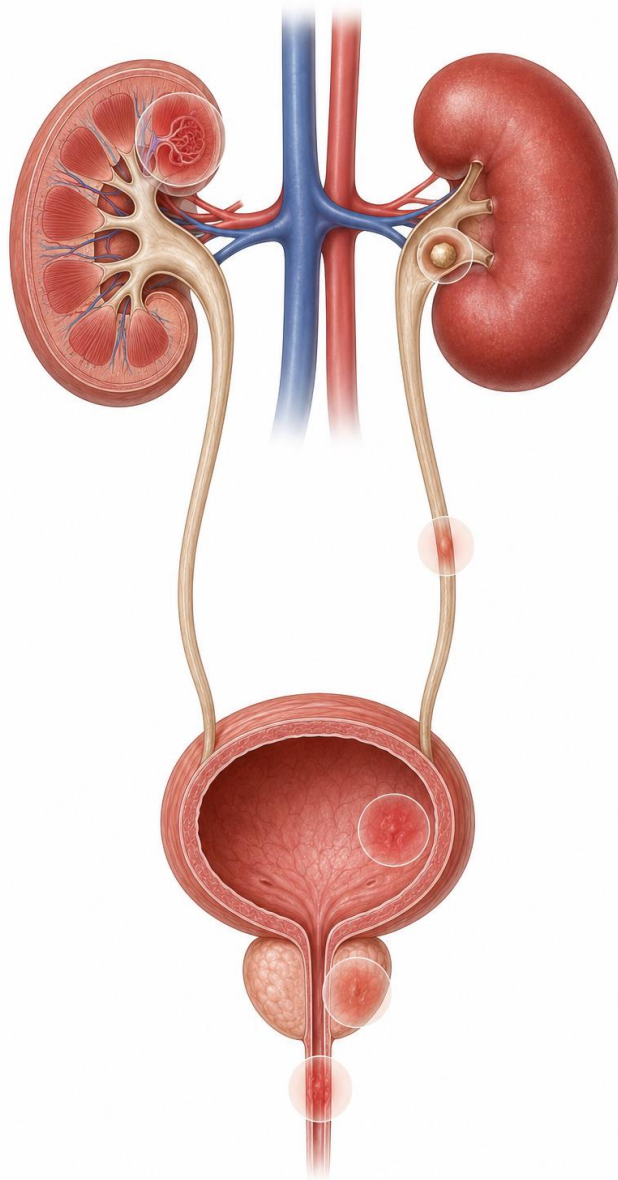


Figure 1. Anatomical sites that may produce hematuria: renal parenchyma/glomeruli, collecting system, ureters, bladder, prostate, and urethra.

PURPOSE: Rapid localization, safe triage, risk-based investigation, and cause-directed management. Adult guidance is emphasized; pediatric and pregnancy considerations are summarized separately.

SAFETY NOTE: Hematuria is a sign, not a diagnosis. Visible hematuria, clot retention, hemodynamic instability, acute kidney injury, suspected malignancy, or glomerulonephritis requires prompt clinician-led assessment. Local protocols and specialist advice take precedence.

How to use this guide

Need	Go to
Immediate clinical triage	Red flags and emergency stabilization
Distinguish glomerular from urologic bleeding	Localization and urine microscopy
Choose tests	Diagnostic algorithm and investigations
Prepare for examinations	Exam-focused summary and viva prompts
Review guideline thresholds	Adult microhematuria risk-based evaluation

Learning objectives

- Define visible and microscopic hematuria and distinguish them from pigmenturia.
- Recognize unstable bleeding, clot retention, acute kidney injury, infection with obstruction, trauma, and nephritic presentations.
- Localize bleeding using symptoms, proteinuria, casts, red-cell morphology, kidney function, imaging, and cystoscopy.
- Apply a risk-based adult evaluation and select imaging with attention to radiation, contrast, pregnancy, and renal function.
- Initiate supportive treatment and arrange cause-specific urology or nephrology management.

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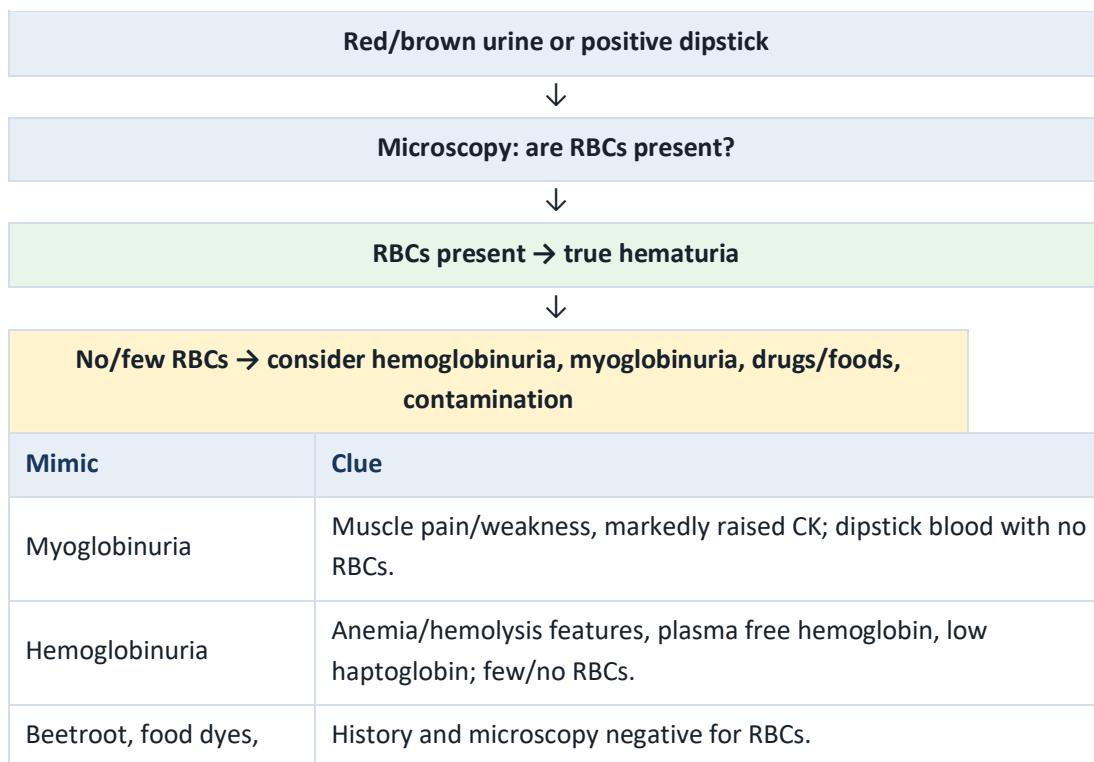
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1. Core definitions and confirmation

MICROSCOPIC HEMATURIA: AUA/SUFU defines adult microhematuria as ≥ 3 red blood cells per high-power field on microscopic evaluation of a single, properly collected urine specimen. Dipstick positivity alone does not establish the diagnosis.

Term	Practical meaning	Key point
Visible (gross) hematuria	Blood changes urine color or visible blood/clots are passed.	Treat as clinically important even if transient; urgently evaluate according to age, context, and local pathway.
Microscopic hematuria	RBCs detected on microscopy without visible discoloration.	Confirm microscopy; interpret persistence and malignancy risk.
Dipstick “blood”	Detects peroxidase activity from RBCs, hemoglobin, or myoglobin.	Positive dipstick + absent/few RBCs suggests pigmenturia or false positivity.
Initial vs terminal vs total	Blood at start, end, or throughout stream.	May suggest urethral, bladder neck/prostate, or upper tract/bladder source, but localization is imperfect.
Clots	Macroscopic coagulated blood.	Usually non-glomerular; worm-shaped clots can arise from upper tract, but clot shape is not diagnostic.

Confirm that it is blood



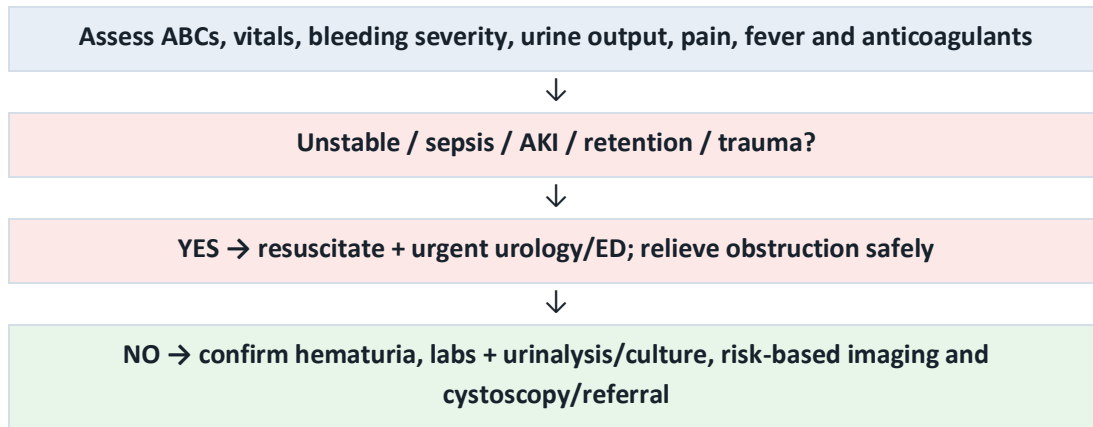
porphyria	
Rifampicin, phenazopyridine, some laxatives	Medication history; orange/red urine without RBCs.
Menstrual/vaginal or rectal contamination	Repeat clean-catch specimen outside bleeding; consider catheter specimen only when clinically justified.

EXAM FOCUS: Red/brown urine + positive dipstick + no RBCs on microscopy is pigmenturia until proved otherwise — not hematuria.

2. Red flags and emergency stabilization

Red flag	Why it matters	Immediate action
Hemodynamic instability, syncope, ongoing heavy bleeding	Hemorrhage/shock	ABCDE, IV access, CBC/coagulation/type and screen, fluids/blood as indicated, urgent urology/ED.
Inability to void, suprapubic pain/distension, clots	Clot retention and obstructive AKI	Urgent large-bore 3-way catheter by trained clinician, manual irrigation, continuous bladder irrigation when indicated; urology.
Fever/sepsis + flank pain/obstruction	Infected obstructed system	Sepsis care, cultures, IV antibiotics, urgent decompression; do not delay.
Rising creatinine, oliguria/anuria, hyperkalemia	AKI or bilateral/solitary-kidney obstruction	Urgent renal panel/ECG, ultrasound or appropriate imaging, nephrology/urology.
Edema, hypertension, proteinuria, RBC casts	Glomerulonephritis/nephritic syndrome	Urgent kidney function, urine protein quantification, serology as directed, nephrology.
Major trauma, pelvic fracture, blood at meatus	Urinary tract injury	Trauma pathway; avoid blind urethral catheterization if urethral injury suspected; appropriate urethral/bladder/upper tract imaging.
Anticoagulated patient with significant bleeding	Bleeding may be amplified; structural lesion still possible	Assess severity and indication; coordinate reversal/holding decisions. Anticoagulation does not remove need for evaluation.

Emergency gross hematuria algorithm



DO NOT MISS: Continuous bladder irrigation is not a substitute for evacuating obstructing clots. Persistent bleeding or inability to clear clots may require cystoscopic clot evacuation and hemostasis.

3. Clinical localization

Feature	Glomerular source	Urologic/non-glomerular source
Urine appearance	Tea/cola/smoky; often no clots	Pink/red; clots may occur
Proteinuria	Often significant, especially albuminuria	Usually absent or mild unless heavy bleeding
Microscopy	Dysmorphic RBCs/acanthocytes; RBC casts	Isomorphic RBCs; no RBC casts
Symptoms	Edema, hypertension, systemic disease	Dysuria, frequency, colic, LUTS, pelvic/flank pain
Renal function	May decline with active nephritis	Often preserved unless obstruction, infection, or advanced disease
Referral emphasis	Nephrology	Urology

CLINICAL PEARL: RBC casts are strongly suggestive of glomerular bleeding. Dysmorphic RBC interpretation requires appropriate microscopy and expertise; absence does not exclude glomerular disease.

Anatomic clues

- Painful hematuria: stones, infection, obstruction, trauma, papillary necrosis, renal infarction; malignancy can also be painful.
- Painless visible hematuria: urothelial or renal malignancy until excluded, particularly with age and smoking exposure.
- Colicky flank-to-groin pain: ureteric calculus.
- Dysuria/frequency/urgency: cystitis, urethritis, bladder pathology.

- LUTS in an older man: benign prostatic bleeding is possible, but malignancy still requires appropriate exclusion.
- Recent upper respiratory/skin infection, edema, hypertension: consider glomerulonephritis.
- Exercise-associated hematuria should resolve after rest; persistent or recurrent hematuria requires evaluation.

4. Differential diagnosis

Compartment	Common/important causes
Glomerular	IgA nephropathy; post-infectious GN; thin basement membrane disease; Alport syndrome; lupus nephritis; ANCA-associated vasculitis; anti-GBM disease; other proliferative GN.
Renal parenchymal/vascular	Pyelonephritis; renal cell carcinoma; papillary necrosis (analgesics, diabetes, sickle cell); polycystic kidney disease; infarction; renal vein thrombosis; interstitial nephritis.
Collecting system/ureter	Calculi; upper-tract urothelial carcinoma; obstruction; infection; instrumentation; trauma.
Bladder	Cystitis; bladder cancer; stones; radiation/chemical cystitis; foreign body; endometriosis (rare).
Prostate/urethra	BPH/prostatic bleeding; prostatitis; prostate cancer; urethritis; stricture; instrumentation; trauma.
Systemic/hematologic	Coagulopathy, thrombocytopenia, sickle cell disease/trait. Anticoagulants can worsen bleeding but should not be assumed to be the sole cause.
Transient/contamination	Menstruation; strenuous exercise; sexual activity; recent procedure; fever/viral illness; collection contamination.

Differential by presentation

Presentation	Prioritize
Painless visible hematuria	Urothelial cancer, renal cancer, BPH/prostatic bleeding, anticoagulation-amplified structural bleeding.
Painful visible hematuria	Stone, UTI/pyelonephritis, obstruction, trauma, papillary necrosis.
Hematuria + proteinuria/edema/HTN	Glomerulonephritis or other medical renal disease.
Hematuria + sterile pyuria	TB (epidemiology), stones, interstitial nephritis, malignancy, partially treated infection.

Presentation	Prioritize
Hematuria + eosinophilia/rash/new drug	Drug-induced interstitial nephritis or systemic disease.
Hematuria after trauma	Renal, ureteric, bladder, or urethral injury depending mechanism/findings.

5. History and physical examination

History checklist

- Onset, duration, recurrence, visible color, clots, timing within stream, relation to exercise/trauma/procedure/menstruation.
- Pain: flank/loin-to-groin, suprapubic, dysuria; fever/rigors; nausea/vomiting.
- Voiding symptoms: frequency, urgency, nocturia, weak stream, retention, incontinence.
- Systemic/renal: edema, reduced urine, hypertension, rash, arthralgia, hemoptysis, recent infection, hearing/visual history.
- Cancer risk: age, tobacco exposure, occupational aromatic amines/benzene, prior pelvic radiation, cyclophosphamide, chronic catheter/irritation, family history/Lynch syndrome.
- Drug history: anticoagulants/antiplatelets, NSAIDs/analgesics, antibiotics, cyclophosphamide; ask about adherence and indication.
- Past urinary stones, UTIs, malignancy, surgery/instrumentation, renal disease; pregnancy possibility; travel/TB/schistosomiasis exposure when relevant.

Examination

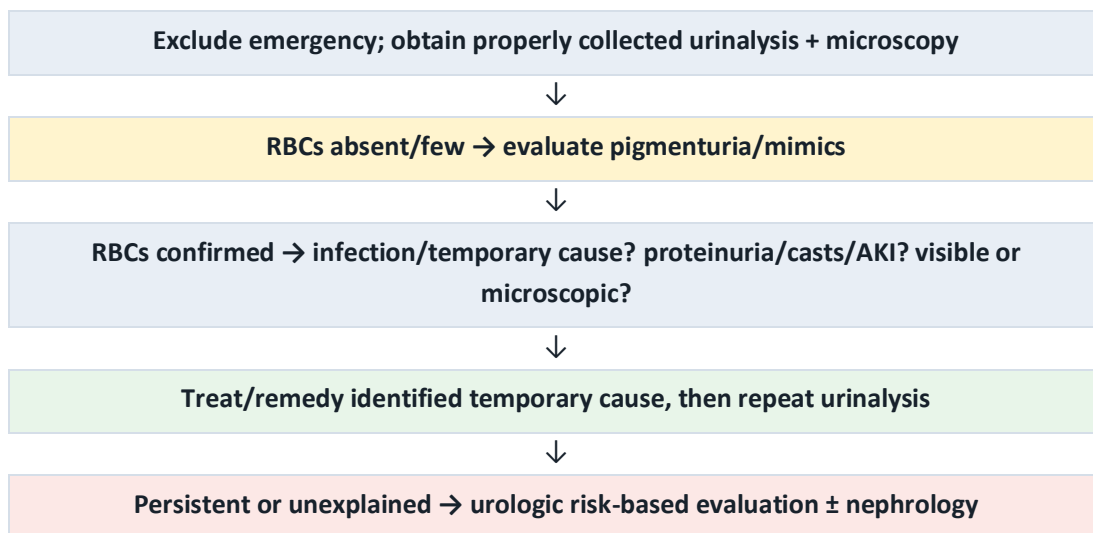
- Vitals: instability, fever, hypertension. Assess pallor and hydration.
- Abdomen/flanks: masses, tenderness, costovertebral angle tenderness, distended bladder.
- Edema, rash/purpura, joint findings and other systemic features.
- External genital examination when indicated; pelvic examination if gynecologic bleeding suspected.
- Digital rectal/prostate assessment when clinically appropriate; do not use a benign-feeling prostate to exclude cancer.
- Trauma: pelvic stability, perineal bruising, blood at meatus, high-riding/non-palpable prostate (low sensitivity).

6. Diagnostic algorithms

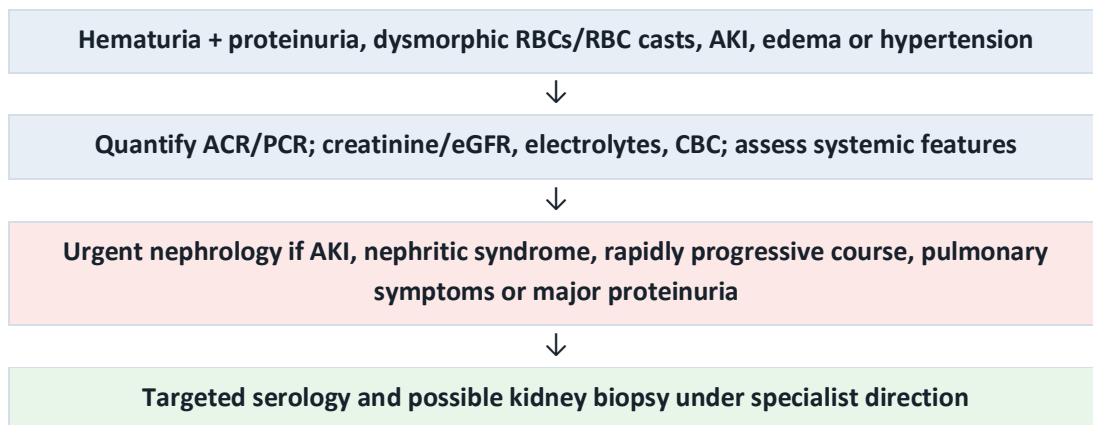
Universal first-pass algorithm

Red/brown urine or incidental positive dipstick

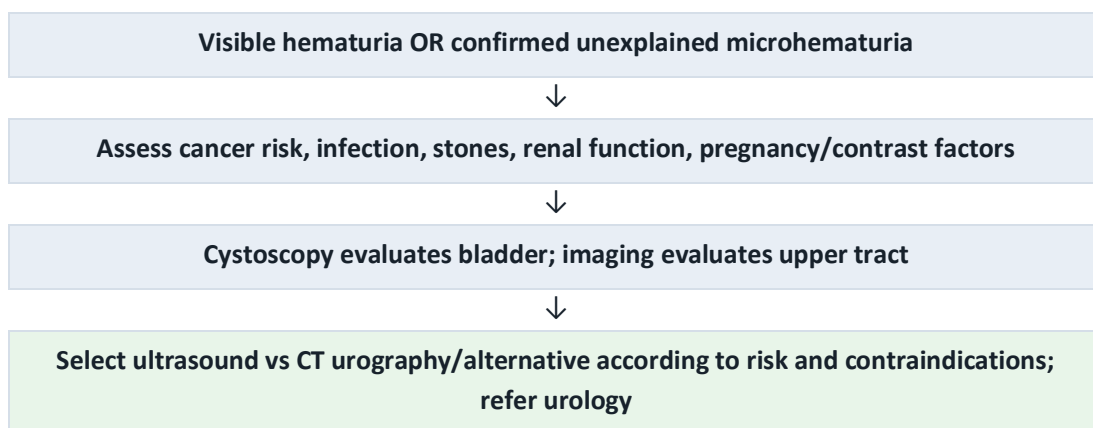




Glomerular pathway



Urologic pathway



7. Investigations

Urine tests

Test	What it answers	Interpretive caution
Dipstick	Blood, protein, leukocyte esterase, nitrite, glucose.	Blood is not RBC-specific; protein can be affected by concentration and gross blood.
Microscopy	RBC count, morphology, casts, WBCs, crystals.	Collection and timing matter; morphology is operator-dependent.
Culture	Confirms bacterial UTI and guides therapy.	Obtain before antibiotics when feasible; repeat urinalysis after treatment to confirm resolution.
ACR or PCR	Quantifies albumin/protein and supports glomerular disease assessment.	Marked proteinuria is not explained by trivial lower-tract bleeding.
Urine cytology	May help detect high-grade urothelial carcinoma in selected settings.	Not a routine replacement for cystoscopy; sensitivity is limited for low-grade tumors.

Blood tests

- CBC: anemia, leukocytosis, platelets.
- Creatinine/eGFR and electrolytes: AKI, contrast planning, obstruction consequences.
- Coagulation profile when bleeding is significant, liver disease is suspected, or anticoagulation effect requires assessment.
- Type and screen/crossmatch for substantial active bleeding.
- Targeted tests: CK for rhabdomyolysis; hemolysis screen; pregnancy test before relevant imaging; PSA only when clinically indicated and interpreted cautiously during infection/instrumentation.
- Glomerular work-up is targeted, not indiscriminate: complements, ANA/dsDNA, ANCA, anti-GBM, hepatitis/HIV, ASO/anti-DNase B, serum electrophoresis/free light chains as context directs.

Imaging selection

Modality	Best use	Limitations/notes
Renal/bladder ultrasound	No radiation; hydronephrosis, renal masses/cysts, bladder volume, some stones; often used in lower-risk evaluation and pregnancy.	Less sensitive for small urothelial lesions and ureteric stones; normal US does not exclude bladder cancer.
Non-contrast CT KUB	Most sensitive common test for urinary calculi and obstruction.	Does not provide urothelial-phase assessment; radiation.

Modality	Best use	Limitations/notes
CT urography	Detailed renal parenchyma and urothelium; commonly used for high-risk hematuria.	Iodinated contrast and radiation; assess pregnancy, allergy, renal function, and local protocol.
MR urography	Alternative upper-tract evaluation when CTU is contraindicated in selected patients.	Availability, time, cost; gadolinium considerations; less sensitive for stones.
Retrograde pyelography	Direct collecting-system/ureter outline when other imaging is inadequate or contrast limitations exist.	Invasive; does not assess renal parenchyma alone.
Trauma protocols	CT with appropriate phases; CT cystography or retrograde urethrography when indicated.	Use mechanism- and injury-specific protocols, not routine hematuria imaging.

CLINICAL PEARL: Cystoscopy and upper-tract imaging answer different questions. A normal scan does not reliably exclude small bladder lesions; a normal cystoscopy does not assess the kidneys and ureters.

Cystoscopy

Cystoscopy directly examines the urethra and bladder and is central to evaluation of visible hematuria and risk-appropriate microhematuria. It can identify tumors, stones, inflammation, foreign bodies, and bleeding sites; biopsy or treatment may follow. The exact referral and timing depend on stability, risk, age, and local pathway.

8. Adult microhematuria: risk-based evaluation

The 2025 AUA/SUFU framework first confirms ≥ 3 RBC/HPF, evaluates benign/gynecologic and medical renal causes, and then stratifies persistent or unexplained microhematuria by malignancy risk. Risk variables include degree and persistence of hematuria, age, sex, smoking exposure, prior visible hematuria, and other urothelial cancer risk factors. Use the current guideline table or local protocol for exact categorization.

Risk tier	Typical approach (summary)	Teaching point
Low/negligible	Shared decision-making; repeat urinalysis within the guideline interval rather than immediate cystoscopy/imaging in appropriate patients.	Persistence on repeat testing changes the pathway.
Intermediate	Cystoscopy plus renal ultrasound is commonly recommended. Selected appropriately counseled patients who wish to avoid cystoscopy may have validated urine marker/cytology strategies, but ultrasound remains part of evaluation and follow-up is required.	Markers do not replace imaging and are not for every patient.

Risk tier	Typical approach (summary)	Teaching point
High	Cystoscopy plus axial upper-tract imaging—typically multiphasic CT urography if suitable; MR urography or other alternatives when contraindicated.	Assess contrast/radiation risks without under-investigating cancer risk.

IMPORTANT: Nephrology referral for suspected medical renal disease does not eliminate the need for risk-appropriate urologic evaluation. Anticoagulant or antiplatelet use also does not exempt a patient from standard evaluation.

Follow-up after a negative evaluation

- Use shared decision-making about future urinalysis based on risk, persistence, and patient preference.
- New visible hematuria, a significant increase in microscopic hematuria, or new urinary symptoms warrants renewed assessment.
- Persistent hematuria after a negative evaluation may require reassessment; avoid automatic repeated CT without a clinical indication.

9. Management by cause

PRINCIPLE: Treat the cause and the consequences. Stabilization, relief of obstruction, infection control, renal protection, and malignancy referral may occur in parallel.

Cause/context	Management outline
Clot retention/heavy gross hematuria	Resuscitate; large-bore 3-way catheter and irrigation by trained staff; continuous irrigation when appropriate; urgent cystoscopy if ongoing bleeding/obstruction. Correct clinically significant coagulopathy with expert guidance.
UTI	Culture-guided antibiotics according to local guideline. If systemic infection or obstruction: admit/escalate and urgently decompress an infected obstructed system. Repeat urinalysis after successful treatment.
Urinary stone	Analgesia, antiemetic, hydration to euvolemia, renal function and imaging. Urgent urology for infection, AKI, solitary kidney/bilateral obstruction, uncontrolled symptoms, or high-risk stone. Definitive treatment depends on size/location.
Glomerulonephritis	Nephrology-directed therapy after syndrome and cause are defined. Control BP/volume; avoid nephrotoxins; immunosuppression or plasma exchange only for appropriate diagnoses.
Bladder/upper-tract/renal malignancy	Urgent specialist staging and multidisciplinary treatment: endoscopic resection/biopsy, surgery, systemic therapy, radiotherapy, or surveillance according to pathology and stage.

Cause/context	Management outline
BPH/prostatic bleeding	Exclude other important causes. Treat LUTS/BPH as indicated; 5-alpha-reductase inhibitors may reduce recurrent prostatic bleeding in selected patients; refractory bleeding may need endoscopic/other intervention.
Trauma	Damage-control resuscitation and injury-specific imaging/management. Urethral injury suspicion requires retrograde urethral evaluation before routine catheterization.
Anticoagulation-associated	Treat severity and source. Decisions to hold/reverse depend on bleeding, agent, renal function, and thrombotic indication; coordinate with relevant specialist. Resume when safe based on individualized balance.

What not to do

- Do not diagnose microhematuria from dipstick alone.
- Do not attribute hematuria solely to anticoagulants, menstruation, exercise, UTI, or BPH without confirming resolution or completing indicated evaluation.
- Do not treat asymptomatic bacteriuria simply because hematuria is present, except in guideline-defined situations.
- Do not use urine cytology as a routine substitute for cystoscopy.
- Do not order broad autoimmune panels without evidence suggesting a glomerular/systemic process.
- Do not delay decompression of an infected obstructed urinary system.

10. Special populations and situations

Pregnancy

- Confirm urinary versus vaginal bleeding; obtain culture and assess infection promptly.
- Ultrasound is generally first-line imaging. MRI without gadolinium may be considered for selected questions; ionizing radiation is used only when benefit outweighs risk and with appropriate protocol.
- Physiologic hydronephrosis complicates interpretation. Obstruction with infection remains an emergency requiring multidisciplinary urology–obstetric care.

Children and adolescents

- Common causes include UTI, hypercalciuria/stones, trauma, glomerular disease, structural anomalies, and familial basement-membrane disorders; malignancy is far less common than in adults.
- Evaluate blood pressure, growth, edema, renal function, urine protein, microscopy, culture, and family history.
- Proteinuria, hypertension, impaired kidney function, RBC casts, recurrent gross hematuria, or systemic features warrant pediatric nephrology input. Imaging is typically ultrasound-led.

Exercise-associated hematuria

May follow prolonged or intense exercise and should clear after a short period of rest. Repeat a properly collected urinalysis after exercise avoidance. Persistent/recurrent hematuria, symptoms, proteinuria, or risk factors require standard evaluation.

Sickle cell disease or trait

Papillary necrosis and renal medullary carcinoma are important considerations. Do not assume benignity; visible hematuria or persistent symptoms require specialist evaluation and appropriate imaging.

Schistosomiasis and urinary TB

Use epidemiology and exposure history. Chronic urinary schistosomiasis is associated with bladder pathology; urinary TB may cause sterile pyuria and hematuria. Arrange specific microbiologic/parasitologic testing and specialist treatment rather than empiric labeling.

11. Follow-up and safety-netting

At discharge/clinic review	Document and communicate
Result status	Was true hematuria confirmed? Visible or microscopic? Infection treated? Repeat specimen arranged?
Pending work	Culture, cytology if selected, imaging, cystoscopy, nephrology studies, pathology.
Escalation symptoms	Inability to void, increasing clots/bleeding, dizziness/syncope, fever/rigors, worsening flank pain, reduced urine, edema or breathlessness.
Medication plan	Any temporary anticoagulant/antiplatelet change must specify who authorized it and when/how it will be reviewed.
Ownership	Named clinician/service responsible for repeat urinalysis, referral, results review, and communicating outcomes.

SAFETY NET: A single “resolved” episode can still be clinically important. Recurrent visible hematuria or new urinary symptoms after a negative evaluation should prompt reassessment.

12. Exam-focused revision

One-minute summary

- Confirm hematuria with microscopy; ≥ 3 RBC/HPF defines adult microhematuria in AUA/SUFU guidance.
- First exclude shock, clot retention, infected obstruction, AKI, trauma, and nephritic syndrome.
- Clots suggest non-glomerular bleeding. RBC casts and significant proteinuria suggest glomerular disease.

- Painless visible hematuria is urothelial malignancy until appropriately excluded.
- Cystoscopy assesses bladder/urethra; imaging assesses upper tracts. CT KUB is for stones; CT urography is for urothelial/renal evaluation in appropriate high-risk patients.
- Treat UTI and confirm resolution; anticoagulation does not cancel evaluation.
- Refer nephrology for glomerular features and urology for visible hematuria, risk-based microhematuria, obstruction, clots, trauma, or suspected malignancy.

Classic exam associations

Finding	Association
RBC casts	Glomerulonephritis
Dysmorphic RBCs/acanthocytes	Glomerular source
Cola-colored urine after URI	IgA nephropathy if synpharyngitic; post-infectious GN classically follows a latent interval
Flank-to-groin colic + hematuria	Ureteric calculus
Painless visible hematuria in smoker	Urothelial carcinoma until excluded
Hematuria + sterile pyuria	TB, stone, malignancy, interstitial nephritis, partially treated UTI
Blood at urethral meatus after pelvic trauma	Possible urethral injury—retrograde urethral evaluation before routine catheterization
Positive dipstick blood + no RBCs + high CK	Myoglobinuria/rhabdomyolysis

Viva framework: “How would you assess hematuria?”

14. Stabilize and identify emergencies.
15. Confirm true hematuria; exclude pigmenturia and contamination.
16. Classify visible versus microscopic, painful versus painless, glomerular versus urologic.
17. Take focused history and perform targeted examination.
18. Order urinalysis/microscopy, culture, renal function, CBC, protein quantification, and targeted tests.
19. Select imaging and cystoscopy according to clinical question, malignancy risk, renal function, pregnancy, and contrast suitability.
20. Treat urgent complications and the underlying cause; refer urology/nephrology appropriately.
21. Arrange results ownership, repeat urinalysis where indicated, and explicit safety-netting.

Self-test questions

Question	Answer
Can dipstick alone diagnose microhematuria?	No. Confirm with microscopy.

Question	Answer
Does anticoagulation explain away hematuria?	No. It may amplify bleeding; evaluate according to the same risk principles.
Which finding most strongly localizes bleeding to glomeruli?	RBC casts; dysmorphic RBCs and significant proteinuria support the diagnosis.
What are the two complementary pillars of urologic evaluation?	Cystoscopy for the lower tract and appropriate imaging for the upper tract.
What is the key emergency in stone + fever?	An infected obstructed system—urgent antibiotics and decompression.
When should a treated UTI with hematuria be revisited?	Repeat urinalysis after successful treatment to document resolution.

13. References and further reading

Primary guidance used for this educational summary (accessed August 2026):

22. [American Urological Association / SUFU. Microhematuria Guideline \(2020; amended 2025\).](#)
23. [AUA/SUFU 2025 Microhematuria Guideline Amendment Summary.](#)
24. [NICE. Suspected cancer: recognition and referral \(NG12\), urological symptoms.](#)
25. [NICE. Quality standard QS215: suspected cancer pathway referral for visible hematuria.](#)
26. [American College of Radiology. Appropriateness Criteria: Hematuria.](#)
27. [European Association of Urology. Guideline collection \(urological infections, malignancies, stones, trauma\).](#)
28. [KDIGO. Clinical practice guideline resources for glomerular diseases and acute kidney injury.](#)

GUIDELINE NOTE: Referral age thresholds, imaging pathways, biomarker use, and risk categories differ between jurisdictions and evolve. Apply current local cancer referral pathways and institutional protocols.

Prepared as an educational study resource. It does not replace individualized clinical assessment, local policy, specialist consultation, or emergency care.