Evaluation of the child with hematuria

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Synopsis

• Case presentations and discussion

• Algorythm for systematic evaluation

• Useful - beneficial – reasonable – redundant?
Case presentation 1

• 3 years old girl
• High fever for three days
• Strep test positive
• Treatment: penicilline and aminophenzone
• „dark-reddish” urine passed in the morning
Case presentation 1

• Urine: hyaline casts
• Hgb: negative
• ASO: normal

• Dg: Coloured urine due to drugs
Substances causing „pseudo-hematuria”

• Drugs
  – Phenazopyridine (Pyridium), Ibuprofen, Salicylates,
  – Sulfasalazine
  – Chloroquine, Metronidazole, Rifampin,
  – Phenolphthalein,
  – Phenoethiazines
  – Deferoxamine, Iron sorbitol,

• Dyes (vegetable/fruit):
  – beets, blackberries, food coloring (beverages)
  – Urates
  – Homogentisic acid, Melanin, Porphyrin
  – Methemoglobin
Case presentation 2

- 7 y boy
- „Dark” urine passed in the evening following physical exercise
- Unilateral costolumbar pain (evolving to loin pain in the night)

- Urine: isomorphic erythrocytes
- US: 4 mm hyperechogenic body at the uretero-vesical junction
Urine microscopy

Non-glomerular hematuria

arrows indicate the so-called crenated erythrocytes, frequent finding in non-glomerular hematuria if urine is hyperosmolar
US image of ureter stone

St = stone; U = ureter; Bl = bladder

• Dg: Ureterolithiasis
Case presentation 3

• 14 y boy
• „Dark” urine passed in the evening following long distance (10 km) running
• Unilateral costolumbar discomfort

• Urine: isomorphic erythrocytes
• Ultrasound: „normal”
Case presentation 3

• Regular check-ups
  – No hematuria most of the time
  – Eventually several erythrocytes in the urine

• 1 month later
  – „Dark” urine passed in the evening following a football game
Case presentation 3
Ultrasound 2

„Nutcracker” phenomenon: Compression of the left renal vein by the mesenterial artery
Spontaneous remission of persistent severe hematuria in an adolescent with nutcracker syndrome: seven years’ observation

Significant dilatation of the left renal vein (LRV) is visible MRA (arrow).
Development of periureteral collateral veins (*arrows*) from the LRV with reflux into the gonadal vein, ascending lumbar vein, clearly visible by MRA.
Factors affecting spontaneous resolution of hematuria in childhood nutcracker syndrome

Table 1 Clinical data of 20 children with nutcracker syndrome (*MH* microscopic hematuria, *GH* gross hematuria)

<table>
<thead>
<tr>
<th></th>
<th>No. of patients (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>10.6±3.4</td>
</tr>
<tr>
<td>Gender (male:female)</td>
<td>10:10</td>
</tr>
<tr>
<td>Follow-up (years)</td>
<td>1.9±0.9</td>
</tr>
<tr>
<td>Clinical manifestation</td>
<td></td>
</tr>
<tr>
<td><em>MH</em></td>
<td>16</td>
</tr>
<tr>
<td><em>GH</em></td>
<td>4</td>
</tr>
<tr>
<td>Left flank pain</td>
<td>2</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
</tr>
<tr>
<td>Disappearance of <em>MH</em></td>
<td>13</td>
</tr>
<tr>
<td>Improvement of <em>MH</em></td>
<td>3</td>
</tr>
<tr>
<td>Resolution of <em>GH</em></td>
<td>2</td>
</tr>
<tr>
<td>Persistence of <em>GH</em></td>
<td>2</td>
</tr>
</tbody>
</table>
Case presentation 4

- 7 y old girl
- Upper respiratory tract infection for 3 days with low-grade fever
- Dark, coke-like urine passed on the second day of the infection
- Bilateral costolumbal dyscomfort
- Urine: dysmorphic erythrocytes, erythrocyte cast
- US: enlarged kidneys, decreased corticomedullar differentiation
Case presentation 4. Urine microscopy

Glomerular hematuria

The dysmorphism is mainly due to irregularities of the cell membrane

Inset: Acanthocytes. A ring–formed cell body with one or more blebs of different size and shape

Arrows pointing on blebs
Case presentation 4
US of the kidneys

- Dg: Postinfectious GN. IgA nephropathy?

Hyperechogenic enlarged kidneys
Case presentation 5

• 12 y boy
• Urine screening at school
  – 20-25 erythrocytes
  – Protein < 100 mg/l
  – Normal blood tests
  – Normal US

• Dg: monosymptomatic hematuria
Systematic checkup of the child with hematuria
Hematuria algorythm

- Gross
  - Urine brownish glomerular
  - Urine bloody Non-glomerular

- Microscopic
  - +Proteinuria
  - +Hypertension
  - +Decreased GFR or White blood cells

- Isolated
  - Urine Ca/crea Oxalic acid
  - RBC morphology
  - US – stone hydronephrosis aberrant artery
  - US – nutcracker bladder wall
  - Biopsy??
  - Cystoscopy??

Family screening
- Audiometry
- Ophthalmology

Regular check-up
- Hypertension
- Proteinuria

Biopsy??
Cystoscopy??
# Table 1. Number of Patients Having Discretionary Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Microscopic Hematuria (n = 342)</th>
<th>Gross Hematuria (n = 228)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antistreptolysin O or Streptozyme titer</td>
<td>153</td>
<td>126</td>
</tr>
<tr>
<td>Antinuclear antibody</td>
<td>109</td>
<td>102</td>
</tr>
<tr>
<td>Hemoglobin electrophoresis</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>Urine culture</td>
<td>215</td>
<td>158</td>
</tr>
<tr>
<td>Ultrasonography</td>
<td>180</td>
<td>111</td>
</tr>
<tr>
<td>Ultrasonography and intravenous pyelography</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Ultrasonography, intravenous pyelography, and cystogram</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Intravenous pyelography and cystogram</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Intravenous pyelography</td>
<td>69</td>
<td>53</td>
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<tr>
<td>Ultrasonography and cystogram</td>
<td>39</td>
<td>18</td>
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<tr>
<td>Renal biopsy</td>
<td>2</td>
<td>53</td>
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</table>
### Table 3. Evaluation Outcomes

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Microscopic Hematuria (n = 342)</th>
<th>Gross Hematuria (n = 228)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diagnosis</td>
<td>274</td>
<td>86</td>
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<tr>
<td>Hypercalciuria without nephrolithiasis</td>
<td>56</td>
<td>51</td>
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<tr>
<td>Hypercalciuria with nephrolithiasis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>IgA nephropathy</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>Post-streptococcal nephritis</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Exercise</td>
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<td>8</td>
</tr>
<tr>
<td>Thin basement-membrane disease*</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Alport syndrome</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sickle cell trait</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mesangial proliferative nephritis</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Autosomal dominant polycystic kidney disease</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Membranoproliferative nephritis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Ureteropelvic junction obstruction</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>IgA nephropathy and hypercalciuria</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Bilateral dysplasia</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Urinary tract infection</td>
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<td>1</td>
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<tr>
<td>Solitary kidney</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Wilms tumor</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Duplex collection system</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Unilateral hypoplasia</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Vesicoureteral reflux (grade 3)</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Conclusions

1. Diagnostic evaluation for potential causes of asymptomatic microscopic hematuria in children may not be necessary.

2. Microscopic hematuria can, rarely, be the first sign of occult renal disease, long-term follow-up is mandatory.

3. Clinically important abnormalities of the urinary tract are commonly discovered in children with asymptomatic gross hematuria, a thorough diagnostic evaluation is warranted.

4. ?!?