Approach to proteinuria

By Dr. Waqas
• Normal urinary protein excretion in children is up to 4mg/m/hr.
• Urinary protein excretion of more than 4mg/m/hr is considered as significant proteinuria.
## Normal Urinary Protein Excretion in Infants and Children

<table>
<thead>
<tr>
<th>Age group</th>
<th>Total protein (mg/24 hrs)</th>
<th>Total protein (mg/m²/24hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 30 days (premature)</td>
<td>29</td>
<td>182</td>
</tr>
<tr>
<td>7 to 30 days (full term)</td>
<td>32</td>
<td>145</td>
</tr>
<tr>
<td>2 to 12 months (infant)</td>
<td>38</td>
<td>109</td>
</tr>
<tr>
<td>2 to 4 years (child)</td>
<td>49</td>
<td>91</td>
</tr>
<tr>
<td>4 to 10 years</td>
<td>71</td>
<td>85</td>
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<tr>
<td>10 to 16 years</td>
<td>83</td>
<td>63</td>
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Mechanism of proteinuria

- Glomerular capillary wall & its adjacent structures constitute main barrier to the passage of macromolecules.
- Glomerular capillary wall also contains negatively charged proteins which repel negatively charged macromolecules such as albumen.
Mechanism of proteinuria

- Most inflammatory glomerular diseases result in alteration of size barrier & loss of anionic charges leading to proteinuria.
- Injury to tubular epithelium leads to inability of tubule to reabsorb freely filtered low molecular weight proteins & loss in urine.
Mechanism of proteinuria

• Hemodynamic alterations in glomerular blood flow can also result in proteinuria.

• Reduced number of functioning nephrons, as occurs in chronic renal failure, leads to increased filtration of proteins in the remaining nephrons and to proteinuria.

• Other conditions that cause proteinuria include exercise, fever, seizures, epinephrine use and emotional stress.
Measurement of proteinuria

- **Dipstick method**
  Proteins in solution cause change in color of reagent Tetrabromophenol blue
  Amount of protein in urine is assessed as:
  - Nil   (<10mg/dl)
  - Trace (10—20mg/dl)
  - 1+    (30mg/dl)
  - 2+    (100mg/dl)
  - 3+    (300mg/dl)
  - 4+    (1000-2000mg/dl)
• False positive results can be obtained when urine is alkaline (pH > 7) or when it contains heavy mucus, pus, semen or vaginal secretions

• False-negative results can be obtained in the presence of a dilute urine (i.e., specific gravity less than 1.010).

(Urine with a specific gravity greater than 1.015 is necessary for reliable results)
Etiologic Classification of Proteinuria in Children

- Transient proteinuria
- Isolated asymptomatic proteinuria
  - Orthostatic proteinuria
  - Persistent fixed proteinuria
Etiologic Classification of Proteinuria in Children

- Proteinuria secondary to renal diseases
  - Minimal change nephrotic syndrome
  - Acute postinfectious glomerulonephritis
  - Focal segmental glomerulonephritis
  - Membranous nephropathy
  - Membranoproliferative glomerulonephritis
  - Lupus glomerulonephritis
  - Henoch-Schönlein purpura nephritis
  - HIV-associated nephropathy
Etiologic Classification of Proteinuria in Children

- **Tubular diseases**
  - cystinosis
  - wilson disease
  - galactosemia
  - tubulointestinal nephritis
  - acute tubular necrosis
  - heavy metal poisoning
Etiologic Classification of Proteinuria in Children

• Congenital and acquired urinary tract abnormalities
  Hydronephrosis
  Polycystic kidney disease
  Reflux nephropathy
  Renal dysplasia
Evaluation of proteinuria

Urine sample positive for protein

Repeat twice

Only first urine sample is positive for proteins

Transient Proteinuria
(routine follow up)

Two or more urine samples are positive for proteins

s.electrolytes, s.urea, s.creatinine, s.albumen, CBC, urinary protein creatinine ratio, C3
Transient proteinuria
Fever
Strenuous exercise
cold exposure
Epinephrine administration
Emotional stress
Congestive heart failure
Abdominal surgery
Seizures

Proteinuria resolve spontaneously after cessation of causal factor & extensive workup is usually not recommended.
Two or more urine samples are positive for proteins

- s.urea, s.creatinine, s.albumen, CBC, urinary protein creatinine ratio, C3

- Normal lab. results
  - Collect first voided urine sample immediately upon arising in the morning for 3 consecutive days
  - No proteinuria

- Orthostatic Proteinuria (annual follow up)

- Abnormal lab. results
Orthostatic (Postural) Proteinuria

- accounts for up to 60 percent of all cases of asymptomatic proteinuria
- children with orthostatic proteinuria excrete less than 1 g of protein in 24 hours (UPr/Cr less than 1.0).
- prognosis with orthostatic proteinuria is excellent
- Yearly follow-up is recommended for children diagnosed with this condition.
Two or more urine samples are positive for proteins

s.urea, s.creatinine, s.albumen, CBC, urinary protein creatinine ratio, C3

s.Creatinine- high/normal
Urinary protein creatinine ratio > 2.0
H/O UTI & polyuria
Urinary protein excretion > 40mg/m²/hr
S.Albumen – decreased
s.Cholestrol - increased

Tubulo-interstitial disease

Nephrotic syndrome (corticosteroid therapy)
Nephrotic syndrome

- Minimal change nephrotic syndrome
- Focal segmental glomerulonephritis
- Mesangial proliferation

**Diagnosis**

Proteinuria 3+ or 4+
nurinary protein creatinine ratio > 2.0
S.Albumen – decreased, s.Cholestrol – increased
Urinary protein excretion > 40mg/m^2/hr

Total urine protein (g/m^2/day) = 0.63 x (UPr/Cr)
Two or more urine samples are positive for proteins

s.urea, s.creatinine, s.albumen, CBC, urinary protein creatinine ratio, C3

Gross hematuria
C3 level - low
U.Pr:Cr <= 1.0
Increased ASO titre
s.Creatinine - high/normal

Purpuric rash on thigh/buttocks
Variable hematuria & proteinuria
Albumen - normal/low

HSP nephritis

Acute glomerulonephritis
Thank You