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Hematuria Can Be Visible to the Naked Eye or Under a Microscope

Abstract

Hematuria refers to the presence of blood within urine, which can either be seen without assistance or only detected through microscopic examination. This symptom can point to a range of issues within the urinary tract, including infections, stones, an enlarged prostate, trauma, and, though less frequently, severe conditions like tumors. While hematuria does not always signify illness, it invariably warrants additional investigation as it can indicate anything from benign to serious health issues. Additionally, the hue of urine can be altered due to dietary factors or medications.

Keywords: Hematuria, Blood, Urine, Pathology, Health

Research Article

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Introduction

Hematuria can be categorized into visible and non-visible types, where non-visible hematuria is defined by observing 3 to 5 red blood cells in a high-power field during urine analysis in at least two out of three tests conducted over 2 to 3 weeks [1]. In contrast, visible hematuria is less common and recognized through a singular observation of urine that appears discoloured due to blood. Both visible and non-visible hematuria may result from similar underlying issues, but the frequency at which these causes occur differs between the two categories.

Hematuria

Hematuria is characterized by the presence of red blood cells in the urine [2]. Care should be exercised to differentiate this condition from other reasons that may lead to urine discoloration. All instances of hematuria must undergo comprehensive evaluation. When hematuria is first identified using dipstick methods, microscopic examination is essential for confirmation.

Is there a correlation with pain in hematuria that might indicate an infection or inflammation? Typically, painless hematuria can be linked to tumours or tuberculosis. Total hematuria, which occurs throughout urination, indicates potential bleeding from the upper urinary tract or bladder. Initial hematuria, present at the start of urination, points towards bleeding occurring in the urethra or prostate. Terminal hematuria, seen at the end of urination, indicates bleeding from the bladder or prostate. It is important to inquire about a family history of polycystic kidney disease, as well as other conditions such as tuberculosis. Have there been any recent travels to areas known for schistosomiasis? Is there any pain in the lower back suggesting kidney issues, or a history of ureteric colic indicating the movement of stones or clots in the ureter? Bladder-related issues might present with suprapubic discomfort, frequent urination, and painful urination. Examine for signs of prostatism, such as trouble starting urination, weak urine flow, and night-time urination. Injuries to the urethra are usually noticeable and can happen from pelvic fractures or accidents resulting in straddling an object. Is the individual taking anticoagulants? Is there any known blood disorder? Are there signs indicative of sickle cell disease or prior exposure to malaria? Intense physical activity might lead to hematuria as well. Has there been a recent kidney biopsy? Variations in urine color can arise from many sources. Hemoglobinuria may arise from hemolytic events, while myoglobinuria can occur after muscle injury or blood flow restrictions. It's important to check for any substances consumed that could alter urine color. Acute intermittent porphyria is an extremely rare condition often paired with stomach pain. If urine is allowed to sit in light

for some time, it may develop a purplish-red tint.

Visible hematuria is primarily attributed to malignancy, as 14% of individuals display visible hematuria, which can impact any area of the urogenital system [3]. As a result, patients exhibiting visible hematuria should be directed to urology for imaging studies, such as ultrasound or CT, and for cystoscopy. Other frequent reasons for visible hematuria include urinary infections and stones. This condition may also appear in patients suffering from IgA nephropathy, often following an upper respiratory infection.

Non-visible hematuria may suggest the presence of an underlying cancer, and despite variations in guidelines, the current recommendations in the UK indicate that all individuals over the age of 60 with consistent non-visible hematuria (identified on at least two out of three consecutive dipstick tests) and either dysuria or an increased serum white blood cell count should undergo imaging studies and cystoscopy. In younger individuals, the likelihood of a tumour is considerably lower, and if a glomerular origin is not suspected, it could be suitable to monitor them periodically in primary care, although there are instances where these patients may develop significant renal issues during follow-up.

Glomerular bleeding occurs when inflammatory, destructive, or degenerative conditions affect the glomerular basement membrane, allowing red blood cells to enter the urine. A key aspect of glomerular bleeding is the presence of an 'active urinary sediment,' showcasing dysmorphic red blood cells or red cell casts when viewed under a microscope, although this is not universally observed. Individuals with both visible and non-visible hematuria should also be evaluated for hypertension, proteinuria, a decrease in renal function, a family history of kidney diseases, or signs of systemic illness. The detection of any of these factors raises the concern for intrinsic renal issues, thus necessitating a referral to nephrology for further assessment, which may include renal biopsy consideration.

Gross Hematuria

Gross hematuria signifies the apparent presence of blood in the urine and typically indicates lower urinary tract disorders and/or bleeding disorders rather than intrinsic renal issues [4]. Exceptions include cyst rupture in polycystic kidney disease and post-pharyngitic exacerbations of IgA nephropathy. Microscopic hematuria, defined as more than 1 to 2 red blood cells per high-powered field, when coupled with proteinuria, hypertension, and active urinary sediment (known as the "nephritic syndrome"), is most often associated with inflammatory glomerulonephritis, particularly post-streptococcal glomerulonephritis.

Dipstick tests can identify free hemoglobin and myoglobin; however, a negative urinary sediment in conjunction with a strongly heme-positive dipstick typically signifies either hemolysis or rhabdomyolysis, which can be distinguished using clinical history and laboratory evaluations. While RBC casts are not a sensitive finding, their presence is highly indicative of glomerular bleeding, generally related to glomerular inflammation, although this is not exclusively the case. The specificity of urinalysis can be improved by utilizing a phase contrast microscope, which is capable of identifying dysmorphic red cells, or "acanthocytes," linked to glomerular disease.

Non-visible Hematuria

The underlying causes of non-visible hematuria are [1]:

1. Glomerular (for instance, glomerulonephritis, immunoglobulin A nephropathy, hereditary factors)
2. Non-glomerular

a) Upper urinary tract (nephrolithiasis, pyelonephritis, renal cell carcinoma, kidney cystic disease, renal injury, metabolic disorders like hypercalciuria)

b) Lower urinary tract (bladder and prostate cancers, benign entities such as benign prostatic hyperplasia and bladder papillomas, urethritis, cystitis)

3. Additional factors (for example, excessive anticoagulation, 'march' hematuria)

Glomerulonephritic Diseases

In conditions that involve glomerulonephritis, injury to the glomerular capillary membranes allows red blood cells and proteins, which are typically too large to move across these membranes, to seep into the renal tubular space, leading to the occurrence of hematuria and proteinuria [5]. The reduction in the glomerular filtration rate (GFR) occurs either due to inflammatory cell infiltration in the glomerular capillaries or as a response from contractile cells, like mesangial cells, to vasoactive agents, which constrict blood flow to numerous glomerular capillaries. A lowered GFR results in the retention of fluids and

salts, clinically presenting as edema and elevated blood pressure.

A decrease in serum complement is noted as a consequence of the deposition of immune complexes and complement within the glomerulus, which is commonly observed in conditions like lupus nephritis, membranoproliferative glomerulonephritis, and post-infectious glomerulonephritis.

In instances tied to infections by group A beta-hemolytic streptococci, there is a notable increase in antibody titers against streptococcal antigens. Additionally, a significant trait of the clinical progression in poststreptococcal acute glomerulonephritis is the delay between the onset of infection symptoms and the emergence of nephritis symptoms.

Individuals diagnosed with nephrotic syndrome experience low levels of albumin in their blood and severely reduced plasma oncotic pressures due to the excretion of serum proteins in urine. This condition results in reduced intravascular volume and triggers the activation of the renin-angiotensin-aldosterone system alongside the sympathetic nervous system. There is also an increase in vasopressin production. Furthermore, these individuals exhibit modified renal reactions to atrial natriuretic peptide. Despite indications of volume excess, such as fluid retention or severe swelling, patients may show symptoms of intravascular volume depletion, which can include fainting, shock, and kidney injury. The hyperlipidemia associated with nephrotic syndrome seems to stem from diminished plasma oncotic pressure, which promotes the liver's production and release of very low-density lipoproteins.

A clinically significant aspect of nephrotic syndrome is hypercoagulability, which results from the renal loss of proteins C and S along with antithrombin, in combination with increased serum levels of fibrinogen and lipids.

In nephrotic syndrome, the loss of additional plasma proteins beyond albumin can result in varied conditions: (1) impaired bacterial opsonization leading to heightened infection risk due to IgG loss; (2) a condition of vitamin D deficiency paired with secondary hyperparathyroidism stemming from the loss of vitamin D–binding proteins; and (3) altered results in thyroid function tests while not indicating true thyroid issues, as a result of decreased thyroxine-binding globulin.

Malignancy

Ten percent of cases can be traced back to malignancies and urolithiasis, while a considerable number remain without explanation [1]. Causes that are glomerular and non-glomerular can be identified through the presence of proteinuria, which is typically seen in the former group but absent in the latter. Although isolated dipstick-positive hematuria does not necessarily require immediate further testing, certain historical factors may guide the general practitioner in deciding whether additional investigation is warranted; these include a family history of prostate cancer and the patient's past with benign prostatic hyperplasia and tobacco use. The general practitioner should also consider other potential causes like recent physical activity, sexual engagement, or any injury to the urinary tract.

Examination

Evaluation of hematuria within secondary healthcare is conducted in a methodical way, with 'one-stop' hematuria clinics becoming increasingly common [1]. The process necessitates urine dipstick tests, microscopy, and cultures, alongside an assessment of renal function. In cases where proteinuria and impaired renal function are evident, it is appropriate to refer the patient to a nephrologist, as a glomerular issue is probable. Urine microscopy serves to confirm the presence of hematuria and to search for indicators of its origin, such as red cell casts in glomerulonephritis, while cultures can detect infections.

Following this initial evaluation, investigations extend to both the upper and lower urinary systems. Imaging through ultrasound or CT urogram is fundamental in examining the upper urinary tract, with CT being favored due to its superior sensitivity and specificity. In approximately 30% of individuals, these imaging studies will reveal a diagnosis; those who do not require further investigation of the lower urinary tract. Urine cytology is essential for assessing urothelial cancer, and cystoscopy should be considered since it demonstrates greater sensitivity compared to cytology for detecting bladder cancer. It is typically advised for all individuals aged 40 and older with non-visible hematuria and for those with risk factors linked to bladder cancer.

Urinalysis

Urinalysis is an effective and straightforward method for diagnosing kidney and urinary tract conditions [6]. Generally, the urine dipstick assessment for blood is used first to detect individuals with microscopic hematuria. The sensitivity of the urine dipstick for blood ranges from 91% to 100%, while its specificity varies between 65% and 99%. This test measures the peroxidase activity of red blood cells, meaning hemoglobin and myoglobin can lead to false-positive outcomes. Other factors that may result in false positives include dehydration, physical exertion, povidone-iodine, and oxidizing substances. Conversely, false negatives may occur due to the presence of vitamin C and exposure to air.

The urine dipstick is proficient enough to identify 1 to 2 red blood cells per high-power field. Due to its high sensitivity, a urine dipstick test is generally adequate to exclude hematuria. Nevertheless, owing to variable specificity, any positive dipstick result ought to be confirmed through urine microscopy. A midstream clean-catch method generally yields uncontaminated urine from both men and women; washing the external genitalia has not shown clear benefits. While conducting urine microscopy, careful steps must be taken to prepare the sample accurately. A fresh urine sample of 10 to 15 mL should be centrifuged at 1500 to 3000 rpm for five minutes. The supernatant is then poured off, and the sediment is mixed with the remaining supernatant. A single drop is placed onto a clean glass slide, followed by the application of a coverslip.

Diagnosis

After ruling out non-cancerous reasons, detecting hematuria should prompt a urologic investigation [7]. The assessment for hematuria involves taking a medical history, conducting an examination, performing various tests, cystoscopy, and imaging of the upper urinary tract using either CT urogram, which is standard, or MR urogram compared to renal ultrasound with retrograde pyelography in patients with impaired renal function. The first step to establishing a diagnosis is to collect a midstream clean catch urinary sample correctly and find three or more red blood cells in each high-power field. A dipstick test is insufficient for detecting microhematuria because it can yield positive results due to oxidation or myoglobinuria. This must be verified through microscopic urinalysis. This analysis allows for the detection of red blood cell casts, proteins, and abnormal red blood cells, which may suggest a renal medical cause for hematuria. A urine culture should also be conducted to check for infections. If the evaluation yields no significant findings but microscopic hematuria continues, a follow-up urologic assessment can be considered in three to five years.

In the medical history, providers should evaluate risks for urologic cancers while also asking about medical renal conditions, urinary tract infections, trauma, and menstruation. A physical examination should consist of a detailed abdominal and genital assessment along with a blood pressure measurement.

Laboratory assessments should consist of glomerular filtration rate estimation, creatinine levels, and blood urea nitrogen testing to assess kidney function. The status of renal function can influence the suitability for additional diagnostic procedures. Although urine cytology was once thought to be essential in evaluations, it is of limited utility and should not be included in the initial assessment of asymptomatic microscopic hematuria.

For patients aged 35 and older, cystoscopy, which allows for direct visualization of the urethra and bladder using a camera, should be conducted. For patients younger than 35, cystoscopy can be performed based on the clinician's judgment, particularly if there is a concern for cancer possibly due to environmental exposures or bothersome urinary symptoms. This procedure may take place in an outpatient setting for selected patients. Cystoscopy can reveal urethral abnormalities, strictures, false passages, as well as bladder lesions or tumours, and help differentiate the source of hematuria from a ureter's opening. Furthermore, retrograde imaging studies can be conducted if fluoroscopy resources are available.

The ideal imaging technique for the evaluation of hematuria is multi-phasic CT urography. This approach involves three phases, both with and without contrast: a non-contrast phase for detecting stones, a nephrogenic phase for examining kidney masses, and an excretory phase to evaluate filling defects in the collecting system, including the ureters and bladder. An alternative is MR urography. If CT or MRI scans are not an option, or if the patient cannot have them due to pregnancy, allergy to iodinated contrast, or kidney failure, an ultrasound examination of the kidneys and bladder along with

retrograde pyelography may be suitable.

In situations involving traumatic hematuria, if the patient's condition permits imaging, an intravenous contrast-enhanced CT scan of the abdomen and pelvis, including delayed imaging to assess the collecting system, should be performed. If the patient's condition is too critical for imaging and they must go directly to the operating room, an intravenous pyelogram should be conducted, especially if a nephrectomy is being considered, to verify the presence of the contralateral kidney.

Management

Patients experiencing significant hematuria require intravenous fluids, blood transfusions if they have severe anemia, cessation of anticoagulant medications, correction of coagulopathies, and placement of a large-bore urethral catheter (20-24°F) for bladder irrigation and clot removal [8]. If bladder irrigation proves ineffective, cystoscopy is warranted to break up the clots, examine the urethra and bladder for a manageable bleeding source, and coagulate any active bleeding vessels or tumours.

Subsequent management will be dependent on the underlying diagnosis, tumour size, and previous treatments. Hematuria alongside urethral blockage due to prostate cancer can typically be managed with external-beam radiation therapy or through transurethral resection and coagulation of the tumour. In cases where substantial hematuria arises from bladder cancer, transurethral resection, urgent cystectomy, use of a Helmstein hydrostatic balloon, or hypogastric artery embolization might be necessary. Hematuria resulting from treatment may need targeted systemic therapies (for example, mesna after bleeding caused by oxazophosphorines) or localized interventions (like formalin instillations or 1% alum, hyperbaric oxygen).

Conclusion

The presence of blood in urine is generally not alarming and rarely requires treatment, but it is advisable to seek medical advice to identify the underlying cause. Blood can originate from the kidneys, where urine is generated, as well as from the ureters, bladder, and urethra. Hematuria may result from hemoglobin and myoglobin in urine, porphyria, or the consumption of specific foods and medications. Certain antibiotics can also alter urine coloration.

References

1. Shamil, Eamon, Praful Ravi, and Ashish Chandra. *100 Cases in Clinical Pathology and Laboratory Medicine*. CRC Press, 2023.
2. Raftery, Andrew T., Eric Kian Saik Lim, and Andrew JK Ostor. *Churchill's pocketbook of differential diagnosis*. Elsevier Health Sciences, 2014.
3. Conway, B.; Phelan, P. J.; Stewart, G. D. (2023.): „Nephrology and urology" in Penman, I. D.; Ralston, S. H.; Strachan, M. W. J.; Hobson, R. P. (eds): „Davidson's Principles and Practice of Medicine, 24th Edition", Elsevier Limited, London, UK, pp. 568. – 569.
4. Jameson, J. Larry. "Harrison's manual of medicine." *(No Title)* (2020).
5. Perlman, R. L.; Heung, M.; Ix, J. H. (2014.): „Renal Disease" in Hammer, G. D.; McPhee, S . J. (eds): „Pathophysiology of Disease - An Introduction to Clinical Medicine, Seventh Edition", McGraw-Hill Education, New York, USA, pp. 475. – 476.
6. Jimbo, Masahito. "Evaluation and management of hematuria." *Primary Care: Clinics in Office Practice* 37, no. 3 (2010): 461-472.
7. Avellino, Gabriella J., Sanchita Bose, and David S. Wang. "Diagnosis and management of hematuria." *Surgical Clinics* 96, no. 3 (2016): 503-515.
8. Paz-Ares, L.; Jaime, J. C.; García-Carbonero, R. (2009.): „Medical Emergencies "in Cavalli, F.; Kaye, S. B.; Hansen, H. H.; Armitage, J. O.; Piccart-Gebhart, M. J. (eds): „Textbook of Medical Oncology, Fourth Edition ", Informa UK Ltd, London, UK, pp. 336.

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