BMJ Best Practice

Assessment of gross haematuria

The right clinical information, right where it's needed

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Summary

- Gross haematuria is urine that is visibly discoloured by blood or by blood clot. It may present as urine that is red to brown, or as frank blood. As little as 1 mL of blood can impart colour to 1 litre of urine. By contrast, microscopic haematuria is not visible to inspection and is defined as three or more RBCs per high power field (HPF) on microscopic inspection.

  Gross haematuria, even when transient or asymptomatic, may indicate a significant disease process and always requires further investigation. The spectrum of aetiologies has a significant age-dependence, whereby the work-up of haematuria can differ between children, adults under the age of 35 years, and adults aged 35 years or older.

  An important population to consider are patients at higher risk for urological malignancy. Gross haematuria is a presenting sign in more than 66% of patients with urological cancer.[1] Risk factors for urothelial carcinoma include male sex; age 35 years or older; smoking; exposures to benzene, aromatic amines, carcinogens, chemotherapy, or high doses of analgesics; and a history of irritative voiding symptoms, chronic urinary tract infection, indwelling urinary catheter, or pelvic irradiation. Patients with gross haematuria represent a higher-risk group than those presenting with microscopic haematuria.[2] The sensitivity of gross haematuria in revealing malignancy is significant: 0.83 for urothelial carcinoma of the bladder, 0.66 for ureteric carcinoma, and 0.48 in renal cell carcinomas.[3]

  Gender differences exist in the oncological significance of gross haematuria. In men aged over 60 years, the positive predictive value of gross haematuria for urological malignancy is 22.1%, and in women of the same age it is 8.3%.[4]

OVERVIEW

Aetiology

Gross haematuria can originate along any portion of the urinary system. Anatomically, it is divided into the upper tract, which includes the kidneys and ureters, and the lower tract, which includes the bladder and urethra. Localising the source of bleeding is a key step in determining the aetiology of haematuria.[5]

Trauma, infection, stones, structural abnormalities, kidney disease, and malignancy can cause gross haematuria. Coagulopathy caused by clotting disorders or anticoagulation can induce or exacerbate bleeding from underlying urinary tract lesions. Nephrotoxic medications can cause kidney inflammation and renal papillary necrosis, whereas other medications (e.g., ciclosporin) can cause bleeding from the bladder mucosa. Instrumentation of the urinary bladder by endoscopes and catheters can cause traumatic bleeding that is generally self-limiting. Benign forms of haematuria can be seen in exercise-induced haematuria and in loin-pain haematuria syndrome, an idiopathic condition of unknown clinical significance. Finally, gross haematuria should always be distinguished from pseudohaematuria, where blood originating from a non-urinary-tract source or discolouration of the urine by non-haeme compounds gives the appearance of haematuria.

Trauma

- Penetrating or blunt injury to the kidneys, ureters, bladder, or urethra usually presents as gross haematuria.
- Renal trauma is usually caused by blunt injury to the flank or abdomen in 80% to 90% of cases.[6] Other causes include penetrating injuries from gunshots and stab wounds, deceleration injuries in motor vehicle accidents, and laceration by fractured lower ribs.
- Ureteral trauma is rare, occurring in the setting of penetrating, blunt, or iatrogenic injury. Iatrogenic transection of the ureter can occur during complicated colorectal or gynaecological procedures. Endoscopic procedures, such as ureteroscopy, are more likely to cause haematuria than transection or ligation of ureters. Percutaneous access of the urinary tract, renal biopsy, or placement of ureteral stents can also cause traumatic bleeding.
- Bladder trauma causes gross haematuria and is usually seen in motor vehicle crashes or pelvic fractures. Pelvic fractures are associated with bladder rupture in 8% to 10% of cases.[7]
- Urethral injury, generally in males, presents as blood at the urethral meatus. This may be accompanied by the inability to void or voiding with initial or terminal haematuria.
- Males with pelvic fracture and blood at the urethral meatus must not have a urethral catheter placed until a retrograde urethrogram can rule out urethral disruption.
- Female urethral injury is a rare event, due to its shorter length and mobility, but may occur in the setting of pelvic fracture.[8]

Urinary stone disease

- Urolithiasis, caused by the precipitation of crystals in the kidney or bladder, commonly causes intermittent pain that can be severe. Microscopic haematuria can be seen in up to 85% of cases,[6] but gross haematuria tends to be rare.

Haematological

- Sickle cell anaemia can present with urinary symptoms including haematuria, dysuria, and polyuria, with isosthenuria (urine that is not concentrated by the kidneys) on urinalysis.
- Coagulopathic patients may bleed from multiple sites, including the GI and GU tract.

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- Patients on anticoagulation therapy may have gross haematuria, but urinary tract bleeding (even in cases of super-therapeutic anticoagulation) almost always represents an exacerbation of an underlying disease process or urinary tract lesion.

Structural abnormalities

- Benign prostatic hyperplasia (BPH) predisposes men to gross haematuria and clot formation, possibly due to increased density of microscopic vessels in the prostate. A 2002 cross-sectional study had a self-reported rate of haematuria in 2.5% of subjects with BPH.[9]
- After relief of acute urinary retention by catheter decompression, gross haematuria can occur in 2% to 16% of patients (haematuria ex vacuo).[10]
- Cystic renal lesions such as those in polycystic kidney, medullary sponge kidney, and medullary cystic disease may cause gross haematuria.
- Vascular malformations and arterial-venous fistulas may spontaneously bleed into the urinary tract.
- Renal vein thrombosis, which can be caused by renal cell carcinoma or in the setting of nephrotic syndrome, generally presents as flank pain and gross haematuria.

Infectious

- UTIs and pyelonephritis are extremely common causes of macroscopic haematuria and often associated with symptoms of urinary frequency and dysuria. Urinalysis may also reveal leukocytes, nitrite, or leukocyte esterase.
- GU tuberculosis may present with haematuria and sterile pyuria.

Medical renal disease

Numerous medical renal diseases cause haematuria. Pathology that involves the renal parenchyma and glomeruli may present as haematuria that is characterised by dysmorphic red cells and casts of red or WBCs. Significant proteinuria may be a prominent feature of these disorders, and renal function may be compromised. Referral to a nephrologist is important for the management of this broad category of disorders. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained, as expeditious treatment or a renal biopsy may be necessary.[11]

- Benign familial haematuria is caused by a genetic defect that results in thinning of the basement membranes. The resulting haematuria is similar to that caused by hereditary nephritis.
- Alport's syndrome is a hereditary disorder presenting as proteinuria, haematuria, hearing loss, and HTN leading to renal failure.
- Glomerulonephritides (such as IgA nephropathy, post-infectious glomerulonephritis, membranoproliferative glomerulonephritis, rapidly progressive glomerulonephritis, and SLE) require renal consultation and are a spectrum of primary and secondary immune-mediated diseases that cause inflammation of the glomeruli. Proteinuria and renal failure are also present in these disorders to varying degrees.
- Glomerular pathology can be an isolated phenomenon or part of a systemic autoimmune process such as SLE.

Neoplastic

Haematuria may be the only symptom of GU malignancy. Cancer of the urinary tract is more common in patients with gross haematuria (23%) than in patients with microscopic haematuria (5%).[12]

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OVERVIEW

- Urothelial carcinoma can occur anywhere along the urinary tract. Ninety percent of bladder cancers are urothelial carcinomas and typically present as painless haematuria.
- Squamous cell carcinoma and adenocarcinoma are rare types of bladder tumours.
- Renal cell carcinoma and metastases to the kidney can also cause haematuria, with or without flank pain.
- Prostate cancer can present with intermittent gross haematuria.[4]
- Penile cancers are squamous cell carcinomas of the skin, but urethral or vascular invasion may cause visible blood in the urine.

Gynaecological

- Placenta percreta is a form of invasive placental implantation where the myometrium of the uterus is penetrated. Five percent to 7% of cases show this depth of invasion and in rare cases extends into the bladder to cause severe haemorrhage and haemodynamic instability.[13] This diagnosis should be suspected in the setting of pregnancy and gross haematuria, especially if there is a history of placenta praevia or prior caesarean section.
- Cases of endometriosis where the ectopic endometrial tissue involves the ureters or bladder may present as flank pain, dysuria, and haematuria that is cyclic in nature.

Iatrogenic

- Instrumentation of the urinary tract by endoscopes or percutaneous access can cause self-limited bleeding.
- Catheters or the presence of an indwelling ureteral stent or nephrostomy tube can cause urinary tract bleeding.
- External beam radiation for pelvic cancers can cause inflammatory radiation cystitis that ranges in severity from microscopic haematuria and urinary frequency to severe haemorrhage, incontinence, and bladder necrosis.
- Prostate brachytherapy can lead to acute or late complications of haematuria.
- Medications that can incite tubular necrosis or interstitial nephritis can cause haematuria. Nephrotoxic medications include aminoglycosides and chemotherapeutic agents. Interstitial nephritis can be induced by penicillin, sulfonamides, and non-steroidal anti-inflammatory drugs.
- Ciclosporin is an important cause of haemorrhagic cystitis that may result in severe bleeding.
- Anticoagulation such as heparin, warfarin, and low-molecular-weight heparin can cause GU tract bleeding. Typical therapeutic levels generally do not cause haematuria unless some underlying pathology exists. Further evaluation must be undertaken to rule out important causes of bleeding, such as malignancy.

Idiopathic

- Exercise-induced haematuria is a benign, self-limited condition in athletes and active people.
- Loin-pain haematuria syndrome is a benign entity of unknown aetiology where symptoms of pain and intermittent haematuria predominate. This occurs primarily in women of childbearing age. The clinical significance of this syndrome as a diagnostic entity is a matter of debate.

Pseudohaematuria

- Cyclic pseudohaematuria may occur during menses.

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- Certain foods and medications can discolour the urine, mimicking haematuria. Medications include pyridium, rifampicin, phenytoin, levodopa, methyldopa, and quinine. Consumption of beets, blackberries, and rhubarb can also discolour the urine.

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Urgent considerations

(See **Differential diagnosis** for more details)

Emergency action for haemodynamically unstable patients

These patients require urgent evaluation in an emergency department or intensive care setting. Haemorrhagic shock from severe bleeding requires aggressive resuscitation with fluids, colloid, or blood products. Emergency exploratory surgery or vascular embolisation by interventional radiology may be required for control of bleeding. Life-threatening bleeding from the urinary tract is exceedingly rare but may present in select aetiologies including renal trauma, haemorrhage from arteriovenous malformations or renal masses, placenta percreta, or haemorrhagic cystitis.[4]Haemodynamically unstable patients with poor response to resuscitation may require immediate intervention such as surgery or angio-embolisation in selected situations.[14] Catheterisation may be necessary, particularly if bladder distension with blood and/or urine is present.

Clot retention

The presence of clots in the urine indicates more significant haematuria. Blood clots can cause urinary obstruction at the bladder outlet. Irrigation of the bladder and the possible use of continuous bladder irrigation may be necessary to prevent clot retention and obstructive renal failure.

Red flags

- Renal trauma
- Bladder trauma
- Urethral trauma
- Sickle cell anaemia
- Coagulopathy
- Arterial-venous malformation
- Renal vein thrombosis
- Extrapulmonary tuberculosis
- Post-infectious glomerulonephritis
- Membranoproliferative glomerulonephritis
- Rapidly progressive glomerulonephritis
- Systemic lupus erythematosus
- Bladder cancer
- Renal cancer
- Metastatic cancer
- Prostate cancer

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- Urethral cancer
- Penile cancer
- Placenta percreta
- Cytotoxic medications

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Step-by-step diagnostic approach

The evaluation of gross haematuria requires a complete history and physical examination.[5] The urinalysis is a critical component of the work-up of gross haematuria and should be an initial test. It is important that a fresh, midstream, clean-catch or catheterised urine specimen be collected. The presence of WBCs, leukocyte esterase, and nitrites points to an infectious process that should be confirmed by urine culture and treated with antibiotics. The presence of significant proteinuria, red cell casts, and dysmorphic RBCs requires nephrology consultation for an intrinsic renal process. Older patients with painless, gross haematuria should be considered at high risk for malignancy, and urine cytology should be performed. A serum creatinine is used to assess baseline renal function and suitability for radiographic studies that require IV contrast. A full blood count (FBC) is helpful for evaluating potential anaemia and for the presence of infection. Other blood tests may be ordered if a coagulopathy is suspected. Imaging of the upper urinary tract, such as by computed tomographic urography (CTU), which is the imaging modality of choice, must follow laboratory testing. Finally, referral to a urologist for cystoscopy is necessary to rule out pathology of the lower urinary tract. Further investigations should be carried out in all patients with confirmed haematuria that is not explained by the above causes.

History

- Age: patients aged 35 years or older with gross haematuria are at higher risk for GU tract cancer and require a full evaluation.
- Gender: premenopausal women may have pseudohaematuria from menses or recent intercourse. Women tend to have more UTIs than men. Men have a higher incidence of urinary tract cancer. Young women exposed to dieting agents containing aristolochic acid are a special population at risk for upper tract urothelial carcinoma. Pregnant women with prior caesarean sections are at risk for placenta percreta.
- Timing of blood in the urine stream: the timing of haematuria during micturition (initial, terminal, total) is an important clue in localising the source of bleeding. Blood that appears at the onset of a void, then clears, is called initial haematuria. Terminal haematuria occurs at the end of a void. Initial and terminal haematuria represent bleeding from the urethra, prostate, seminal vesicles, or bladder neck. Total haematuria, which is present throughout the void, indicates bleeding of bladder or upper tract (kidney or ureteral) origin.
- Lower urinary tract symptoms: a personal history of dysuria, urinary frequency, urgency, and urethral discharge points to an infectious or inflammatory process. Benign prostatic hyperplasia (BPH) can cause haematuria and obstructive urinary symptoms such as urinary hesitancy, straining to void, and a sensation of incomplete emptying. Urinary stasis, caused by severe BPH, can lead to UTI and bladder stone formation.
- Pain: haematuria alone does not cause pain unless it is associated with inflammation or acute urinary obstruction. Pyelonephritis and renal nephrolithiasis may present as flank pain. Pain from kidney stones often radiates to the groin. Intermittent or total bladder outlet obstruction by a bladder stone or clot can present as suprapubic pain or discomfort.
- Recent vigorous physical activity: can cause a self-limited exercised-induced haematuria, but other important aetiologies must be ruled out.
- Haematuria can be due to inflammatory or cytotoxic mechanisms. Any history of analgesic abuse should be elicited. The degree of therapeutic anticoagulation should be determined if appropriate.
- Exposures such as smoking and industrial chemicals (benzene, aromatic amines): linked to urothelial carcinomas.
- Periorbital and peripheral oedema, weight gain, oliguria, dark urine, or HTN suggests a glomerular cause.
- Recent pharyngitis or skin infection: may suggest post-infectious glomerulonephritis.
- Joint pains, skin rashes, and low-grade fevers suggest a collagen vascular disorder or SLE.
- Family history: should include a history of kidney stones, cancer, prostatic enlargement, sickle cell anaemia, collagen vascular disease, and renal disease.

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- Recent urological interventions: may cause recurrent haematuria, for example, bladder catheterisation, placement of an indwelling ureteral stent, or recent prostate biopsy.

Physical examination

- Vital signs: hypotension and tachycardia are seen in patients who are haemodynamically unstable from acute blood loss. Body core temperature may be raised in the setting of infection.
- Pallor of the skin and conjunctiva: often seen in patients with anaemia.
- Periorbital, scrotal, and peripheral oedema: may indicate hypoalbuminaemia from glomerular or renal disease.
- Cachexia: may indicate malignancy.
- Tenderness of the flank or costovertebral angle: may be caused by pyelonephritis or by enlarging masses such as a renal tumour.
- Suprapubic tenderness: can be elicited in the setting of cystitis, whether caused by infection, radiation, or cytotoxic medications.
- The bladder is not palpable when decompressed: bladder filled with 200 mL of urine is percussible. In acute urinary retention, usually seen in cases of BPH or obstruction by clots, the bladder is palpable and may be felt up to the level of the umbilicus.
- An abnormal, nodular, digital rectal examination: may signify prostatic adenocarcinoma or an invasive bladder tumour. An enlarged prostate or enlarged median lobe of the prostate is a sign of benign prostatic hyperplasia.
- Palpable adenopathy: either supraclavicular or inguinal, may indicate a neoplastic process.
- The presence of a urethral catheter, suprapubic catheter, ureteral stent, or nephrostomy tube may signify an iatrogenic cause of bleeding that is generally benign.

Laboratory evaluation

- Urine dip strip analysis must be performed for dark or discoloured urine to differentiate true haematuria from pseudohaematuria caused by medications or foods. False-positive tests may occur in the setting of myoglobinuria or haemoglobinuria, confirmed by the absence of RBCs on microscopic examination. A low specific gravity is seen in urine that is poorly concentrated due to intrinsic renal disease. Heavy proteinuria (>3 g/day) suggests glomerulonephritis. The presence of nitrite or leukocyte esterase may indicate infection.
- Microscopic evaluation of the urine will confirm the presence of RBCs or casts. Three or more RBCs per high power field (HPF) (on 2 of 3 separate urine collections) is considered microscopic haematuria.[15] Frank haematuria will obscure the microscopic examination with a full field of RBCs, usually reported as >150 RBCs/HPF. Red cell casts or dysmorphic RBCs indicate a tubular/glomerular source of bleeding. Bacteria, WBCs, and white cell casts indicate a UTI. Crystals in the urine indicate urolithiasis.
- Urine cultures should be performed in patients with clinical evaluation suggestive of infection to identify the cause of a UTI and the sensitivity data used to direct appropriate antimicrobial therapy. Urine cultures should be performed on catheterised or clean-catch, mid-stream specimens to avoid contaminated results. A repeat urinalysis should be performed 6 weeks after treatment.[13]
- Urine cytology should be sent for patients with any risk factors for urothelial carcinoma. These risk factors include age greater than 35 years, a history of smoking, occupational exposure to chemicals or dyes, previous episodes of gross haematuria, a history of primarily irritative voiding symptoms, a history of recurrent UTIs, analgesic abuse, or prior pelvic radiation.[15] Renal cell carcinoma and prostate cancers are not detected by this test.
- FBC can be sent to evaluate anaemia in cases of severe bleeding. Leukocytosis supports a diagnosis of infection.

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- Coagulation studies may be performed if there is suspicion for undiagnosed coagulopathy, disorders of haemostasis, or supertherapeutic anticoagulation therapy. In general, these studies do not add to the evaluation of haematuria, and further investigations must be performed to determine the cause of bleeding. Gross haematuria in anticoagulated patients likely signifies underlying pathology. Microscopic haematuria in anticoagulated patients has an incidence similar to the general population.

- Other specific testing may include haemoglobin electrophoresis to diagnose sickle cell disease, or measurement of serum complement levels to evaluate glomerular pathology. Low serum complement levels are seen in post-infectious glomerulonephritis, SLE nephritis, bacterial endocarditis, and membranoproliferative glomerulonephritis. A high antistreptolysin O titre suggests a recent streptococcal infection.

- Urinary bladder cancer markers (BTA stat, NMP22, uCyt +/Immunocyt, UroVysion FISH, and microsatellite analysis) are being investigated. However, they are not proven or useful in the primary work-up of haematuria. They may have a greater role in surveillance of known cancer patients with equivocal cytology results.

- Prostate specific antigen (PSA) may play a role in assessing the lower urinary tract (e.g., prostate cancer) as a source of gross haematuria.

Imaging studies

- Imaging is a key part of the evaluation of haematuria and provides structural and functional information about the renal parenchyma and upper urinary tract. Several modalities are available for visualisation of the upper urinary tract, including ultrasonography (US), computed tomographic urography (CTU), magnetic resonance urography (MRU), and intravenous urography (IVU).

- CTU is the imaging modality of choice, as it provides the greatest anatomical detail and the highest sensitivities and specificities for a range of aetiologies ranging from renal masses to stones to urothelial tumours.[16] CTU, compared with IVU, has a superior ability to characterise renal masses, and a higher sensitivity in detecting upper tract urothelial tumours.[17] [18] The non-contrast phase of CT can also detect renal stones with sensitivity of 94% to 98%, compared with 52% to 59% for IVU.[19]

- An ideal CTU should be have 4 distinct phases: a non-contrast phase establishes baseline tissue density and reveals urinary stones, fat, and haematoma; an arterial enhancement phase reveals inflammatory or neoplastic structures; a corticomedullary phase can show sustained renal tissue changes and damage; and a delayed excretory phase allows for evaluation of the urothelium of the ureters and bladder.[20] When used in the evaluation of trauma, sufficient contrast is necessary to evaluate the injury effectively.

- Prior to CTU, patient renal function should be assessed by the evaluating clinician, and a serum creatinine may be ordered to rule out impaired kidney function. The use of iodinated contrast is a well-known cause of acute renal failure, especially in patients with renal insufficiency.[21] Clinicians should also be aware of the risks of severe contrast reactions, which are rare but well documented. Finally, clinicians should be cognisant of the dose of ionising radiation delivered by each imaging modality, particularly in pregnant or paediatric patients.[22] [23]

- For patients with relative or absolute contraindications to CTU, MRU is an alternative imaging approach.[24] MRU provides less detailed anatomical visualisation than CTU, but has the advantage of avoiding ionising radiation.

- If circumstances preclude the use of both CTU and MRU, combining a non-contrast CT scan or renal US with retrograde pyelography (RGP) provides an alternative evaluation of the upper urinary system.[16]

- If urinary calculi are detected in a non-contrast CT, a plain radiograph of the abdomen (KUB) should be performed to note the position and radiodensity of the stones for future follow-up. Often, a CT scout (topogram) is performed at the time of CTU, which can serve this purpose.

- CT virtual cystoscopy (CTVC) and MR virtual cystoscopy (MRVC) have been investigated as potential tools in the detection of bladder tumours. Although one meta-analysis shows some improvement in sensitivity and specificity over conventional ultrasonography, the definitive test for the diagnosis of bladder tumours remains cystoscopy.[25]

- Nuclear renal scans, arteriography, and voiding cystourethrography are other imaging studies that can be ordered as clinically indicated, but are not part of the initial evaluation.

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Special studies

- Cystoscopy: during a cystoscopic examination, a rigid or flexible cystoscope is used to evaluate the urothelium of the bladder, prostate, and urethra. The ureteral orifices can be visualised, and upper tract bleeding can be seen as a jet of blood-tinged urine or clot emanating from these structures. Because urothelial carcinoma can arise from any portion of the urinary tract mucosa, complete visualisation of the bladder, bladder diverticula, and anterior and posterior urethra is necessary. Prostatic hypertrophy can be seen, and associated varices that may cause bleeding can be visualised. A drawback of flexible cystoscopy is its limited usefulness in the presence of active urinary bleeding.
- RGP: contrast can be injected into each ureteral orifice to opacify the luminal space of the ureter and kidney. In patients who cannot undergo CTU or MRU, RGP is an alternative.
- Renal biopsy: may be necessary to determine a medical renal cause of gross haematuria. As certain types of medical renal disease, such as crescentic glomerulonephritis, can quickly progress to renal failure and requires expeditious immunosuppressive therapy, an urgent consultation and kidney biopsy by a nephrologist may be necessary.

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Differential diagnosis overview

Common
Benign prostatic hyperplasia (BPH)
Urinary tract infection
Acute pyelonephritis
Alport's syndrome
Bladder cancer
Prostate cancer
Kidney stone
Instrumentation of the urinary tract
Menstruation
Uncommon
Renal trauma
Bladder trauma
Urethral trauma
Sickle cell anaemia
Coagulopathy
Cystic renal disease
Arterial-venous malformation
Renal vein thrombosis
Extrapulmonary tuberculosis
Benign familial haematuria (thin basement membrane nephropathy)
Post-infectious glomerulonephritis

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Uncommon
Membranoproliferative glomerulonephritis
Rapidly progressive glomerulonephritis
IgA nephropathy
Systemic lupus erythematosus
Renal cancer
Metastatic cancer
Urethral cancer
Penile cancer
Placenta percreta
Endometriosis
Bladder stone
Radiation cystitis
Cytotoxic medications
Anticoagulation
Exercise-induced haematuria
Loin pain haematuria syndrome
Medication
Food-related

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Differential diagnosis

Common

◊ Benign prostatic hyperplasia (BPH)

History	Exam	1st Test	Other tests
urinary hesitancy, straining to void, sensation of incomplete emptying, double voiding, weak stream, intermittency, urinary frequency, urgency, nocturia, hx of BPH, FHx of BPH, prior episode of retention	enlarged prostate on digital rectal examination, palpable bladder due to urinary retention	»**PSA :** may be raised Normal PSA does not exclude possibility of prostate cancer.	»**transrectal ultrasound of the prostate:** increased prostate size, volume >40 g, increased size of median lobe of the prostate Volumetric assessment of the prostate can be made from measurements of the length, width, and height of the prostate from transverse and sagittal views. »**uroflowmetry with bladder ultrasonography:** low peak flow rate, high post-void residual volume Urine flow meters are standard practice in many urological clinics. Post-void residuals can be measured by straight catheterisation or bladder ultrasound. Bladder ultrasonography is less invasive and a more reliable measure of bladder volume.

◊ Urinary tract infection

History	Exam	1st Test	Other tests
dysuria, urinary frequency, small volume voiding, nocturia, suprapubic pain, prior hx of UTI and treatment, hx of pyelonephritis, hx of antibiotic treatment failure	fever, suprapubic tenderness, bladder distention in urinary stasis, cystocele on pelvic examination	»**urinalysis:** positive leukocyte esterase, positive nitrite, pyuria (>10 WBC per high power field), bacteriuria The presence of leukocyte esterase has a 50% positive predictive value and a 92% negative predictive value. The sensitivity of urinary nitrate is 35% to 85%, with false-negatives occurring	»**urine culture and sensitivity:** >10,000 colony forming unit/mL urine Clean-catch or catheterised specimen should be obtained before the initiation of treatment.

DIAGNOSIS

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Common

◊ Urinary tract infection

History	Exam	1st Test	Other tests
		in the setting of diuretic use, or infection with Gram-positive organisms or *Pseudomonas*.[28]	

◊ Acute pyelonephritis

History	Exam	1st Test	Other tests
flank pain, fever, chills, nausea, vomiting, abdominal pain, suprapubic pain, hx of nephrolithiasis, UTI and diabetes, immunosuppression	costovertebral angle tenderness, suprapubic tenderness, fever, decreased bowel sounds	»**urinalysis:** positive leukocyte esterase, positive nitrite, pyuria (>10 WBC/high power field), bacteriuria The presence of leukocyte esterase has a 50% positive predictive value and a 92% negative predictive value. The sensitivity of urinary nitrate is 35% to 85%, with false-negatives occurring in the setting of diuretic use, or infection with Gram-positive organisms or *Pseudomonas*.[28] »**urine culture and sensitivity:** >10,000 colony forming unit/mL voided urine Clean-catch or catheterised specimen should be obtained before the initiation of treatment.	»**KUB:** renal calculi, intraparenchymal gas »**renal ultrasound :** renal enlargement, hypo-echoic parenchyma with loss of corticomedullary differentiation »**contrast CT abdomen:** heterogeneous uptake of contrast (lobar nephronia), oedematous renal parenchyma, perinephric stranding, intraparenchymal gas in emphysematous pyelonephritis

◊ Alport's syndrome

History	Exam	1st Test	Other tests
recurrent, persistent microscopic haematuria with episodes of gross haematuria, hearing impairment, FHx of	HTN, oedema, sensorineuronal hearing loss, anterior lenticonus, corneal erosions[29]	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE)	»**skin biopsy:** positive immunohistochemistry »**renal biopsy:** diffuse thickening and splitting of the basement membrane,

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Common

◊ Alport's syndrome

History	Exam	1st Test	Other tests
haematuria, hearing loss, or renal disease		Proteinuria is usually present to some degree with Alport's syndrome and can be severe in up to one third of patients. A nephrology consult should be obtained. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained immediately, as expeditious treatment or a renal biopsy may be necessary. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	focal glomerulosclerosis and tubular atrophy; negative immunohistochemistry

◊ Bladder cancer

History	Exam	1st Test	Other tests
painless haematuria, dysuria, frequency, urgency, age over 50 years, hx of pelvic irradiation, hx of smoking, weight loss, exposure to environmental/chemical carcinogens	pelvic mass, costovertebral angle tenderness from obstruction; frequently no abnormalities detected	»**urinalysis:** RBCs »**urine cytology:** atypical or malignant cells, signified by increased clustering, increased cellularity, or altered nuclear morphology Cytological examination of voided urine (overall diagnostic accuracy of 49%) has a lower accuracy than cytology performed on bladder washings during cystoscopy (overall diagnostic accuracy of 66%). The sensitivity is poor for low-grade cancers, when compared with high-grade cancers and carcinoma in situ.[30]	

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Common

◊ Bladder cancer

History	Exam	1st Test	Other tests
		»**CTU or MRU :** ureteral or renal collecting system mass or filling defect Two percent of patients with bladder tumour have a coincident upper tract tumour.[15] »**cystoscopy:** bladder tumour Performed in the urology clinic with local analgesia. [Fig-1]	

◊ Prostate cancer

History	Exam	1st Test	Other tests
advanced age, FHx, obstructive voiding symptoms, weight loss; prior hx of treatment with surgery, radiation, or brachytherapy	abnormal digital rectal examination, prostate nodule or diffuse hardness of the gland	»**PSA:** raised »**digital rectal examination:** prostate may be palpable	»**transrectal ultrasound-guided prostate biopsy :** confirmed adenocarcinoma

◊ Kidney stone

History	Exam	1st Test	Other tests
abrupt onset of severe flank pain, pain radiating to the groin, haematuria, nausea, vomiting, previous hx of calculi, FHx of nephrolithiasis, hx of gout, hx of inflammatory bowel disease	costovertebral angle tenderness	»**urinalysis :** haematuria, pyuria, crystalluria, cysteine crystals, acidic or alkaline pH »**non-contrast CT abdomen:** urolithiasis, hydronephrosis	»**KUB:** radiodense stones Certain categories of stones are radiolucent and therefore may only be visualised on CT scan. A CT scan is the preferred modality for diagnosis, but a KUB will help guide treatment.

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Common

◊ Instrumentation of the urinary tract

History	Exam	1st Test	Other tests
recent cystoscopy, ureteroscopy, prostate needle biopsy	presence of a urethral catheter, suprapubic catheter, ureteral stent with retrieval strings in urethra	»**urinalysis:** diagnosis is clinical, and tests are not routinely recommended	»**KUB:** ureteral stent and drain visualisation

◊ Menstruation

History	Exam	1st Test	Other tests
current menses, hx of cyclical haematuria	physical examination is normal	»**urinalysis:** diagnosis is clinical, and tests are not routinely recommended	

Uncommon

◊ Renal trauma

History	Exam	1st Test	Other tests
blunt flank trauma, penetrating flank or abdominal wounds (gunshot or stab), fractured lower ribs	hypotension, tachycardia, flank tenderness, flank contusion, abdominal tenderness, abdominal distention	»**IV contrast-enhanced CT of the abdomen and pelvis with immediate and delayed images:** lacerations to the renal parenchyma, collecting system, and renal vessels; perinephric haematoma, active bleeding, and urinary extravasation Contrast-enhanced CT is the best modality for the staging of renal injuries. Renal injuries are classified from grade I to grade V. Grade I is haematuria associated with contusion or contained subcapsular haematoma. Grade II injuries include renal cortical laceration <1 cm deep. Grade III injury is a renal parenchymal laceration >1 cm. Grade IV injuries include lacerations >1 cm extending into the collecting system or	»**intraoperative intravenous urography ('one-shot IVP'):** confirms contralateral renal function Haemodynamically unstable patients that are taken to the operating room should undergo 'one-shot' IVP at the time of laparotomy. This can be used to exclude life-threatening renal injury and confirm the existence of a contralateral functioning kidney.[26] Two millilitres of contrast per kg of body weight should be infused with a single IVP image taken 10-15 minutes after infusion.[14]

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Uncommon

◊ Renal trauma

History	Exam	1st Test	Other tests
		involve segmental renal vessels. Grade V injuries include laceration or avulsion of the main renal vessels, and major multiple lacerations.	

◊ Bladder trauma

History	Exam	1st Test	Other tests
blunt pelvic trauma, penetrating pelvic or abdominal wounds (gunshot or stab), pelvic fracture, inability to void	suprapubic tenderness, lower abdominal ecchymoses	»**retrograde cystogram:** extravasation of contrast revealing bladder injury Urethral catheter is passed after urethral injury is ruled out. The bladder is filled by gravity drip infusion without pressure (300 mL of water-soluble iodinated contrast) and anteroposterior, oblique, and post-drain films obtained. Intraperitoneal and extraperitoneal bladder rupture can be diagnosed in this way. A CT cystogram and retrograde cystogram are equivalent, but CT has become the first-line choice for acute trauma imaging.[27]	»**X-ray:** possible fracture of the pelvic ring, lacerating fragments of bone causing injury to the bladder, or a disruption of the symphysis pubis X-ray of the pelvis is indicated in cases of acute blunt lower abdominal or pelvic trauma, and should be performed in cases of penetrating trauma if the presence of a foreign body (e.g., a bullet) is suspected.[27]

◊ Urethral trauma

History	Exam	1st Test	Other tests
external genital trauma, straddle injury, bilateral pubic rami fracture and Malgaigne's fracture, perineal lacerations, inability to void, recent complicated colorectal or gynaecological procedure	blood at penile meatus, bloody urethral discharge, high riding prostate on digital rectal examination, sleeve of ecchymoses limited to the penile shaft, butterfly-ecchymosis of the perineum	»**retrograde urethrogram:** contrast extravasation from the urethra A retrograde urethrogram should be performed before placement of a urethral catheter.	»**X-ray:** possible pelvic fracture or diastasis of the pubic symphysis X-ray of the pelvis should be performed to determine if a pelvic fracture or diastasis of the pubic symphysis has occurred. This procedure can be

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Uncommon

◊ Urethral trauma

History	Exam	1st Test	Other tests
			combined with retrograde urethrography.[27] »**contrast CT abdomen:** contrast extravasation from the urethra »**cystoscopy:** urethral disruption Cystoscopy can be performed to assess the degree of urethral disruption and to place an aligning catheter across the defect.

◊ Sickle cell anaemia

History	Exam	1st Test	Other tests
African-American descent, prior episodes of sickle crises, FHx of sickle cell disease, migrating, intermittent pain	hepatosplenomegaly, abdominal tenderness, testicular atrophy, oedema of extremities	»**peripheral blood smear:** sickle cells	»**Hb electrophoresis (whole blood):** haemoglobin S Electrophoresis differentiates patients who are homozygous from those who are heterozygous. A homozygous patient will have haemoglobin SS (HbSS, 80% to 90%), haemoglobin F (HbF, 2% to 20%), and haemoglobin A2 (HbA2, 2% to 4%). A carrier patient will have HbSS (35% to 40%) and haemoglobin A (HbA, 60% to 65%).

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◊ Coagulopathy

History	Exam	1st Test	Other tests
easy bruising, propensity to bleed, recurrent epistaxis, FHx of bleeding diatheses, hx of cirrhosis	ecchymoses, prolonged bleeding	»**PT, PTT, INR:** may be normal or raised »**full blood count (FBC):** thrombocytopenia Thrombocytopenia may occur in idiopathic thrombocytopenic purpura and thrombotic thrombocytopenic purpura.	»**LFTs:** hypoalbuminaemia Hepatic dysfunction impairs production of clotting factors. »**von Willebrand factor antigen (whole blood):** reduced in von Willebrand's disease Von Willebrand's disease is a common inherited coagulopathy. »**ristocetin cofactor activity (whole blood):** reduced in von Willebrand's disease »**factor VIII, IX activity (whole blood):** reduced in haemophilia, VIII reduced in von Willebrand's disease

◊ Cystic renal disease

History	Exam	1st Test	Other tests
often asymptomatic, flank pain, self-limited haematuria, UTI, renal colic	costovertebral angle tenderness, palpable flank mass in polycystic kidneys, HTN	»**renal ultrasound :** cystic lesions Renal cysts are well characterised by ultrasound. Structural features such as calcification or septation, often graded under the Bosniak classification system, may warrant further characterisation by other studies, such as CT.	»**serum creatinine:** raised Creatinine may be raised in cases of polycystic kidney disease. »**CT abdomen:** well-defined, oval lesions

◊ Arterial-venous malformation

History	Exam	1st Test	Other tests
passage of long, vermiform clots, flank pain, previous hx of renal bx or	HTN, cardiomegaly, abdominal or flank bruit	»**CT abdomen with contrast:** mass lesion, filling defect, delayed nephrogram	»**renal angiography:** simultaneous filling of the arterial and venous system,

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◊ Arterial-venous malformation

History	Exam	1st Test	Other tests
percutaneous renal procedure			delayed nephrogram, demonstration of vascular defect

◊ Renal vein thrombosis

History	Exam	1st Test	Other tests
sudden flank pain, hx of nephrotic syndrome	evidence of flank trauma, oedema	»**Doppler ultrasonography:** enlarged, oedematous, echogenic kidney with absent venous signal Doppler ultrasound may demonstrate peaked, abruptly decreasing systolic frequency shifts in the renal artery and proximal segmental branches. Venous signal may be absent or show flow turbulence in narrowed sections of the renal vein.	»**CT abdomen:** loss of corticomedullary differentiation, low-attenuation thrombus in the renal vein, renal enlargement with parenchymal opacification Although inferior vena cavography and selective catheterisation of the renal vein is the gold standard of diagnosis, non-invasive modalities are employed first. »**IV urography :** delayed excretion of contrast from kidney, kidney enlargement due to congestion, notched ureter Renal collateral circulation causes the renal collecting system to opacify to varying degrees. The renal pelvis may be distorted, and notching of the ureter represents the formation of collateral circulation.

◊ Extrapulmonary tuberculosis

History	Exam	1st Test	Other tests
irritative voiding symptoms, nocturia, weight loss, malaise, hx of TB exposure, hx of cystitis unresponsive to	orchalgia with reactive hydrocele, nodular prostate on digital rectal examination	»**urinalysis:** pyuria (>10 WBC/high power field) with no visualised bacteria	»**IV urography:** moth-eaten calyces with ulceration, calyceal obliteration, hydronephrosis,

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◊ Extrapulmonary tuberculosis

History	Exam	1st Test	Other tests
antibiotics, hx of epididymitis, recurrent UTIs with *Escherichia coli,* fever, night sweats		»**urine culture, mycobacterial culture, acid-fast stain:** >10,000 colony forming unit/mL urine First morning urine specimen offers highest yield for TB, repeat 3 early-morning urine tests.	calcification, calculi, small bladder

◊ Benign familial haematuria (thin basement membrane nephropathy)

History	Exam	1st Test	Other tests
recurrent, persistent gross and microscopic haematuria, FHx of haematuria	oedema and HTN	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE) Medical renal diseases, suggested by the presence of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consultation should be obtained immediately, as expeditious treatment or a renal biopsy may be necessary. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	»**renal biopsy:** thinning of the glomerular basement membrane (150-225 nM) Because this is a benign condition generally diagnosed through history alone, a renal biopsy is not indicated unless there is refractory HTN or renal failure. The need for biopsy should be assessed by a nephrologist, and is generally performed in the setting of refractory HTN, heavy proteinuria, or renal failure.

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Uncommon

◊ Post-infectious glomerulonephritis

History	Exam	1st Test	Other tests
abrupt onset of oedema, weakness, malaise, gross haematuria, headache, 1 to 2 weeks post-pharyngitis, 2 to 4 weeks after streptococcal dermatitis, most common from age 2 to 10 years	periorbital and peripheral oedema, HTN, skin rashes	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE) Medical renal diseases, suggested by the presence of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained immediately. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	»**serum antistreptolysin O titre :** raised

◊ Membranoproliferative glomerulonephritis

History	Exam	1st Test	Other tests
abrupt onset of dependent or periorbital oedema, fatigue, recurrent gross haematuria, headache from HTN, oliguria	periorbital and peripheral oedema, HTN, conjunctival pallor, retinal drusen	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE) Medical renal diseases, suggested by the presence of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained immediately, as expeditious treatment	»**serum complement levels (C3, C4):** low Multiple complement components may be depressed. Nephrological consultation is necessary to perform a comprehensive work-up, which may include a renal bx. »**renal bx:** hypercellular glomeruli, expanded mesangium, positive immunofluorescence, electron dense deposits The need for biopsy should be assessed by a nephrologist.

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◊ Membranoproliferative glomerulonephritis

History	Exam	1st Test	Other tests
		or a renal biopsy may be necessary. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	

◊ Rapidly progressive glomerulonephritis

History	Exam	1st Test	Other tests
prodromal symptoms of malaise, fever, arthralgias, anorexia, and myalgias; abdominal pain, painful skin nodules or ulcerations	HTN, painful cutaneous nodules, conjunctivitis, uveitis, oliguria	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE) Medical renal diseases, suggested by the presence of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. Suspicion of a rapidly progressive glomerulonephritis requires immediate nephrology consult with further serologies and renal bx. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	»**renal bx:** hypercellular, sclerotic glomeruli with crescentic inclusions The need for biopsy should be assessed by a nephrologist.

◊ IgA nephropathy

History	Exam	1st Test	Other tests
recurrent macroscopic haematuria associated with upper respiratory tract infections	generally asymptomatic, occasional HTN	»**urinalysis:** RBC casts, mild proteinuria Medical renal diseases, suggested by the presence	»**renal bx:** IgA deposition in the mesangium, proliferative crescents in severe cases

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◊ IgA nephropathy

History	Exam	1st Test	Other tests
		of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained immediately, as expeditious treatment or a renal bx may be necessary. »**urea and creatinine:** creatinine >2.0, urea >20 »**24-hour urine collection for protein :** >1 gram/24 hours	

◊ Systemic lupus erythematosus

History	Exam	1st Test	Other tests
arthralgias, low-grade fever, fatigue, malaise, anorexia, nausea, weight loss, seizures, pleuritic pain, photosensitivity	malar, butterfly or discoid rash, oral or vaginal ulcers, retinal vasculitis, systolic murmur	»**urinalysis:** pyuria, RBCs, granular casts, proteinuria Medical renal diseases, suggested by the presence of dysmorphic red cells, proteinuria, and cellular casts, require referral to a nephrologist for further laboratory testing and imaging. In cases where renal failure, heavy proteinuria (>3 g/day), or severe HTN is present, a nephrology consult should be obtained immediately, as expeditious treatment or a renal bx may be necessary. »**urea and creatinine:** creatinine >2.0, urea >20	»**renal bx:** mild glomerulitis to widespread immunoglobulin deposition and proliferative crescent formation »**lupus serologies (ANA, anti-dsDNA, antiphospholipid antibody):** raised »**serum complement (C3, C4):** low

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◊ Systemic lupus erythematosus

History	Exam	1st Test	Other tests
		»**24-hour urine collection for protein :** >1 gram/24 hours	

◊ Renal cancer

History	Exam	1st Test	Other tests
flank fullness, hx of dialysis, hx of smoking, FHx of renal cell carcinoma, polycystic kidney disease, weight, exposure to environmental/chemical carcinogens	HTN, flank mass, adenopathy, new onset of left varicocele, lower extremity oedemas	»**renal ultrasound:** solid or cystic renal mass »**CT abdomen with and without IV contrast:** contrast enhancing renal mass 85% of solid renal masses that enhance are renal cell carcinomas.[6] [Fig-2] Other findings may include displacement and distortion of the renal collecting system or aberrant vasculature surrounding the mass.	

◊ Metastatic cancer

History	Exam	1st Test	Other tests
hx of primary lung, breast, or GI malignancy, weight loss	cachexia, anaemia, cough, RUQ pain, neurological deficits, lymphadenopathy	»**CT abdomen with and without IV contrast:** contrast enhancing renal mass	

◊ Urethral cancer

History	Exam	1st Test	Other tests
more common in white women and in those aged over 50 years, frequency, hesitancy, obstructive urinary symptoms	palpable mass, hard stricture	»**CTU:** filling defect, mass »**voiding cystourethrogram:** filling defect, mass Useful in evaluating strictures, fistulas, diverticula, and neoplasms.	»**urethroscopy:** visible urethral mass »**MRI:** will help determine the depth of invasion and the stage of disease

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◊ Penile cancer

History	Exam	1st Test	Other tests
hx of penile lesion, hx of condyloma	erythematous patch, induration, palpable mass, inguinal lymphadenopathy	»**skin biopsy:** squamous cell carcinoma	»**MRI/CT pelvis:** will effectively stage the extent of disease

◊ Placenta percreta

History	Exam	1st Test	Other tests
painless vaginal bleeding in the first or second trimester, hx of prior caesarean section, advanced age during pregnancy	haemodynamic instability, sudden abdominal pain, distention	»**pelvic ultrasound with Doppler studies:** placental erosion through uterine wall, loss of hypo-echoic boundary between the placenta, bladder wall, and surrounding organs; sonolucent spaces, representing placental lacunae, adjacent to myometrium and surrounding structures »**MRI :** placental erosion through uterine wall	

◊ Endometriosis

History	Exam	1st Test	Other tests
cyclic haematuria following menses, women of reproductive age, nulliparous women with short menstrual cycles, dysmenorrhoea, chronic pelvic pain, dyspareunia, pain responsive to non-steroidal anti-inflammatory drugs and oral contraceptives	abdominal or suprapubic tenderness especially during palpation of the uterosacral ligaments and adnexa	»**pelvic ultrasound:** pelvic mass, endometrial cysts	»**CTU:** filling defect, mass Indicated in cases of gross haematuria. »**cystoscopy:** bladder endometrioid tissue

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◊ Bladder stone

History	Exam	1st Test	Other tests
suprapubic pain, haematuria, bladder outlet obstructive symptoms, previous surgery	suprapubic tenderness	»**urinalysis:** haematuria, leukocyte esterase, nitrites »**non-contrast CT abdomen:** bladder stone	»**KUB:** radio-opaque bladder stone Certain stones, such as magnesium-ammonium phosphate stones, are generally radiolucent and may be seen as a filling defect in the bladder or not visible on plain radiograph.

◊ Radiation cystitis

History	Exam	1st Test	Other tests
hx of pelvic radiation, dysuria, urinary frequency, urgency, nocturia, haematuria, timing and dosage of prior radiation	suprapubic tenderness	»**cystoscopy:** inflamed bladder mucosa	

◊ Cytotoxic medications

History	Exam	1st Test	Other tests
hx of analgesic use or abuse, aminoglycoside, cyclophosphamide, ciclosporin, penicillin, sulfonamides, non-steroidal anti-inflammatory drugs, recurrent haematuria, flank pain, dysuria	hypotension, oedema, suprapubic pain	»**urinalysis:** dysmorphic red cells, red cell casts, proteinuria, increase in urinary albumin excretion (UAE) Insults to the kidney by nephrotoxic medications may present as medical renal disease and requires referral to a nephrologist for further laboratory testing and imaging. »**full blood count (FBC):** peripheral blood eosinophilia Drug hypersensitivity results from interactions between a pharmacological agent and the human immune system.	»**cystoscopy:** amyloid deposits, haemorrhagic inflammation

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◊ Cytotoxic medications

History	Exam	1st Test	Other tests
		»**serum creatinine:** raised	

◊ Anticoagulation

History	Exam	1st Test	Other tests
hx of atrial fibrillation, mechanical valve, stroke, bruising, bleeding gums	pelvic mass, costovertebral angle tenderness, bruising, bleeding gums	»**coagulation studies:** raised	

◊ Exercise-induced haematuria

History	Exam	1st Test	Other tests
recent hx of vigorous exercise	physical examination is usually normal	»**urinalysis:** RBCs	

◊ Loin pain haematuria syndrome

History	Exam	1st Test	Other tests
young women, intermittent haematuria, intermittent flank pain ranging from mild to severe, oral contraceptive use	low-grade fever	»**urinalysis:** diagnosis is clinical, and tests are not routinely recommended	

◊ Medication

History	Exam	1st Test	Other tests
use of medications such as pyridium, rifampin, phenytoin, levodopa, methyldopa, and quinine	physical examination is normal	»**urinalysis:** diagnosis is clinical, and tests are not routinely recommended	

◊ Food-related

History	Exam	1st Test	Other tests
hx of beets, blackberries, rhubarb in diet	physical examination is normal	»**urinalysis:** diagnosis is clinical, and tests are not routinely recommended	

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Diagnostic guidelines

Europe

Guidelines on urological trauma

Published by: European Association of Urology
Last published: 2016
Summary: Guidelines to assist medical professionals in the management of urological trauma in adults.

North America

Hematuria as a marker of occult urinary tract cancer: advice for high-value care from the American College of Physicians

Published by: American College of Physicians
Last published: 2016
Summary: Describes indications for the evaluation of haematuria as a marker of occult urinary tract cancer.

ACR appropriateness criteria: hematuria

Published by: American College of Radiology
Last published: 2014
Summary: Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision.

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Images

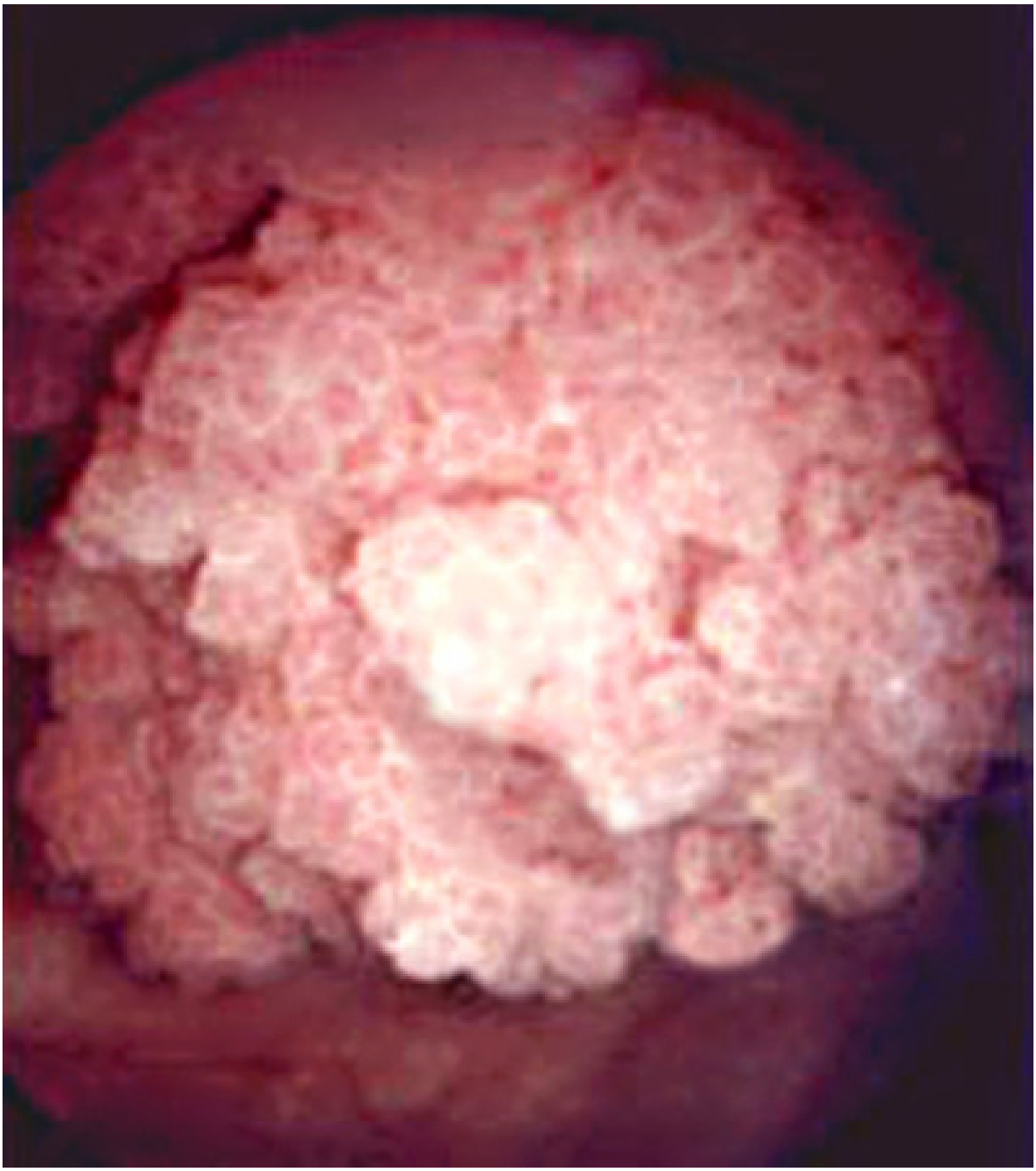

Figure 1: Bladder tumour visible on cystoscopy

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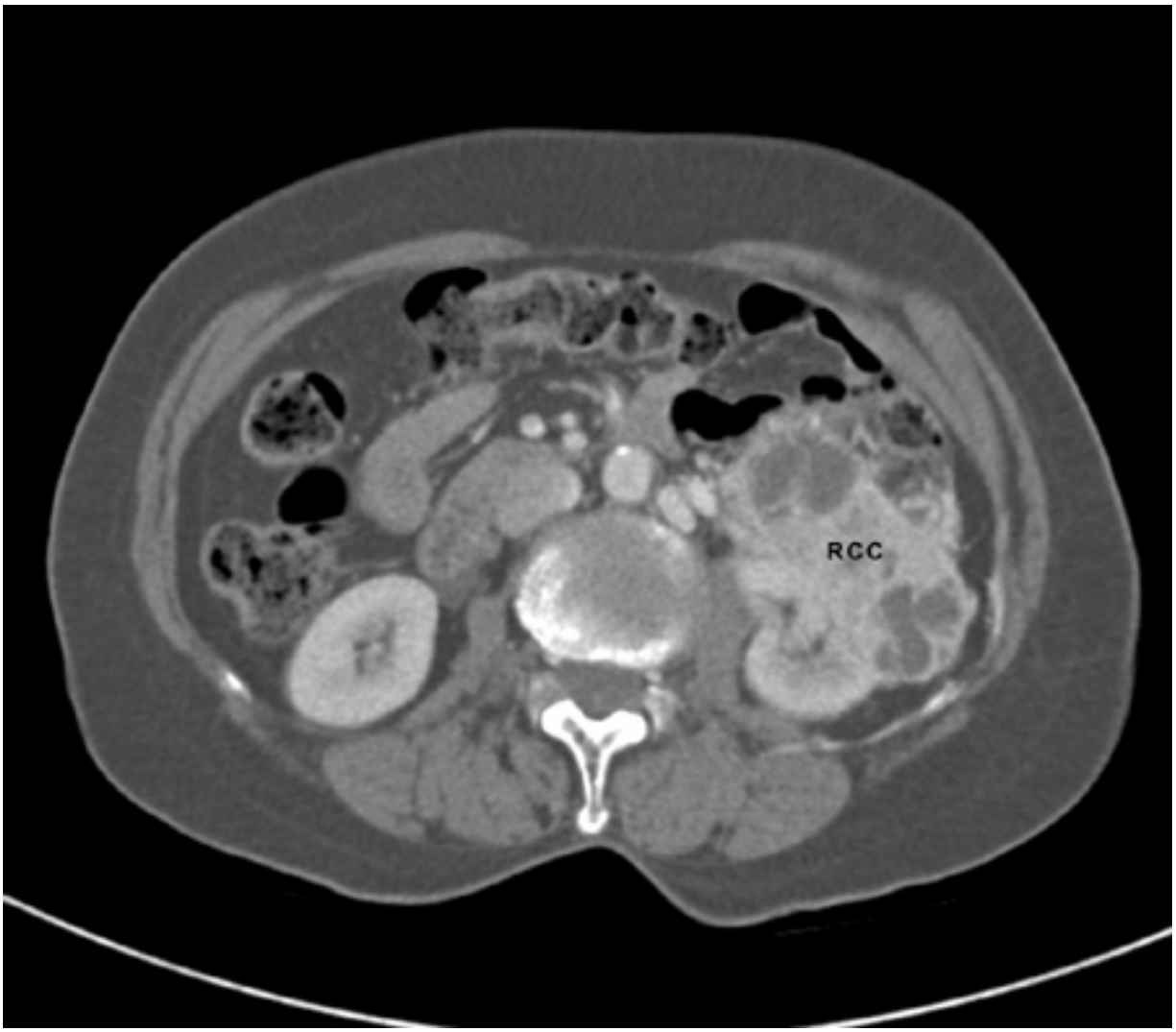

Figure 2: CT of renal cell carcinoma (RCC) of the left kidney

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