Hematuria

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Common Case Presentation

64-year-old male presents with red colored urine, difficulty with urination, and feeling of incomplete emptying. He notes the symptoms started two days ago and the urine has become progressively bloodier and his urinary symptoms more pronounced.

I. Receiving the Phone Call and Initial Thoughts

A. **There are numerous causes of hematuria and the initial questions should view the nature of hematuria, gross or microscopic, hemodynamic stability of the patient, and ability to empty the bladder.**

B. **Is the patient experiencing gross or microscopic hematuria?**
Patients may present with either grossly visible blood in the urine, gross hematuria (GH), or the finding of red blood cells seen on a microscopic examination of the urine, microscopic hematuria (MH). Evaluation of MH does not represent an acute event requiring urgent or emergent evaluation and is covered in the **AUA/SUFU Guideline 2020**. Gross hematuria represents a significant source of admission and possible life-threatening event.

C. **Is the patient hemodynamically stable?**
Patients with gross hematuria from certain underlying causes can experience significant blood loss. Fluid resuscitation and blood transfusion can be critical in these patients.

D. **Is the patient able to urinate?**
Other than hemodynamic stability, the patient's ability to void and empty the bladder is the most pressing issue. Patients may present with urinary retention secondary to bladder outflow obstruction from blood clots. Expeditious urinary catheter placement can be an urgent intervention.

E. **Is the patient experiencing any other physical symptoms like flank pain, nausea, vomiting, or fever and chills?**

Hematuria may be the result of nonmalignant urologic conditions such as renal or ureteral calculi, urinary tract infections, or prostatitis.

F. **Is the patient on anticoagulation therapy, have a history of bleeding diathesis, or a non-urologic malignancy?**
Certain medications, such as anti-platelet therapy or other anticoagulants, or systemic illnesses or conditions may result in bleeding of urologic source and require different treatment approaches.

G. **Has the patient undergone any recent urologic intervention, procedure, or surgery?**
Patients may develop gross hematuria following urologic surgery or manipulation of the urinary system. Management of these post-operative or procedural complications will drive patient's management and guide work up formation.

H. **Does the patient have a Foley catheter or suprapubic tube in place?**
Traumatic placement or exchange of a urinary drainage catheter may account for hematuria and require interrogation if the tube improperly positioned. Smaller 2-way Foley catheters or non-hematuria 3-way catheters may need to be exchanged for larger bore, i.e. 20 French or more, or hematuria catheters to relieve the obstruction.

II. Differential Diagnosis

The differential diagnosis for hematuria is broad, but the causes can be narrowed into distinct categories. For the focus of this review, the emphasis will be gross hematuria emanating from the lower urinary tract.

A. 1. **Neoplasm Malignancy**
Urologic malignancies often present with an episode of gross hematuria although they may be self-limited. Often these patients have are male sex, with a smoking history, occupational exposure, and voiding symptoms. Organs of origin include:

a. **Bladder**
b. **Urethra**
c. **Upper tract malignancy**

Each of the malignancies are covered within corresponding sections of the Core Curriculum.

2. **Infection/Inflammation**
This represents a more heterogenous group of causes depending on the patient's risk factors and past medical history

a. **Cystitis**
Typically, patients with signs and symptoms of urinary tract infection including fever and chills, dysuria, cloudy or malodorous urine, and a urinalysis diagnostic of urinary tract infection.

b. **Prostatitis**

Male patients with signs and symptoms or urinary tract infection but likely more pronounced voiding symptoms or urinary retention

c. Urethritis
Possible causes can include bacterial, viral, chemical, and foreign body

d. **Hemorrhagic cystitis**
Patients should be questioned for a history (recent or distant) of radiation exposure or therapy for non-urologic malignancy. Additionally, patients with a history of specific chemotherapeutic agent therapy - oxazaphosphorine (e.g. cyclophosphamide or ifosfamide). The metabolite of this class drug is acrolein which can damage the bladder

3. **Calculus disease**
Patients usually present with specific symptoms of nausea, vomiting, flank pain (in upper tract stones), and fever or chills.
4. **Benign Prostatic Enlargement**
Patients typically have a longer history of lower urinary tract symptoms (LUTS) and prior therapy. Typically, these are older, male patients.
5. **Trauma**
These patients present following an acute traumatic injury and have specific signs and symptoms. The onset of this type of hematuria is chronologically related to this traumatic event. Genitourinary trauma is covered in the specific section in this Consults and Emergencies chapter. The comprehensive review is a separate section in the Core Curriculum.
6. **Medical Renal Disease**
Beyond the scope of this chapter, but includes patients with prior renal disease, hypertension or azotemia
7. **Abnormal or Dysfunctional Anatomic Findings**
    a. History of renal cystic disease
    b. Upper urinary tract obstruction or ureteropelvic junction obstruction
    c. Urethral diverticulum
    d. Urethral stricture disease

    These patients often present with long standing LUTS and history of recurrent urinary tract infection. Many times, these patients are younger than the typical patient with BPE and heightened suspicion is warranted. See the **Core Curriculum section on Urethral Strictures disease** for complete information.

8. **Miscellaneous**
    a. Exercise induced hematuria
    b. Pseudohematuria (Menses)
    c. Recent urologic surgery or procedural intervention

III. Evaluation

A. **Physical Exam - Key Points**

1. **Vital signs**: Due to the potential life threating nature of a hematuria, physical evaluation should begin with vital signs.
    a. Any suggestion of hemodynamic instability (hypotension, tachycardia) should initiate fluid resuscitation and possibly blood transfusion.
    b. Any indication of infection or sepsis (tachypnea, tachycardia, fever) should initiate resuscitation and administration of intravenous antibiotics
2. **Physical Examination**
    a. Examination for these conditions is limited to the abdomen, flank, genitalia, perineum, and rectum.
    b. Patients in urinary retention may have a palpable or tender bladder in the suprapubic area or tender
    c. Digital rectal exam can reveal benign enlargement of the prostate, a hard prostate concerning for advanced prostate cancer, or a soft, “boggy” prostate concerning for prostatitis
    d. Any indication of external violence or trauma to the flank, abdomen, or genitalia should raise the suspicion of a traumatic source of bleeding
    e. The physical presence of a Foley or suprapubic catheter should raise the question of traumatic placement or recent surgical or procedural intervention of the urinary system
    f. Visual inspection of the urine can help qualify the degree of gross hematuria

B. **Laboratory Data**

1. CBC with differential - Key findings
    a. Leukocytosis or indication of left shift which may be present with a urologic infection resulting systemic infection
    b. Thrombocytopenia with decreased platelet count from chronic medical conditions or chemotherapy may result in coagulopathy
    c. Anemia as the result of rapid or chronic blood loss as the result of ongoing hematuria, try to obtain prior baseline data for comparison
2. Blood urea nitrogen (BUN)/Creatinine
    a. Evaluate for adequate renal function in the face of chronic renal disease, longstanding urinary obstruction, or temporary dehydration
    b. Secondarily can guide imaging work-up i.e., if patient can tolerate IV contrast dye for hematuria work-up
3. Coagulation studies (PT/PTT) to evaluate for coagulopathy as cause of or contributor to hematuria
4. Urinalysis with microscopy– check for presence of UTI, proteinuria or abnormal RBC morphology which may be indicative of nephrological cause

C. **Radiologic / Diagnostic Studies**

1. CT urogram (3-phase). The recommended study for the evaluation of hematuria from AUA guidelines. Allows for full evaluation of the urinary system and drainage film with cross sectional images. Additionally, can help identify the burden of blood clots in the bladder. Radiologic evaluation for microscopic hematuria differs from gross hematuria and should include CT urography versus renal ultrasonography depending on risk-stratification (see **AUA Microhematuria guidelines**)
2. MR urography – alternative imaging option for patients with iodine allergy or risk of contrast-induced nephropathy. Should not be used in patients who need more urgent imaging evaluation due to large volume hematuria.
3. Renal ultrasonography +/- retrograde pyelography – less comprehensive imaging (due to lack of cross-sectional imaging) as an option for patients unable to undergo contrast enhanced imaging.
4. Endoscopic evaluation with cystoscopy to visually inspect the prostate and bladder. For the bladder, this can diagnose a source related to tumor, stone, or radiation cystitis.
    a. This has the potential to be therapeutic to evacuate blood clots or eliminate the source of bleeding form the prostate or bladder.
    b. Ureteroscopy can be considered if a concern for upper tract bleeding.

IV. Management

A. **Initial Management / Problem to Resolve**

1. Initial management is primarily focused on ensuring patient stability and bladder emptying, as well as identifying the underlying cause of hematuria (tumor, stone, coagulopathy, etc.)
2. Stop all anticoagulation, anti-platelet therapy, NSAIDS
3. For significant bleeding, place a large bore (≥ 22 French) 3-way catheter and irrigate to evacuate all clots, and then initiate saline continuous bladder irrigation (CBI). Do not initiate CBI until bladder has been cleared of all blood clots
4. Once patient stability and bladder emptying / drainage confirmed, proceed with imaging work-up and endoscopic evaluation

B. **Potential Complications**

1. Organized blood clots – patient may require cystoscopy under general anesthesia for evacuation of large, organized clots, attempting CBI in presence of blood clots may possibly lead to bladder perforation
2. Refractory bleeding – continued bleeding despite adequate CBI and discontinuation of blood thinners, may require blood transfusions to maintain adequate Hgb/Hct
3. Renal impairment – inability to drain kidneys or bladder due to obstruction via blood clots may result in renal insufficiency

C. **Specific Management Plan**

(If hematuria fails to resolve, further treatment is driven by the etiology of bleeding)

1. Refractory bladder bleeding can be treated with
    a. Endoscopic surgery (for tumor or distinct area of bleeding)
    b. Aminocaproic acid - oral or intravesical
    c. Intravesical agents (alum, formalin, silver nitrate, phenol)
    d. Hyperbaric oxygen[1,2,3]
    e. Nephrostomy tube urinary diversion
    f. Internal iliac artery embolization
    g. Cystectomy with urinary diversion
2. Refractory prostatic bleeding may respond to
    a. Light traction on catheter – this is temporary intervention as long-term traction can induce bladder neck injury
    b. 5a-reductase inhibitors
    c. Androgen deprivation therapy
    d. Aminocaproic acid
    e. Surgery (endoscopic, simple prostatectomy)

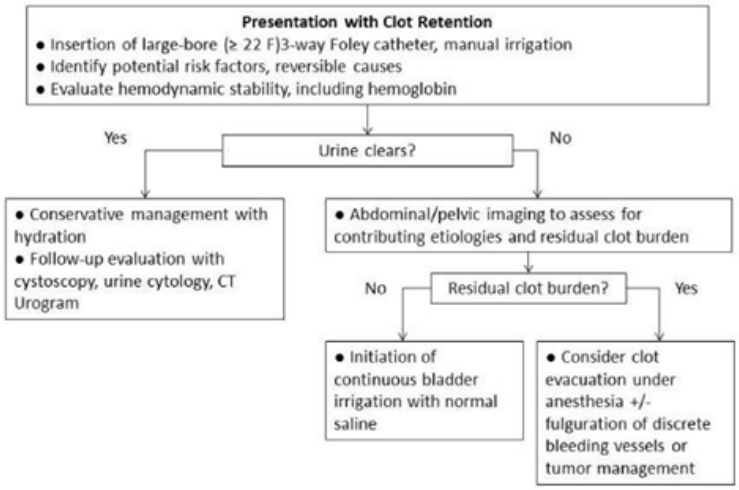

Figure 1. Management algorithm for Hematuria[4]
Adapted from Linder, B.J, Boorgian, S.A. Management of Emergency Bleeding, Recalcitrant Clots, and Hemorrhagic Cystitis. AUA Update Series, 2015. 34(3): p. 17-28.

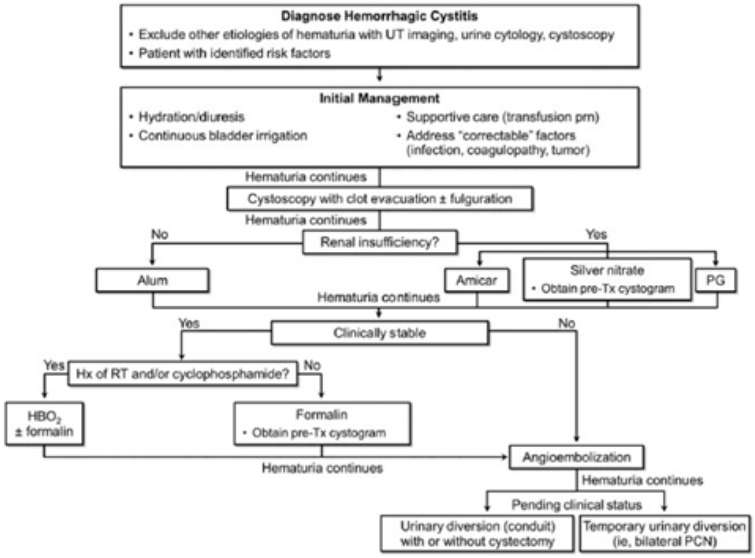

Figure 2. Management algorithm for severe hematuria from hemorrhagic cystitis [4]
UT – upper tract, PG – prostaglandin, Hx – history, Tx – treatment, PCN – percutaneous nephrostomy Adapted from Linder, B.J, Boorgian, S.A. Management of Emergency Bleeding, Recalcitrant Clots, and Hemorrhagic Cystitis. AUA Update Series, 2015. 34(3): p. 17-28.

Key Takeaways

1. Hematuria, especially gross hematuria, can have numerous causes. A complete history and physical exam is imperative to determine the appropriate diagnostic considerations.
2. The initial primary considerations for management are patient hemodynamic stability and urinary drainage.
3. Management of hematuria may require surgical, radiologic, or pharmacologic intervention or treatment. Reevaluation and changing treatment plans may be required for stabilization and resolution of ongoing gross hematuria.

See References: 1,2,3,4,5,6,7,8,9,10,9,11,12,13

References

1 Cardinal J, Slade A, McFarland M, Keihani S, Hotaling JN, Myers JB. Scoping Review and Meta-analysis of Hyperbaric Oxygen Therapy for Radiation-Induced Hemorrhagic Cystitis. Curr Urol Rep. 2018;19(6):38. Published 2018 Apr 13. doi:10.1007/s11934-018-0790-3

2 Liss MA, Osann K, Cho J, Chua WC, Dash A. Severity of hematuria effects resolution in patients treated with hyperbaric oxygen therapy for radiation-induced hematuria. Urol Int. 2013;91(4):451-455. doi:10.1159/000351331

3 Ribeiro de Oliveira TM, Carmelo Romão AJ, Gamito Guerreiro FM, Matos Lopes TM. Hyperbaric oxygen therapy for refractory radiation-induced hemorrhagic cystitis. Int J Urol. 2015;22(10):962-966. doi:10.1111/iju.12857

4 ☆ Linder B.J., Boorgian S.A., Management of emergency bleeding, recalcitrant clots and hemorrhagic cystitis., American Urological Association Education and Research, Inc, AUA Update Series. Maryland2015 (34 (lesson 3))

5 Avellino GJ, Bose S, Wang DS. Diagnosis and Management of Hematuria. Surg Clin North Am. 2016 Jun;96(3):503-15. doi: 10.1016/j.suc.2016.02.007. PMID: 27261791.

6 Groninger H, Phillips JM. Gross Hematuria: Assessment and Management at the End of Life. J Hosp Palliat Nurs. 2012 May 12;14(3):184-188. doi: 10.1097/NJH.0b013e31824fc169. PMID: 24826082; PMCID: PMC4016967

7 Haldar S., Dru C., Bhowmick N.A., Mechanisms of hemorrhagic cystitis., Am J Clin Exp Urol. 2014; 2: 199-208

8 Liem X., Saad F., Delouya G., A practical approach to the management of radiation-induced hemorrhagic cystitis., Drugs. 2015; 75: 1471-1482

9 Rezaeimehr B, Modanloo M, Davoodi M, Sakhaei SM, Farsavian H, Younesi Rostami M. Angioemboliziation of Internal Pudendal Artery for Treatment of Long Lasting Gross Hematuria After Transurethral Resection of the Prostate. Urol J. 2019 Oct 21;16(5):517-518. doi: 10.22037/uj.v0i0.4657. PMID: 30345491.

10 ☆ Sieber PR, Rommel FM, Huffnagle HW, Breslin JA, Agusta VE, Harpster LE. The treatment of gross hematuria secondary to prostatic bleeding with finasteride. J Urol. 1998 Apr;159(4):1232-3. PMID: 9507842.

11 ☆ Ghani KR, Sukumar S, Sammon JD et al: The burden of hematuria in the United States: estimates from the Nationwide Emergency Department Sample. J Urol, suppl., 2013; 189: e29, abstract 69.

12 Payne H, Adamson A, BahlAet al: Chemical- and radiationinduced haemorrhagic cystitis: current treatments and challenges. BJU Int 2013; 112: 885

13 Boorgian, S.A., et al. Evaluation and Management of Hematuria, in Campbell-Walsh Urology, Twelfth Edition, Partin, Alan W., Kavoussi, Louis R., Dmochowski, Roger R., C, Peters, Craig A Editors. 2020, Elsevier-Saunders: Philadelphia, PA.