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شعبة الإمارات لطب الأسرة

Nephrology: Clinical cases & Hematuria

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Lecture Modules

- Clinical Cases
- Hematuria
- Nephrolithiasis
- Electrolyte and Acid-Base

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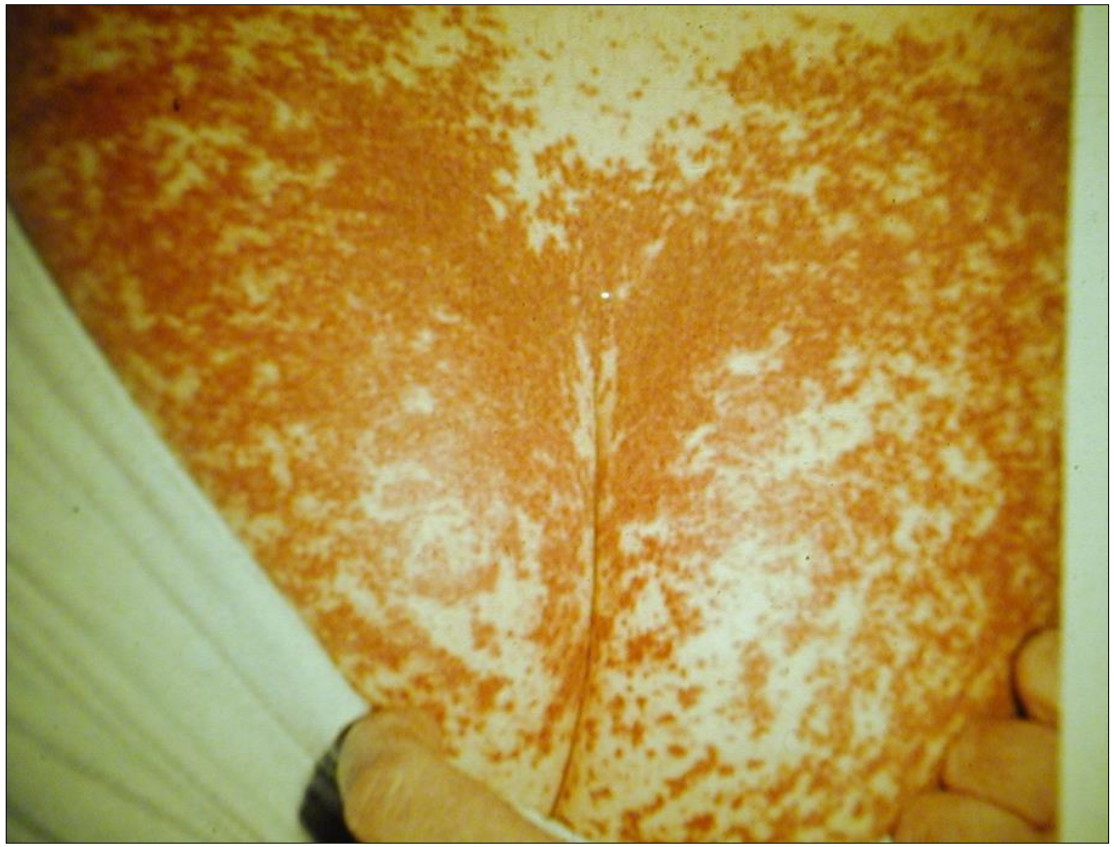
Clinical Cases

Question: 8 yo patient complains of skin rash for 1 week. Notes small amount of blood in urine.



Clinical pictures from:
American College of Rheumatology slide set, copy owned by Eddie Needham, MD

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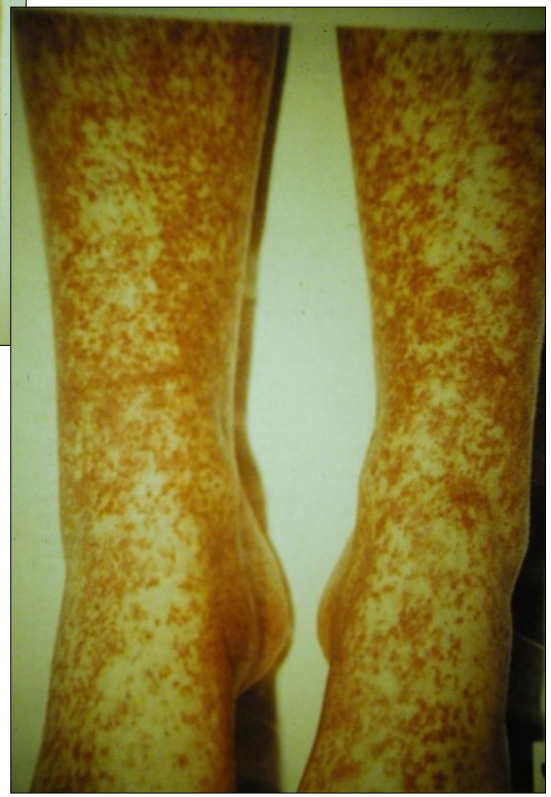
Question *cont'd:* CBC is normal. Dx?

A. Henoch-Schönlein purpura

B. Lupus nephritis

C. Hemophilia A

D. Idiopathic thrombocytopenic purpura (ITP)

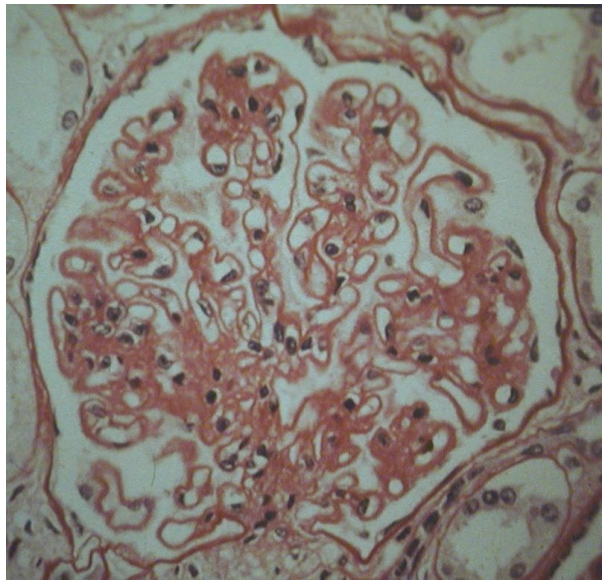


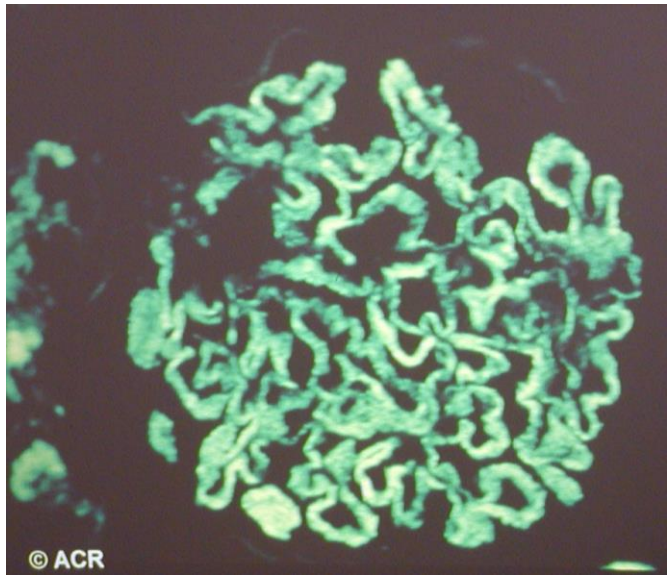
Correct answer is A - HSP

- The skin lesions are consistent with purpura and are notably present on the lower extremities and gluteal cheeks. This is classic for HSP(henoch-schonlein purpura). A normal CBC rules out ITP(idiopathic thrombocytopenic purpura) or TTP(thrombotic thrombocytopenic purpura). Hemophilia A is a rare condition and usually presents with bleeding, mucosal, articular or deep tissue. This rash is not common for lupus.

Signs and Symptoms associated with hematuria

- Patient complaints of skin rash …





- Systemic Lupus Erythematosus (SLE)

Clinical pictures from:
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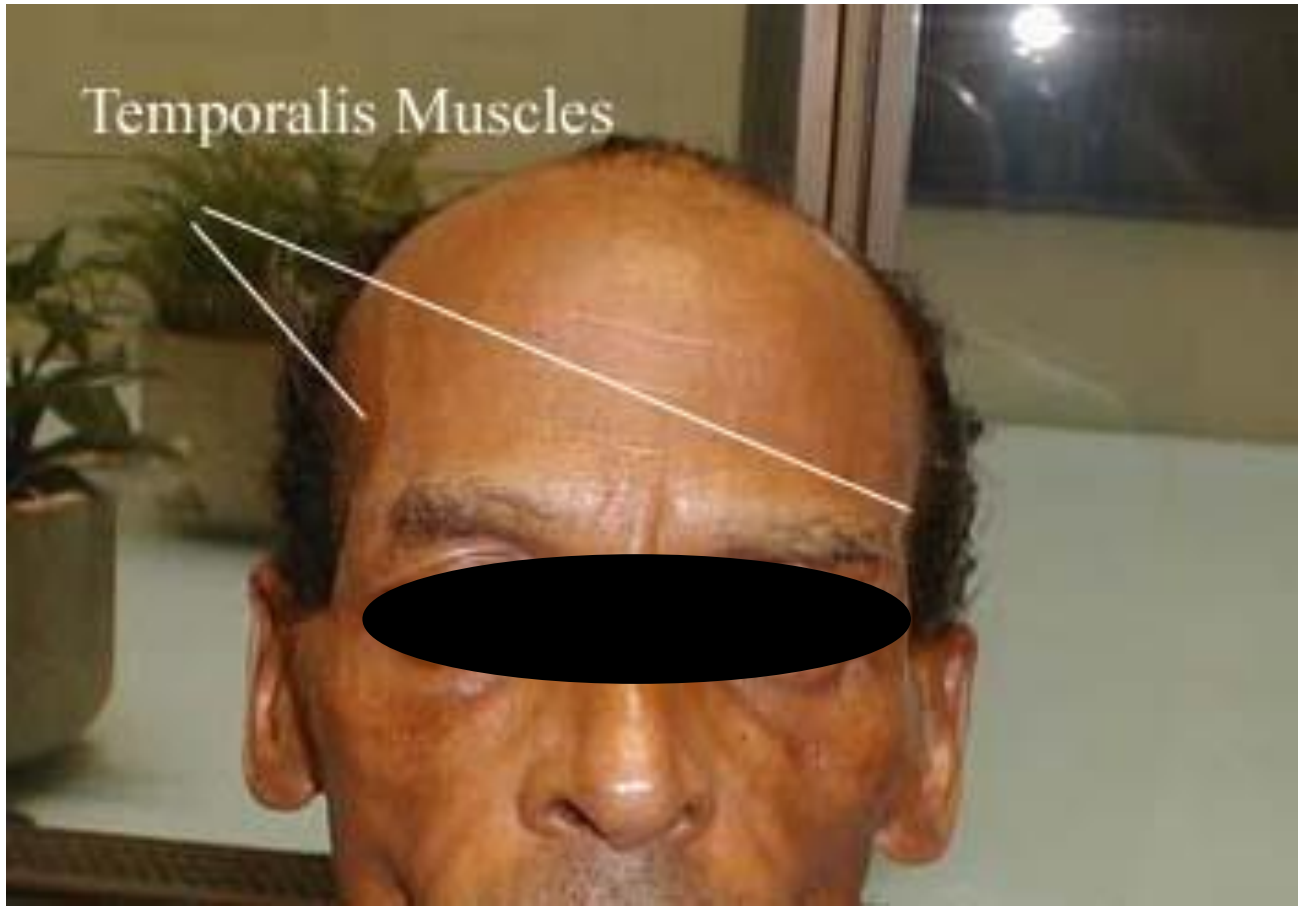
Signs and Symptoms associated with hematuria

- Sixteen year old female had a sore throat last week and now has a rash…

- Scarlet fever with post-streptococcal glomerulonephritis

Signs and Symptoms associated with hematuria

- Sixty-five year old male with decreased appetite and weight loss …



- Renal Cell Cancer

Signs and Symptoms associated with Hematuria

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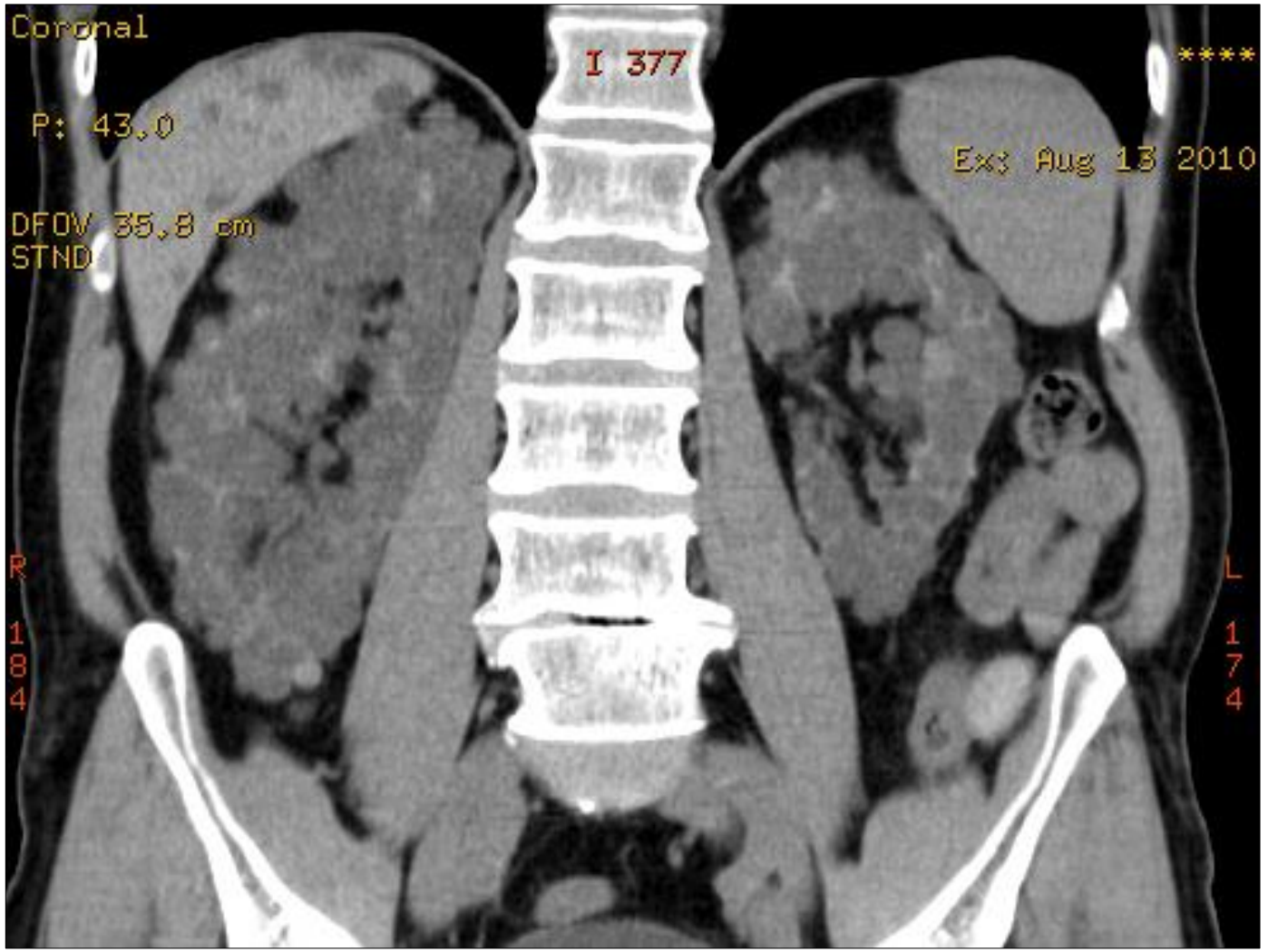
- A bride recently back from her honeymoon in Jamaica…

- Honeymoon cystitis

Signs and Symptoms associated with hematuria

- Family history of renal failure and cerebral aneurysms:
  - Polycystic Kidney Disease (PKD)

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Etiologies of Gross Hematuria

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Table 1. Findings during evaluation of gross hematuria			
Etiology	General population children; 3 *n*=228	Referred children; 18 *n*=294	Adults; 17 *n*=1200
Cancer	1 (0.4%)	4 (1.4%)	270 (22.5%)
Urolithiasis	2 (0.8%)	18 (6.1%)	130 (10.8%)
Urinary tract infection	1 (0.4%)	48 (16.3%)	394 (32.8%)
Congenital anomaly	5 (2.2%)	45 (15.3%)	N/A
Hypercalcuria	51 (22.4%)	N/A	N/A
Renal disease	77 (33.8%)	N/A	N/A
No source found	86 (37.7%)	118 (40.1%)	101 (8.4%)
These data focus on findings to both children and adults. Other outcomes, such as hypospadias and benign prostatic hperplasia are not shown. Abbreviation: N/A, not applicable			

Source: Tu, W. H. & Shortliffe, L. D. (2010) Evaluation of asymptomatic, atraumatic hematuria in children and adults *Nat. Rev. Urol.* doi:10.1038/nrurol.2010.27

Etiologies of Microscopic Hematuria

Table 2 | Findings during evaluation of microscopic hematuria

Etiology	General population children;[3] *n* = 342	Adults;[17] *n* = 1,689
Cancer	0 (0%)	86 (5.1%)
Urolithiasis	1 (0.4%)	84 (5.0%)
Urinary tract infection	0 (0%)	73 (4.3%)
Congenital anomaly	5 (1.5%)	NA
Hypercalciuria	56 (16.4%)	NA
Renal disease	10 (2.9%)	37 (2.2%)
No source found	274 (80.1%)	717 (43.0%)

Some children had multiple findings. Findings unique to adults such as benign prostatic hyperplasia are not shown. Abbreviation: NA, not applicable.

Source: Tu, W. H. & Shortliffe, L. D. (2010) Evaluation of asymptomatic, atraumatic hematuria in children and adults *Nat. Rev. Urol.* doi:10.1038/nrurol.2010.27

Microscopy and Localization

- Dysmorphic cells in combination with proteinuria and RBC casts are suggestive of glomerular disease

Clinical pictures from:
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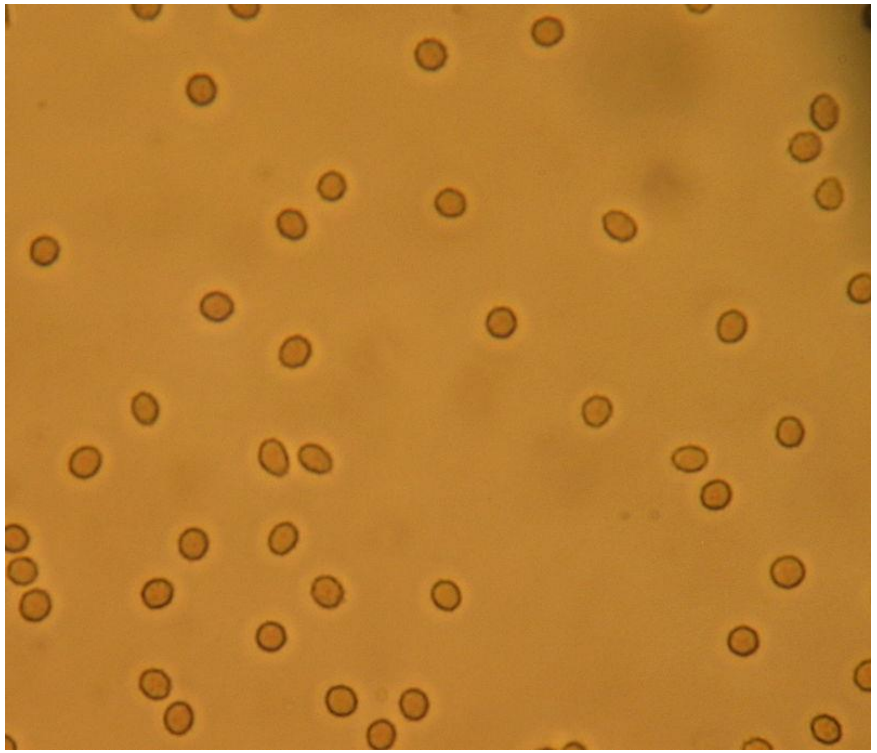
Microscopy and Localization

- RBCs from a nonglomerular source resemble a peripheral blood smear



Hematuria – Diagnosis

- The dipstick test for blood detects the peroxidase activity of erythrocytes
- This reaction results in a green color change that is visible on the dipstick
- The sensitivity of the dipstick to detect hematuria at a concentration of >3 RBCs/HPF is 91%-100%[1,2]
- The specificity is 65%-99%[2]

Source: [1] Hematuria. Emerg Med Clin North Am. 19: 2001; 621-632.
[2] Woolhandler S, Pels RJ, Bor DH, et al. Dipstick urinalysis screening of asymptomatic adults for urinary tract disorders. I. Hematuria and proteinuria. *JAMA*. 1989;262:1214–9.

A 23 y.o. female athlete spends several hours training for a triathlon. She notes dark urine. The UA shows: 3+ blood, neg glucose, neg protein, spec grav. 1.030, ketones 1-2+,
WBCs = 0, RBCs = 0.

Dx of (+) blood?

A. Urinary tract infection

B. Rhabdomyolysis with myoglobinuria

C. Dehydration and concentrated urine

D. Excessive intake of beets

Correct answer is B

- This patient presents a classic case of rhabdomyolysis with UA dip positive for blood without significant RBCs. The UA cannot distinguish hemoglobin from myoglobin. There is no UA evidence for a UTI. Beets can indeed change the color of the urine but do not cause the UA to dip positive for blood.

Urinalysis Results

- False positive
  - Hemoglobinuria
  - Myoblobinuria
  - Dehydration
  - Exercise
  - Menstrual blood
- False negative
  - Elevated specific gravity
  - PH<5.1
  - Proteinuria
  - Vitamin C

Extrarenal Causes of Hematuria

- Benign prostatic hypertrophy
- Calculi
- Coagulopathy
- Infection – prostate, bladder, urethra
- Inflammation – drugs, radiation
  - Cyclophosphamide
- Trauma
- Tumor

Needham's Mnemonic

- "HITS"
- Hematologic disturbances
  - Sickle cell disease, hemophilia
- Infection, Infarction, Inflammation
  - UTI, pyelonephritis, ATN, papillary necrosis, AIN, glomerulonephritis
- Trauma, Tumor, TB
- Stones, "Systs," "S/Cyclophosphamide"/meds

Causes of Benign Transient Hematuria

- Vigorous exercise
  - March hematuria in the military
  - Runner's hematuria
- Trauma to urethra
  - Insertion of Foley catheter
- Menstruation
- Medication
- Sexual intercourse
- Digital rectal exam

- If the patient's history suggests one of these causes, repeat the urinalysis in 48 hours

- If the hematuria has resolved, no further workup is necessary in a low risk patient

Source: Cohen RA, Brown RS. Clinical practice. Microscopic hematuria. N Engl J Med 2003;348:2330-8.

Clinical Cases and Hematuria
Key Points

- Common causes of hematuria include:
  - UTIs, BPH, Stones, local trauma (Foley)
- Gross hematuria confers a 20-25% chance of bladder cancer in adults
- Hematuria can be a manifestation of a systemic condition:
  - SLE, Wegener's, glomerulonephritides

Nephrolithiasis

A 43 y.o. female presents to the ED with severe abdominal pain. She is noted to have 20-30 RBCs/HPF (high power field) on UA and is hCG (human chorionic gonadotropin) negative. Which study is the best initial study to evaluate for nephrolithiasis?

A. Renal ultrasound

B. Abdominal plain films, flatplate (KUB) and upright

C. Abdominal and pelvic CT without contrast

D. Intravenous pyelography

Correct answer is C

- The best study to evaluate for nephrolithiasis as well as surrounding structures is the abd/pelvic CT with and without contrast. Renal ultrasound can be used during pregnancy or in a patient in whom contrast dye should be avoided. There is little indication for IV pyelography in the 21st century.

Hematuria – Evaluation

- Historically, patients with suspected upper tract cause of hematuria were evaluated with an intravenous pyelogram (IVP)
- Emergency Departments currently use helical CT in most instances
- Ultrasound is another diagnostic modality used to evaluate hematuria, especially in pregnant patients.
- Urine cystoscopy studies the lower urinary tract/bladder

Intravenous Pyelography

- Gray Sears et al found that IVP identified 85% of lesions >3 cm in diameter
- However, IVP only identified 21%-52% of smaller lesions

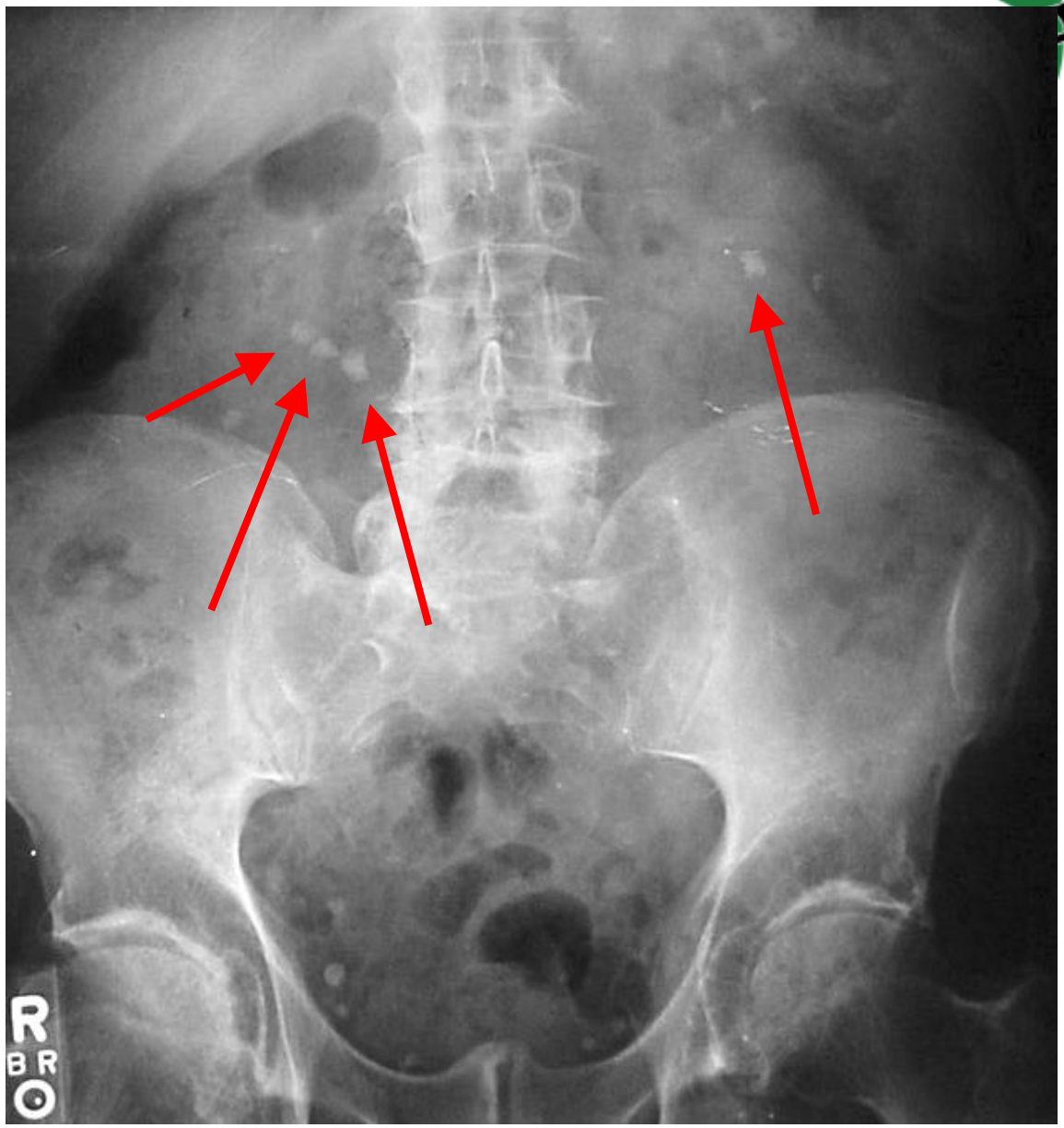
Source: Gray Sears CL, Ward JF, Sears ST, Puckett MF, Kane CJ, Amling CL. Prospective comparison of computerized tomography and excretory urography in the initial evaluation of asymptomatic microhematuria. J Urol 2002;168:2457-60.

Computed Tomography

- Benefits
  - Unenhanced renal CT has excellent sensitivity in diagnosing calculi in patients with renal colic
    - Sensitivity = 97%, specificity = 96%[1]
  - Evaluates surrounding structures to aid in the diagnosis
  - Fast and frequently available in 2010
  - Less radiation than IVP
  - Contrast CT can identify smaller lesions, abnormal vessels, and abscesses
  - CT is frequently used as the follow up study for abnormal IVP and/or ultrasound

Source: [1]Diagnostic procedures for the urogenital system. Emerg Med Clin North Am. 19: 2001; 745-761

Bilateral kidney stones



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Kidney stones on CT w/o contrast

Kidney Stones

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Ureteral Stone

Why kidney stones hurt!

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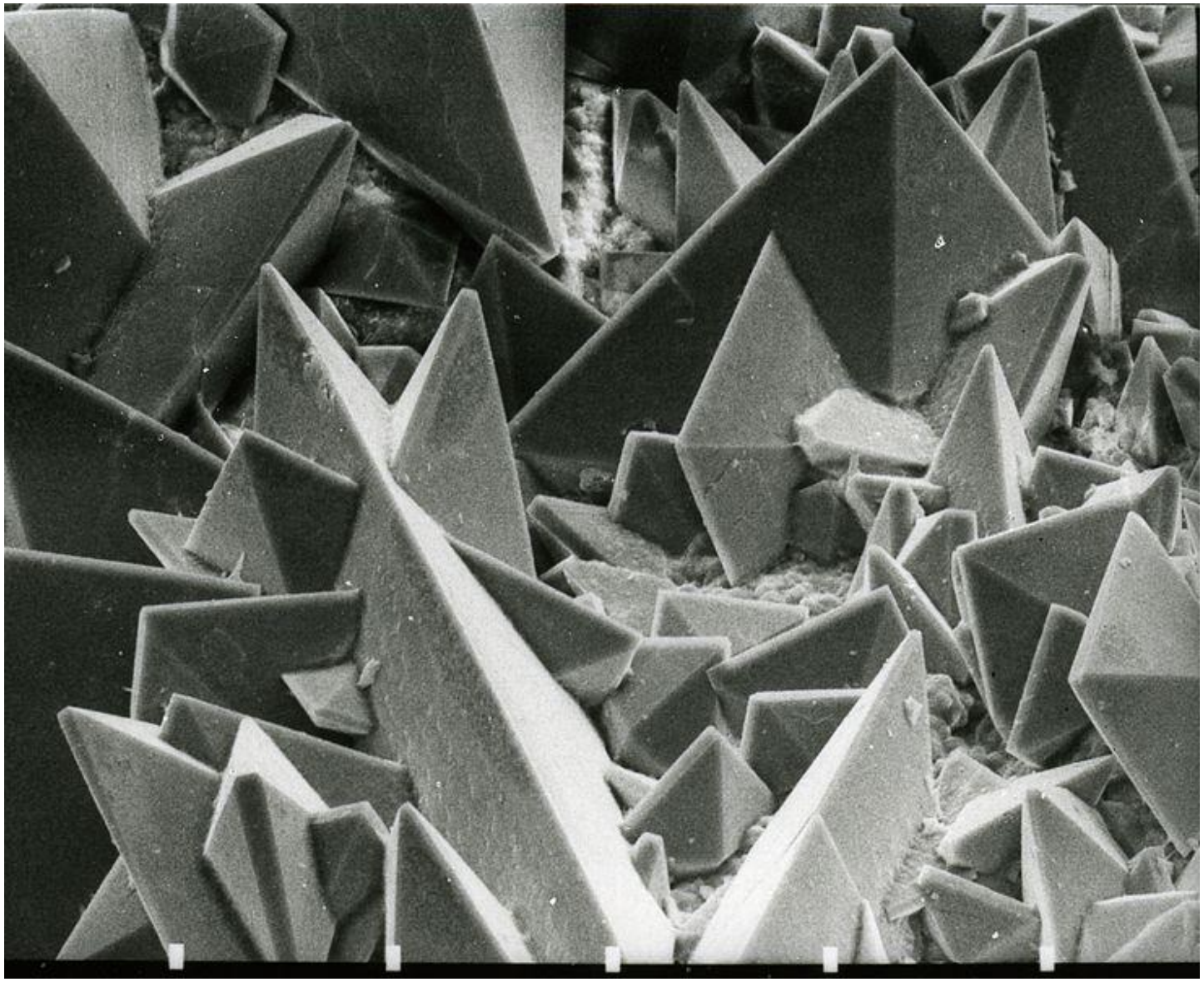

Scanning Electron Microscopy of the surface of a calcium oxalate kidney stone

Creative commons license at: http://en.wikipedia.org/wiki/File:Surface_of_a_kidney_stone.jpg

Renal Ultrasonography

- Benefits
  - Least expensive
  - No exposure to ionizing radiation or contrast media
  - Can be used during pregnancy
- Disadvantage
  - Not as accurate in lesions <3 cm in size[1]
  - Sensitivity at detecting renal calculi = 64%-96%, significantly less than CT[2]

Source: [1]Jamis-Dow CA, Choyke PL, Jennings SB, Linehan WM, Thakore KN, Walther MM. Small (< or = 3-cm) renal masses: detection with CT versus US and pathologic correlation. Radiology 1996;198:785-8.
[2]Jaffe JS, Ginsberg PC, Gill R, Harkaway RC. A new diagnostic algorithm for the evaluation of microscopic hematuria. Urology 2001;57:889-94.

Polycystic Kidney Disease on U/S

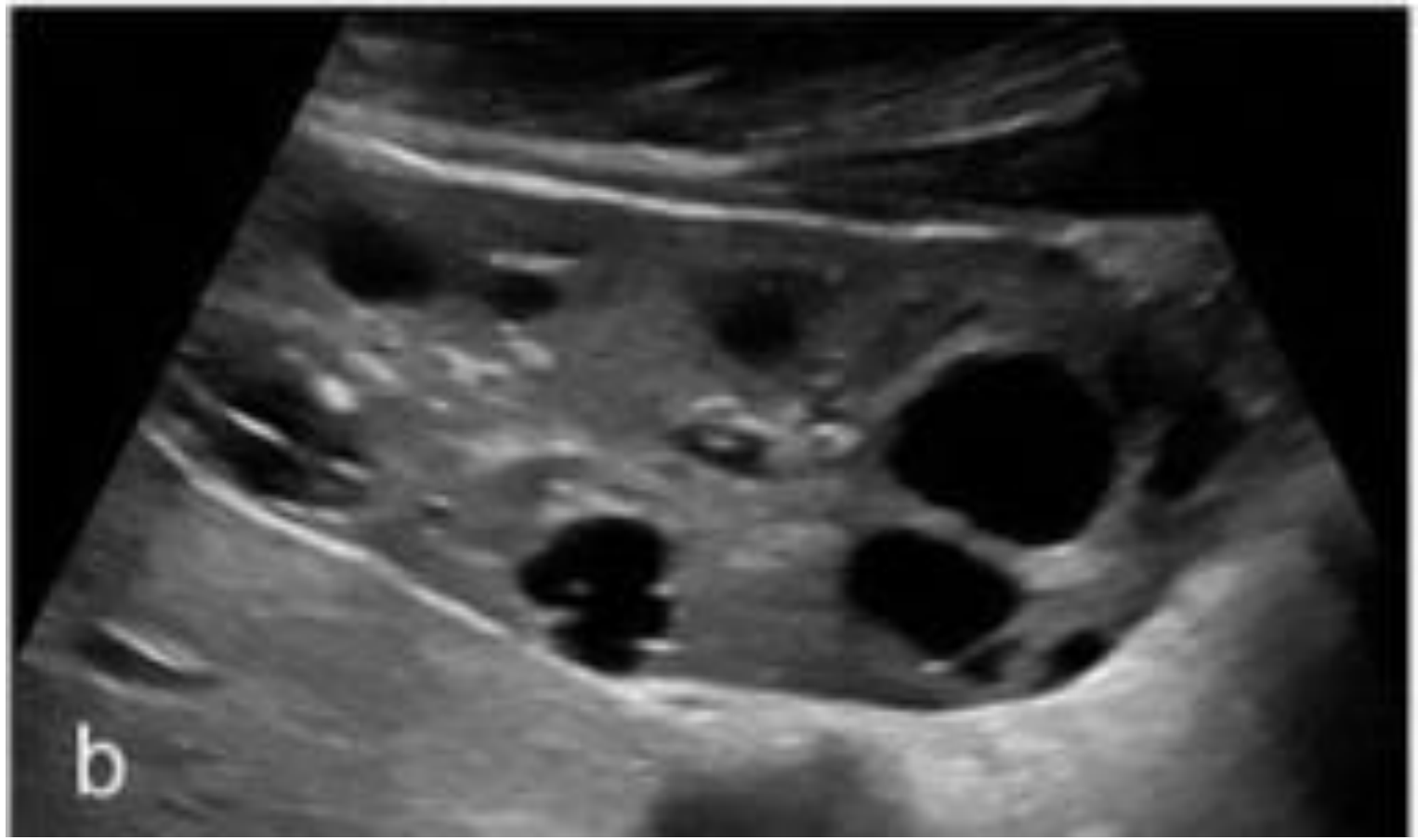

Image at:
https://openi.nlm.nih.gov/detailedresult.php?img=PMC4530564_40348_2015_19_Fig2_HTML&query=polycystic+kidney+disease&it=xg&req=4&npos=16

Hematuria – Lower Tract Assessment

- Cystoscopy
  - Insertion of cystoscope through urethra into bladder for direct visualization
- Urine cytology
  - No longer recommended as part of a work up
  - In July 2012, the American Urologic Association released an updated guideline for asymptomatic microscopic hematuria (AMH).

Source: [1]Cohen RA, Brown RS. Clinical practice. Microscopic hematuria. N Engl J Med 2003;348:2330-8.

Cystoscopy

- The AUA recommends cystoscopy in all patients greater than 40 with hematuria and in higher risk patients who may be younger
- The sensitivity of cystoscopy for detecting bladder cancer is 87%[1]

Source: [1]Cohen RA, Brown RS. Clinical practice. Microscopic hematuria. N Engl J Med 2003;348:2330-8.

Preventable Factors for Hematuria

- Stop smoking
- Avoid occupational exposures
  - Dyes, benzenes, aromatic amines
- Decrease analgesic/high risk medication use if possible

Follow-up of Asymptomatic Microscopic Hematuria

- After completing an initial negative evaluation (helical CT with cytology and/or cystoscopy), consider repeat testing (urinalysis, urine cytology, blood pressure) at 6, 12, 24 and 36 months
- If initial UA confirms a UTI, repeat UA is recommended in 6 weeks

Risk of Urologic Malignancy in Hematuria

- May be present in up to 10% of patients with microscopic hematuria
- May be present in up to 25% of patients with macroscopic hematuria
- 12.1% overall prevalence of malignant disease among patients with hematuria in a cohort of 4020 patients with hematuria

Source: Edwards TJ, Dickinson AJ, Natale S, Gosling J, McGrath JS. A prospective analysis of the diagnostic yield resulting from the attendance of 4020 patients at a protocol-driven haematuria clinic. BJU Int. 2006 Feb; 97(2):301-5

Summary

- When evaluating a patient with hematuria, common things are common
  - Urinary tract infection
  - Renal and ureteral stones
  - Urologic cancer

Hematuria Summary

- Consider using the helical CT to evaluate the upper urinary tract in all patients who can tolerate the procedure
- Evaluate the lower urinary tract with cystoscopy
- A patient with an initial negative evaluation has a low likelihood of subsequent urologic cancer
- Nephrology refer should be considered in patients with a glomerular source of bleeding

HITS Mnemonic

- "HITS"
- Hematologic disturbances
  - Sickle cell disease, hemophilia
- Infection, Infarction, Inflammation
  - UTI, pyelonephritis, ATN, papillary necrosis, AIN, glomerulonephritis
- Trauma, Tumor, TB
- Stones, "Systs," "S/Cyclophosphamide"/meds

Nephrolithiasis
Key Points

- Use a noncontrast abd/pelvic CT to evaluate for nephrolithiasis
- Stones
  - <5mm usually pass spontaneously – give pain meds
  - 5-10mm follow for progression
    - Consider using an alpha-blocker (terazosin, tamsulosin) to assist in passing the stone
  - >10mm – usually do not pass → consider ESWL
- Use cystoscopy to evaluate the lower tract

Electrolyte & Acid-Base Disorders

A 73 y.o. male presents with altered mental status. PMHx: COPD, 60 pk yr smoking. VSS, Lungs with exp. Wheeze, no rales. No edema. BMP shows Na+ 119, BUN/Cr 16/1.2, GFR 52. What is most likely dx?

A. SIADH

B. AKI and volume overload

C. Dehydration

D. Heart failure

Correct answer is A

- This patient has COPD. He is also at higher risk for lung cancer. Both these conditions predispose for SIADH(syndrome of inappropriate antidiuretic hormone). AKI(acute kidney injury) and heart failure both result in volume overload and edema. Pt has no sx of volume overload. The BUN/Cr do not indicate dehydration.

Which of the following is not a usual cause of increased anion gap metabolic acidosis?

A. Renal tubular acidosis

B. Methanol

C. Diabetic ketoacidosis

D. Ethylene glycol

E. Salicylic acid

Correct answer is A

- Use the MUDPILES mnemonic. RTA(renal tubular acidosis) is a cause of normal anion gap metabolic acidosis.

Acid-Base

- Increased anion gap metabolic acidosis
- MUDPILES
  - Methanol
  - Uremia
  - DKA(diabetic ketoacidosis)
  - Paraldehyde (no one really uses this anymore)
  - Isoniazid (INH)
  - Lactic acidosis
  - Ethylene glycol (antifreeze)
  - Salicylates

Electrolyte & Acid-Base Disorders
Key Points

- Hyponatremia
  - Dilutional: increased free water
  - Depletional: total body sodium loss
  - Delusional: lab errors/displaced sodium with too much protein
- (Hyperkalemia covered previously)
- Avoid magnesium in AKI
- Use MUDPILES – it saves lives