Hematuria

(Nelson 2011 and
Brenner 2008, Manual of nephrology 2005,
Pediatric Nephrol. Avner 2009.)

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Hematuria is defined as the presence of at least 5 red blood cells per micro liter of urine

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Significant hematuria suggested by the presence of

> 50 RBC/µL.

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Epidemiology

It occurs with a prevalence of 0.5-2.0% among school-aged children.

(4% Brenner 2008)

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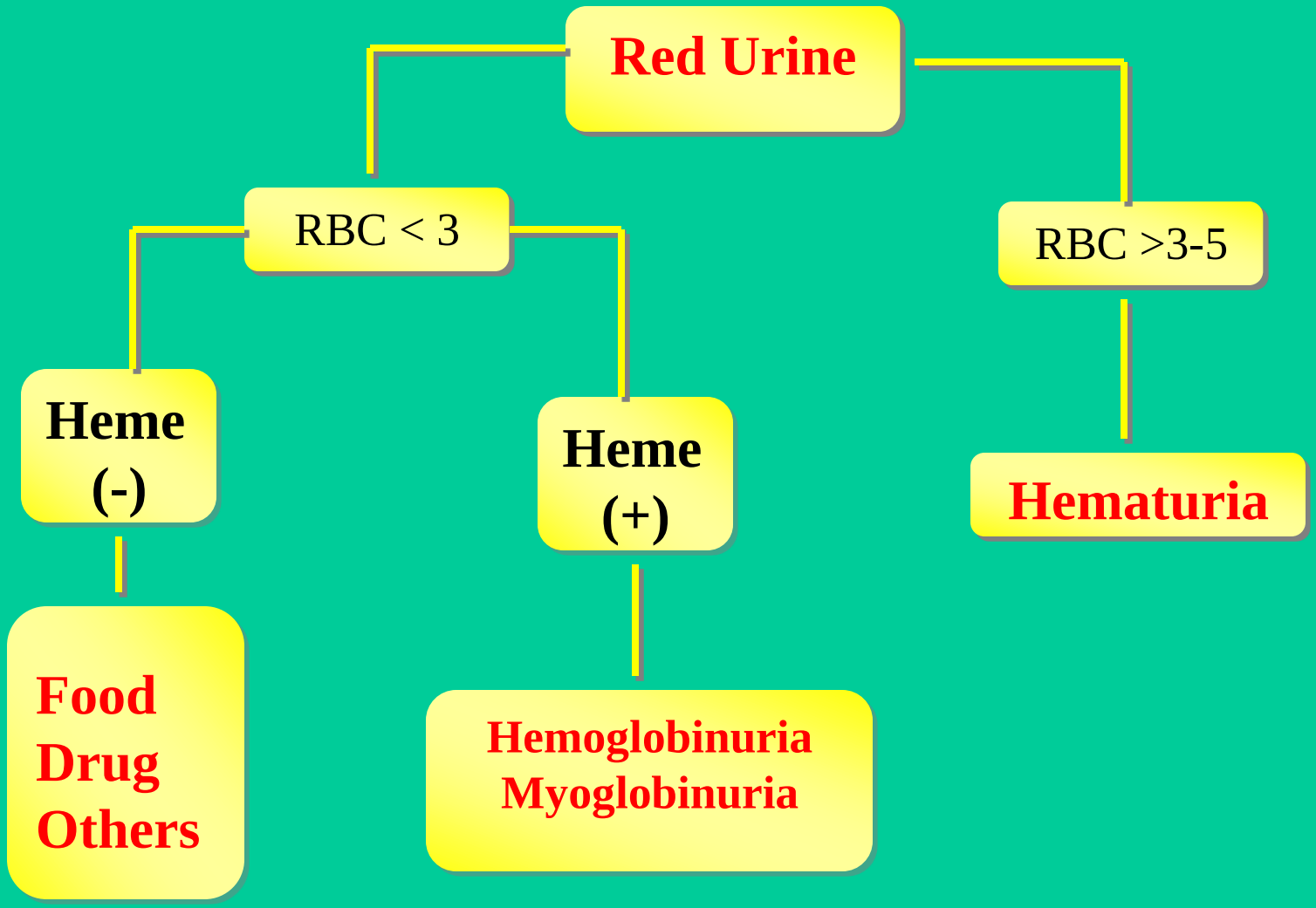
Red Urine
RBC < 3
RBC >3-5
Heme (-)
Heme (+)
Hematuria
Food
Drug
Others
Hemoglobinuria
Myoglobinuria

Red urine without RBCs

- Heme-positive urine without RBCs:
  Hemoglobinuria / Myoglobinuria

- Heme-negative urine without RBCs:
  Drugs
  Foods (blackberries, beets, rhubarb)
  Food dyes
  Urinary metabolites
  (Porphyrin, tyrosinosis, methemoglobin, urate)

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Drugs
(False positive hematuria)

- Chloroquine
- Deferoxamine
- lbuprofen
- lron
- Metronidazole
- Nrtrofurantoin
- Phenazopyridin
- Phenolphthalein
- Phenothiazines
- Rifampin
- Salicylates
- Sulfasalazine

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False-negative Hematuria

Hematuria with negative blood

False-negative results may occur in the

presence of formalin (used as a urine preservative) or high urinary concentrations of ascorbic acid (Vit C intake > 2000 mg/day).

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False-positive hematuria

- Fever
- Exercise
- Menstrual blood
- Alkaline urine with a pH >9
- Contamination with oxidizing agents such as hydrogen peroxide used to clean the perineum

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Causes of hematuria

- Upper urinary tract disease (nephron)
  - Glomerulus
  - Convoluted or collecting tubules
  - Interstitium
- Lower urinary tract disease
- Pelvocalyceal system
- Ureter
- Bladder
- Urethra

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Glomerular hematuria (Acute nephritic syndrome)

- Post infectious GN
- IgA nephropathy
- MPGN
- HSP nephritis
- SLE nephritis
- Wegner
- Microscopic PAN
- Goodpasture
- HUS

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Common causes of gross hematuria

- Urinary tract infection
- Meatal stenosis
- Perineal irritation
- Trauma
- Urolithiasis
- Hypercalciiuria
- Coagulopathy
- Tumor
- Glomerular

Postinfectious glomerulonephritis

Henoch-Schiinlein purpura nephritis

IgA nephropathy

Alport syndrome (hereditary nephritis)

Thin glomerular basement membrane disease

Systemic lupus erythematosus nephritis

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Asymptomatic patients with isolated microscopic hematuria should not undergo diagnostic evaluation until:

- at least 2 additional urine specimens collected over a 1- to 2-wk period demonstrate an abnormal number of RBCs.
- This will reduce the number of unnecessary evaluations by 10- to 100-fold

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Asymptomatic patients with isolated microscopic hematuria

Significant disease of the urinary tract is uncommon

The initial evaluation of these children should include :

- **Urine culture**
- **Spot urine for hypercaiciuria (ca/cr ratio) in culture-negative patients.**
- **In African-American patients, a sickle cell screen.**

If these studies are normal:

- **Uinalysis of all first-degree relatives.**
- **Renal and bladder ultrasonography**

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Special consideration

- Family Hx of hematuria
- Anatomical abnormality
- Malformations syndromes
- Gross hematuria
- HTN
- Edema
- Heart failure

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Recurrent gross hematuria

- IgA nephropathy
- Alport syndrome
- TGBM

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- ……
- Hypercalciuria
- Urolithiasis

Physical Examination

- Glomerular signs
- Systemic signs and symptoms (rashes, lung disease, neurologic abnormalities, musculoskeletal and hematologic abnormalities.)
- Abdominal mass
- Abdominal (renal) Bruits
- Neurocutaneous abnormality

Glomerular hematuria

- Brown. cola-colored / burgundy urine
- Proteinuria >100 mg/dl via dipstick
- RBC casts
- Deformed urinary RBCs (particularly acanthocytes)
- Urinary erythrocyte mean corpuscular volume less than 72 fL (Manual of nephrol.)
- Urinary RBC MCV < Blood RBC MCV

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- Edema
- Hypertension
- Oliguria
- Painless hematuria (can be associated with flank pain)

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Lower urinary tract sources of hematuria

- Gross hematuria (bright red or pink).
- Terminal hematuria
- Blood clots
- Painful / Symptomatic (frequency, dysuria, renal colic)
- Normal urinary RBC morphology
- Minimal proteinuria on dipstick (<100 mg/dl)

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Lower urinary tract sources of hematuria

- Flank mass : hydronephrosis/ renal cystic dis./ RVT/ tumor)
- Headache/ mental status changes/ visual changes/ epistaxia/ heart failure)……HTN

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Hematuria

HTN, Edema
Proteinuria
RBC cast

Glomerular causes

C3, C4, ANA, ds DNA, ANCA

Low C3, C4
PSGN, MPGN, SLE, Chronic infectious Gn. cryoglobinemia.
ANCA +
PAN, Wegner, idiopathic RPGN, HSP
ANA/ dsDNA + ….. SLE
All Normal Other GN, Ig A Neph. HUS, Alport, HSP, Familial Hematuria

Prot, RBC cast (-)
Abdominal pain (+)
Dysuria (+)

Isolated Hematuria

UTICS

Uricosuria
Trauma, **T**umor
Infection
Interstitial nephritis
Cystic disease
Congenital anomaly
Hyper**c**alciuria
Coagulopathy
Stone, **S**ickle cell dis.

Cola/brown urine?
Proteinuria (>30 *mg/dL)?*
RSC casts?

Yes

Acute nephritic syndrome?

Glomerular hematuria

- CBC with differential
- Electrolytes, Ca
- BUN/Cr
- Serum protein/albumin
- Cholesterol
- C3/C4
- ASO/Anti-DNase B

·ANA

- Antineutrophil antibody
- Throat/skin culture (if indicated)
- 24-hour urine
  total protein
  creatinine clearance

Cola/brown urine?
Proteinuria (>30 *mg/dL)?*
RSC casts?

No

Extraglomerular hematuria

Step 1

- Urine culture

Step 2

- Urine calcium/creatinine
- Sickle prep (African American)
- Renal/bladder ultrasound

Step 3

- U/A: siblings, parents
- Serum electrolytes, Cr, Ca
- If crystalluria, urolithiasis, or nephrocalcinosis:

'24-h U for Ca, Cr, UA. Ox

- If hydronephrosis/pyelocaliectasis:

'Cystogram, ±renal scan

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Indications of Renal biopsy

Some children with persistent microscopic hematuria associated with decreased renal function, proteinuria, or HTN.

Most children with recurrent gross hematuria associated with decreased renal function, proteinuria, or HTN.

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