**BASIC INFORMATION**

- **Hematuria**
  - Gross hematuria (GH): 10-20% of pediatric referrals
  - Microscopic hematuria (MH): 80-90%

- **Proteinuria**
  - Measured as protein:creatinine ratio > 0.2 (mg/mg)
  - OR albumin:creatinine ratio > 30 (mg/g)
  - OR > 4 mg/m2/hr in time collection

- A recent study puts the incidence of hematuria and proteinuria in children at over 6%

**MECHANISM OF DISEASE**

- **Proteinuria**
  - Measured as:
    - Protein:creatinine ratio > 0.2 (mg/mg)
    - OR albumin:creatinine ratio > 30 (mg/g)
    - OR > 4 mg/m2/hr in time collection

- **Hematuria**
  - Gross hematuria (GH)
  - Microscopic hematuria (MH)

**THOSE AT HIGHER RISK OF UA FINDINGS**

<table>
<thead>
<tr>
<th>Proteinuria</th>
<th>Hematuria</th>
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<tbody>
<tr>
<td>History of kidney disease</td>
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</tr>
<tr>
<td>Hypertension</td>
<td>History of urinary stone disease</td>
</tr>
<tr>
<td>Fever, exertion</td>
<td>Use of certain medications including analgesic and anticoagulants</td>
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<tr>
<td>History of kidney disease</td>
<td>Those who perform strenuous activities</td>
</tr>
<tr>
<td>History of urinary stone disease</td>
<td>Recent viral or bacterial disease</td>
</tr>
</tbody>
</table>

**DIFFERENTIAL DIAGNOSIS: HEMATURIA**

- **Glomerular**
  - Resolving PSAGN
  - IgA Nephropathy
  - Hereditary Nephritis

- **Non-Glomerular**
  - Acute glomerulonephritis
  - Hypercalcemia
  - Kidney Stone
  - CTP

*Underlying causes are the same in children with GH or MH. However, likelihood of establishing the diagnosis is greater with GH.*
HEMATURIA AND PROTEINURIA: OVERALL CLINICAL APPROACH

Hematuria
- Microscopic: RBC morphology and casts
- Gross: Examine urine
  - Glomerular vs. Non-Glomerular
    - Assess according to RBC morphology

Proteinuria
- Sub-nephrotic Range: Observe 6-12 months
- Nephrotic Range: Consider biopsy if Up/c is rising or >2

ASSESSMENT: HEMATURIA - OVERALL
- Microscopy: RBC morphology and casts
- Other Urinalysis Findings:
  - WBCs suggest UTI or renal parenchymal disease.
  - Concomitant proteinuria indicates higher likelihood of significant kidney disease
- Blood tests:
  - Creatinine
  - Albumin/Cholesterol
  - C3
- Cystoscopy (hardly ever indicated in children)
- Kidney imaging test: Only for non-glomerular hematuria
- Kidney biopsy

ASSESSMENT: HEMATURIA - GLOM VS. NON GLOM
- Careful Family History
- C3
- Audiogram
- ? Serum Creatinine
- Kidney biopsy
- Urine calcium/creatinine
- Ultrasound if gross hematuria
- Glomerular: Casts/Dysmorphic RBC
- Non-Glomerular: No Casts/Eumorphic RBC

DYSMORPHIC CAST RBC

If persists or Up/c >2
- C3
- ANA
- Kidney biopsy

ASSESSMENT (PROTEINURIA)

- Isolated MH usually resolves
- MH that persists but is not accompanied by any other evidence of renal disease can be followed
- GH usually prompts immediate evaluation.
- If a cause for GH is found, treat accordingly.
- If no cause for GH is found:
  - Children with non-glomerular GH can be observed.
  - Those with glomerular GH usually require kidney biopsy.

TREATMENT: HEMATURIA

- Always
  - Check P/C in first morning urine because orthostatic proteinuria is common in pediatric patients
- If child is well and no other signs of renal disease then,
  - Observe for 4-6 months
- If persists or Up/c >2
  - Check P/C
  - C3
  - ANA
  - Kidney biopsy
TREATMENT: PROTEINURIA

- If proteinuria is sub-nephrotic:
  - Observation warranted if patient is well
  - If it is persistent, a biopsy may be done and treatment will be guided by the diagnosis

- If proteinuria is in the nephrotic range:
  - Biopsy is usually performed and treatment is based on histopathology findings
  - ACE inhibitors or angiotensin receptor blockers can be used as sole treatment in patients with sub-nephrotic proteinuria or as ancillary therapy in those with nephrotic range proteinuria

AREAS OF CONTROVERSY

<table>
<thead>
<tr>
<th>JAMA Hematuria Prognosis</th>
<th>Frequency of Testing</th>
<th>Proteinuria as a CV risk factor</th>
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<tbody>
<tr>
<td>An Israeli study, with over 1.2 million military recruits who had a UA in their initial examination, demonstrated a hazard ratio of 32 for ESKD in those with persistent isolated MH.</td>
<td>AAP recommends infrequent UA in healthy children at all visits because of frequent false positives, psychological effects, and cost of testing.</td>
<td>Studies in adults suggest a correlation between proteinuria and developing a cardiovascular disease. Implication: There are no data about the long term CV ramifications of detecting proteinuria in childhood.</td>
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WORKS CITED
