

# Medi Quest BRS Hospital

A monthly News letter from BRS Hospital

## Hematuria in Children

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### Summary

Hematuria is the presence of red cells in the urine, which provokes anxiety in patient and parents. The physician must guard against overlooking serious conditions while at the same time must order investigations rationally.

### Def:

The number of RBCs examined microscopically in a sample of urine is the yardstick used to determine hematuria , and varying definitions exist. RBC's number more than 5/HPF in an uncentrifuged midstream sample of urine is one of the commonly used definitions of hematuria.

Hematuria can be macroscopic ( gross ) or microscopic. In macroscopic hematuria, the urine is red or cola/tea/brown coloured.

Microscopic hematuria is detectable via direct visualization under the microscope or by urine dipstick method.

Before delving into causes and management of hematuria, the other causes for a red urine should be kept in mind.

### Causes for red urine

Substance	Causes	Urine Dip
Hemoglobin	Hemolysis	Positive
Myoglobin	Rhabdomyolysis	Positive
Food	Beetroot, food dyes, berries containing anthocyanins like blueberries or raspberries	Negative
Drugs	Metronidazole, nitrofurantoin, doxorubicin, rifampicin	Negative
Inborn errors of metabolism	Porphyria, tyrosinaemia	Negative
Urate Crystals	Concendrated urine in neonates	Negative

## Diagnostic Approach

Determine whether hematuria is microscopic or macroscopic. Generally, a macroscopic hematuria when red is suggestive of lower urinary tract lesion- bladder, urethra whereas microscopic hematuria is in favour of upper urinary tract lesion glomerulus or tubulo interstitium. Misshapen, deformed RBCs and RBC casts in microscopy associated with proteinuria is seen in glomerular hematuria. When macroscopic hematuria is cola/tea/brown coloured, it signifies presence of blood in urine which has undergone oxidation in the bladder .

## Causes of Gross hematuria

In a **medical setting** the commonest causes are

1. Post infectious glomerulonephritis
2. Urinary tract infection

Largest etiologic categories of hematuria from a retrospective review of 342 children in a **urological setting**

1. Urethrorrhagia (15%)

The term given to irritation and bleeding from the urethra. It is due to irritation , trauma , infection or stricture of the urethra. Spontaneous resolution is possible in the first two conditions.

2. Urinary Tract Infection ( 14%)
3. Trauma 14%
4. Congenital Urinary Tract Anamolies 13%
5. Stones 6%

## Evaluation of Gross Hematuria

History of fever, dysuria, urgency, frequency is in favour of UTI, when associated with flank pain pyelonephritis to be thought of. Intermittent unilateral flank pain , with radiation and gross hematuria suspect renal calculi, and vascular pathology such as Nutcracker syndrome and renal vein thrombosis. Gross hematuria with bilateral flank pain and renal enlargement on Sonography suggests interstitial nephritis. Gross hematuria and flank mass with USG abnormalities indicate renal malignancy.

Initial hematuria is indicative of anterior urethral bleeding (distal to the external sphincter). Total hematuria indicates bleeding from the bladder or above. Terminal hematuria suggests posterior urethral bleeding (prostate or bladder neck).

Fever few days prior with gross hematuria could indicate IgA nephropathy, fever three weeks prior post infectious glomerulonephritis.

## Microscopic Hematuria

More causes are present. For microscopic hematuria, Very often incidentally noted hence it may be difficult to pinpoint the onset of hematuria

1. Episodic microscopic hematuria with Fever  
UTI  
IgA nephropathy
2. Microscopic Hematuria with Rash  
HSP  
SLE
3. Family History of asymptomatic microscopic hematuria  
Without deafness Benign Familial Microscopic Hematuria  
With Deafness / Alport's syndrome  
Thin basement membrane disease
4. Painful crises with microscopic hematuria  
Sickle cell nephropathy  
Renal calculi
5. Microscopic Hematuria with Proteinuria  
Renal Parenchymal diseases

## Physical Exam

What to look for

1. Facial Puffiness
2. Pedal edema
3. Scrotal edema/Vulval Edema
4. Blood Pressure
5. Weight chang
6. Abdominal Exam
  - Renal Mass
  - Flank Tenderness
  - Ascites
  - Trauma

Chaperoned examination of urethral meatus in males and the vaginal introitus in females.

Most important is visual exam of the urine  
Bright red lower urinary tract

**Tea coloured:** Blood in the urine has undergone oxidation

in the bladder.

In the setting of microscopic hematuria; examining a centrifuged sample and looking for

- Casts
- Misshapen RBCs
- Deformed RBCs

These are features of glomerular hematuria

### Management of Hematuria in Kidney Disease in Children

The management is based on diagnosis, as the differential diagnosis is vast, a basic understanding of the common etiologies is discussed, which serves as a framework for the initial assessment and if necessary a pediatric nephrologist referral.

#### The broad diagnostic categories are

1. Structural Acquired Causes of Hematuria
2. Structural Congenital Causes
3. Inflammatory Infective causes
4. Inflammatory Immunologic causes

#### A: Structural Acquired Causes of Hematuria

##### 1. Kidney Stones and crystalluria

###### Clinical Manifestations

Macroscopic stones visible on radio imaging or microscopic – crystalluria. Symptoms are flank pain, vomiting, dysuria, frequency, urgency and frequent UTI.

Majority of urolithiasis are calcium based, others being urate and cysteine based.

###### Pathogenesis

Calcium oxalate, and uric acid crystalizes within an acidic environment, calcium phosphate crystalizes with in an alkaline environment. Crystals irritate the urothelial lining, resulting in microscopic or macroscopic hematuria.

###### Diagnostic considerations

Direct pathologic evaluation of passed stone is an important facet of management.

###### Initial Management

Adequate fluid intake, calcium oxalate and uric acid stones

require alkalization, whereas calcium phosphate stones require urine acidification

Sodium restriction is the recommended dietary intervention to prevent stone formation

##### 2. Renal Mass Lesions

Often associated with macroscopic hematuria

Presenting with enlarged kidneys

Autosomal Dominant Polycystic Kidney disease

Hydronephrosis

Wilm's tumour

###### Diagnosis

History of flank pain, physical exam flank masses, CT and ultrasound imaging

###### Management

As per diagnosis, needs Ped Nephrologist /Urologist referral

#### B. Structural Genetic Causes of Hematuria

##### Alport Syndrome and Thin Basement Membrane Nephropathy (Benign Familial Hematuria)

###### Clinical Manifestations

Alport syndrome is an inherited disorder of the basement membrane, manifesting as microscopic hematuria and occasionally recurrent gross hematuria. Extra renal manifestations of sensori neural hearing loss and ocular abnormalities, anterior lenticonus, dot and fleck retinopathy have been described.

Thin basement membrane nephropathy also known as benign familial hematuria, occurs in ~ 1%.

###### Diagnostic considerations

A careful family history is key in establishing the diagnosis of Alport Syndrome and TBMN, although many individuals with TBMN may escape diagnosis as they only have microscopic hematuria that do not come to clinical attention. Diagnosis is made by renal biopsy. Definitive diagnosis is by genetic testing.

**Treatment:** Is primarily supportive for Alport's and TBMN, surveillance for proteinuria, hypertension and use of ACE inhibitors or ARBs

## C. Inflammatory Infectious causes of Hematuria

### 1. UTI

The most common cause of gross hematuria in children is acute bacterial urinary tract infection. The overwhelming majority of UTIs in children are caused by monomicrobial bacterial infections most commonly *E.coli*. Viral cystitis with adenovirus or polyomavirus can also result in hematuria. In UTI, gross hematuria is usually gone within a week, with microscopic hematuria lasting a few days longer.

### Pathogenesis of Hematuria

Pathogenic bacteria causes UTI by adhering to the urothelium and by passing host defenses, and causing a localised inflammatory response resulting in pyuria and hematuria

## D. Inflammatory Immunological Causes of Hematuria

### 1. Acute Post Infectious Glomerulonephritis

Glomerular inflammation which stems from prior non renal infection most frequently a skin or throat infection most commonly due to a streptococcal infection. PIGN can also be caused by other bacterial, viral and fungal infections.

**Initial Management:** Treatment of the underlying infectious etiology is paramount to preventing or attenuating the course of PIGN. In the case of Post Streptococcal glomerulonephritis, there is evidence patients who receive antibiotic therapy during the course of their nephritis experience a milder clinical course. In patient management is supportive and consists of salt

restriction, with or without fluid restriction, and the use of loop diuretics during disease course.

### 2. IgA Nephropathy

The clinical presentation of IgA is highly variable, it can manifest as microscopic or macroscopic hematuria, associated with proteinuria, episodes of gross hematuria occurring 1-2 days after an upper respiratory or GI infection.

### 3. Henoch Schonlein Purpura associated glomerulonephritis

### 4. SLE associated renal disease

#### When to refer to a Pediatric Nephrologist

Referral to a pediatric nephrologist is warranted when there is hypertension, proteinuria particularly nephrotic range. Diagnostic renal biopsy and definitive management with immunosuppressive and immunomodulatory treatment. Identification of renal cystic disease benefits from nephrology referral to identify the most likely etiology among the array of cystic kidney disease. In nephrolithiasis to initiate appropriate metabolic work up and initiate proper pharmacologic and dietary treatment.

#### When to refer to a Pediatric Urologist

Referral is needed when there is evidence of structural pathology causing gross or microscopic hematuria like hydronephrosis, renal mass, obstruction or renal colic from urolithiasis. Additionally for cystoscopy in lower urinary tract bleeding.

### Conclusion

It would seem that in cases of gross or persistent hematuria, when and whom to refer, referral to Nephrologist or Urologist, would be the decision to make.