

RENAL PROBLEMS

M Chiume

QECH Third Year Teaching

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Objectives

- To recognize a child with renal problems
- To distinguish between nephritic and nephrotic syndrome
- To name the major causes of nephritic and nephrotic syndrome in children

Renal Physiology

Glomerular filtration

intraglomerular pressure is regulated by the tone of the afferent and efferent arterioles

Tubular function

Proximal tube: isosmotic reabsorption of GF (2/3)

Loop of Henle: active reabsorption

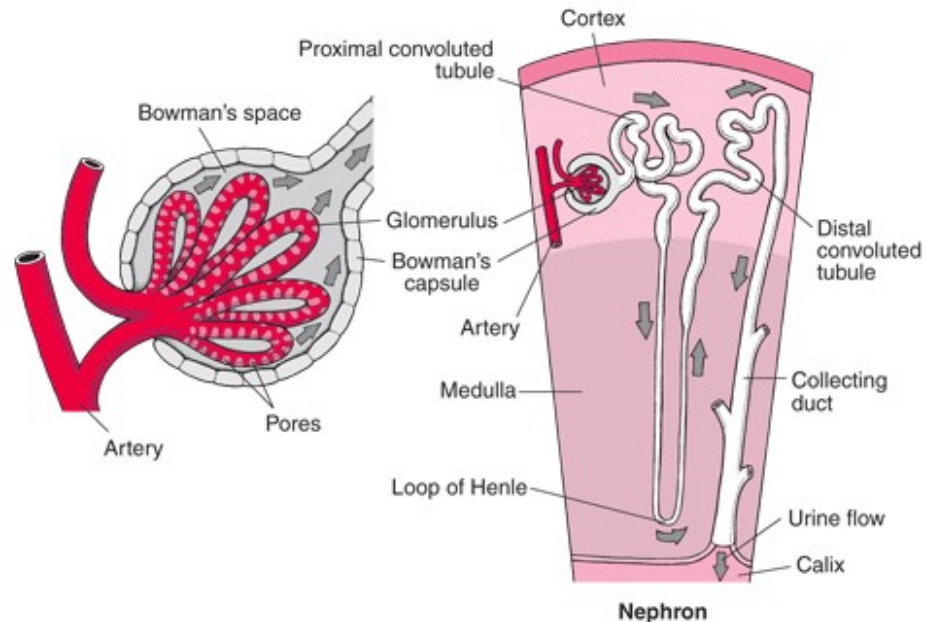
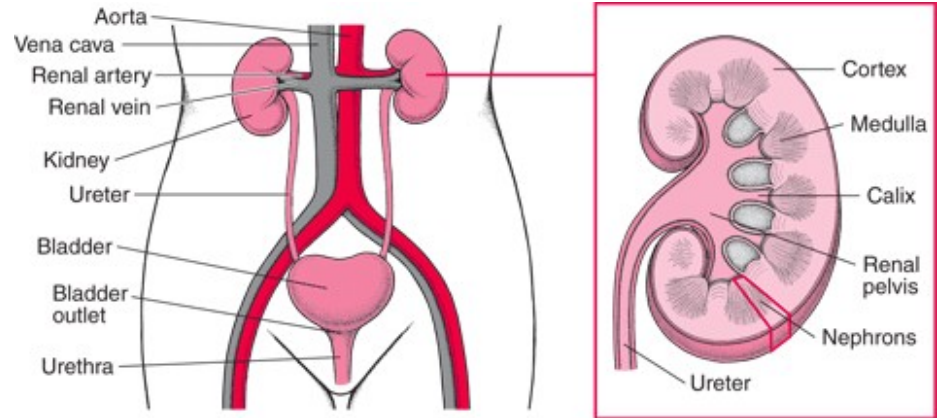
Distal tube: active reabsorption regulated by aldosterone and antidiuretic hormone

MADURATION

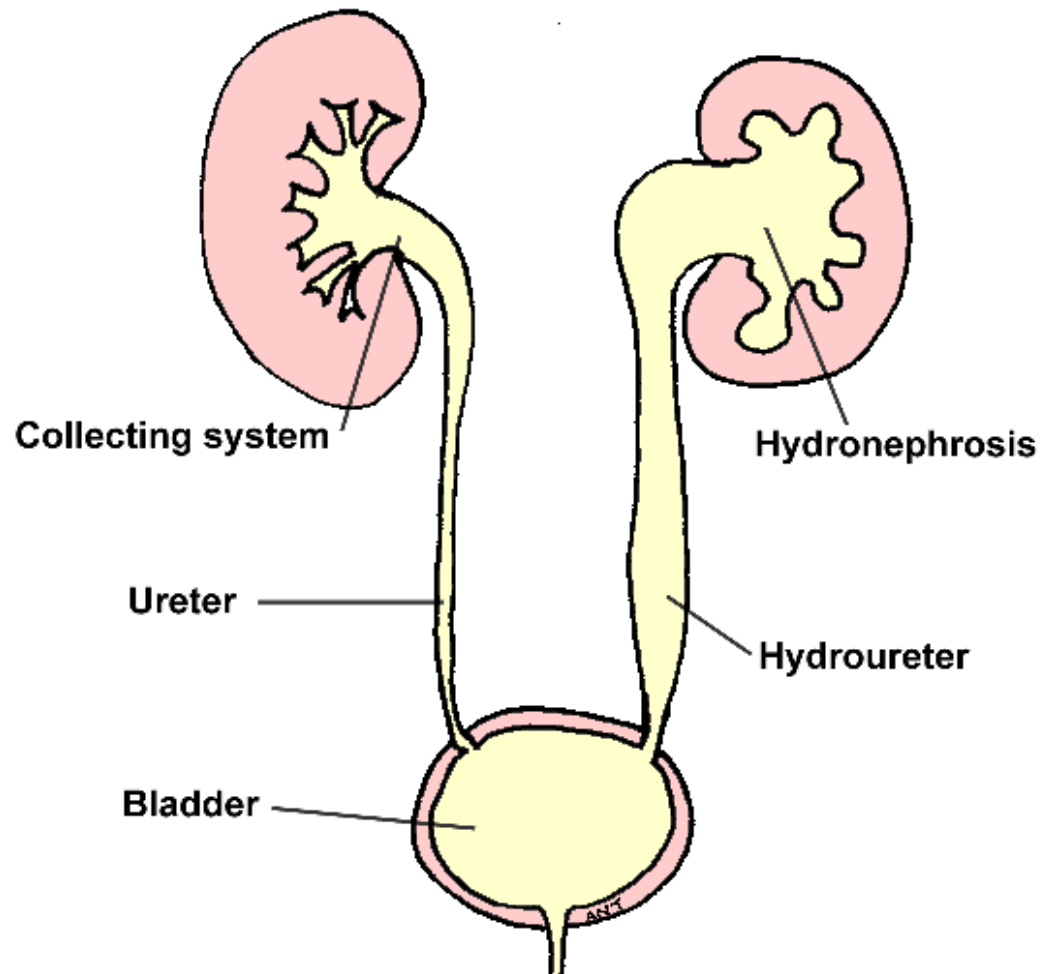
Urinary concentration capacity

newborn (600 to 800 mOsm/L) [adults 1200 mOsm/L]

GFR is much lower than adults, so the capacity to excrete a water load is quantitatively less



Urinary tract anomalies



Case Presentation

- 4 year old child, previously healthy
- 3 day history of swelling of legs and face
- Urine output has been normal
- On exam:
 - edema around eyes, pitting edema 2+ on legs
 - Soft 1/6 systolic murmur, chest creps bilaterally
 - Abdomen soft, non tender, no HSM
 - Few bruises over lower extremities
 - Alert, answers questions appropriately



Peri-orbital edema



Pitting edema

Differential Diagnosis

- Nutritional
- Cardiac
- Infectious
- Oncologic
- Liver
- Renal

What tests do you want?

- Blood Pressure
- Urinalysis
- Renal Ultrasound Scan

The Urinalysis

- What does it tell you?
 - Hydration status (Specific gravity)
 - Acid/base balance (pH)
 - Infection (nitrites/leukocyte esterase)
 - Blood
 - Glucose
 - Urobilinogen
- What it can't tell you:
 - Cellular content
 - Renal failure, nephrotic/nephritic picture

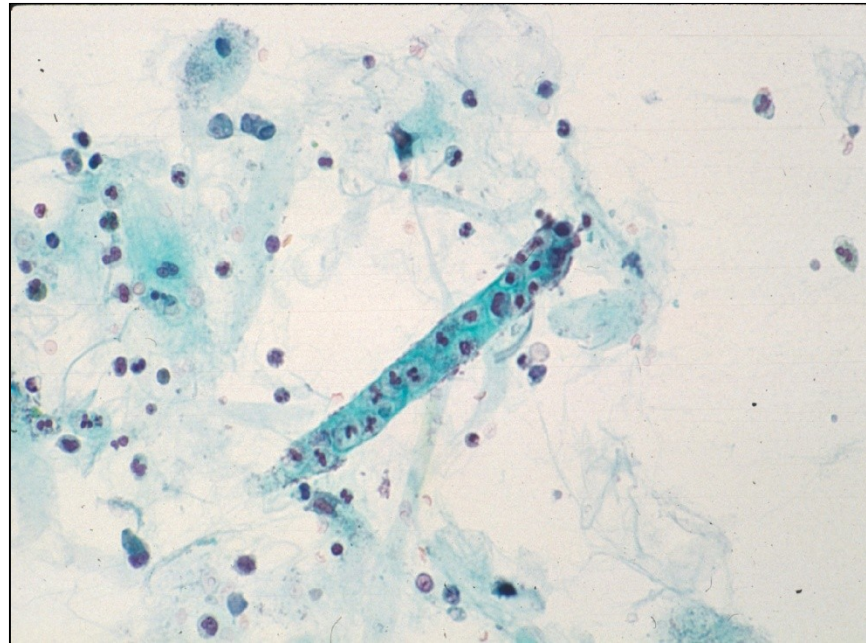
Urine Microscopy

- What does it tell you?
 - Casts
 - Crystals
 - Organisms
- Helps distinguish nephrotic/nephritic picture, identifies certain infections and certain metabolic conditions

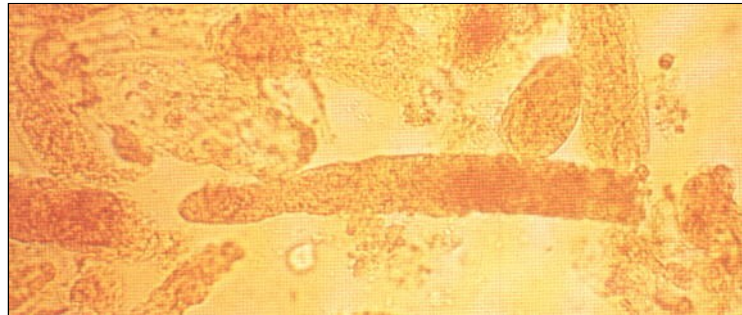
Red Blood Cell Casts



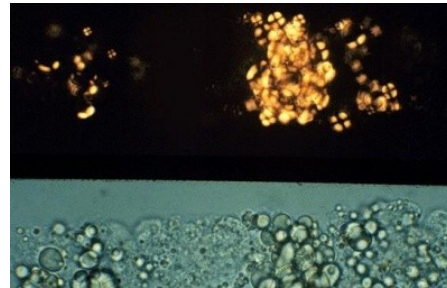
White Blood Cell Casts



Granular Casts



Fatty Casts



Diagnostic Data

- Blood pressure: 160/100
- Urinalysis:
 - 4+ protein
 - 2+ blood
 - Negative glucose
- Microscopy:
 - Granular and fatty casts
 - 5-10 RBC's, no red cell casts
 - No WBC's seen

Clinical Presentations of Renal Disease

- Nephritic Syndrome
- Nephrotic Syndrome
- Mixed (common in Malawi)

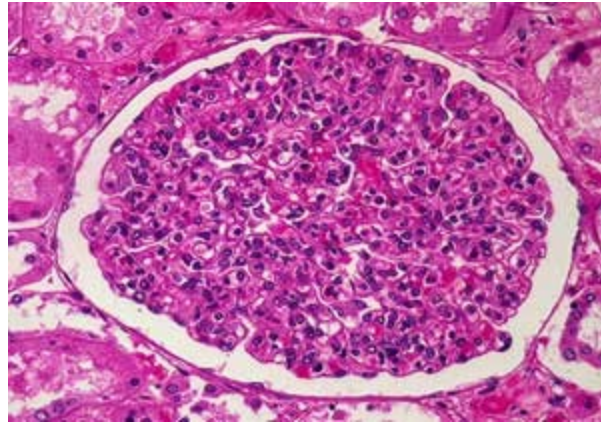
Nephritic Syndrome

- Defined by hematuria and RBC casts in urine
- Accompanying symptoms include:
 - Proteinuria
 - Hypertension
 - Oliguria
 - Edema

Nephritic Syndrome/Glomerulonephritis

- Glomerulonephritis-inflammation of the glomeruli of the kidney
- Microscopy shows influx of inflammatory cells into the mesangial matrix of the glomerulus
- Immune mediated inflammation is the mechanism for proliferative glomerulonephritis, of which PSAGN is the most common form

Acute Glomerulonephritis



Common Causes in Children

- Post-infectious glomerulonephritis
- IgA nephropathy
- Thin basement membrane disease
- Henoch Schonlein purpura (HSP)

Poststreptococcal acute glomerulonephritis

- Usually follows a streptococcal pharyngitis or impetigo (5-21 days)
- It occurs most frequently in children 2 to 12 years old. Boys are more affected
- Poor hygiene, malnutrition, crowded conditions and intestinal parasites may result in epidemic outbreaks

Nephrotic Syndrome

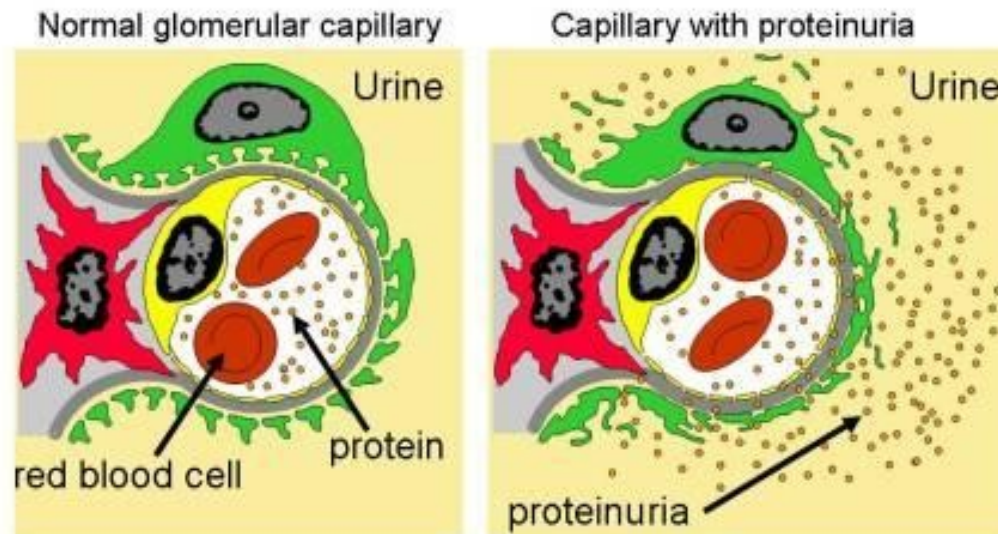
- Characterized by the presence of heavy proteinuria (mainly albuminuria [$>1\text{g}/\text{m}^2/24\text{h}$], hypoproteinemia (serum albumin $<2.5\text{ g/dL}$), hypercholesterolemia ($>250\text{ mg/dL}$) and oedema
- Minimal change nephrotic syndrome is the most common histologic form (70-80%)
- More prevalent in children between ages of 1.5 to 4 years; boys $>$ girls (2:1 ratio)
- Accompanying symptoms include:
 - Anorexia/malaise
 - Hypertension
 - Edema
 - Symptoms related to fluid overload
 - Hyperlipidemia

Urinary Sediment in Nephrotic Syndrome

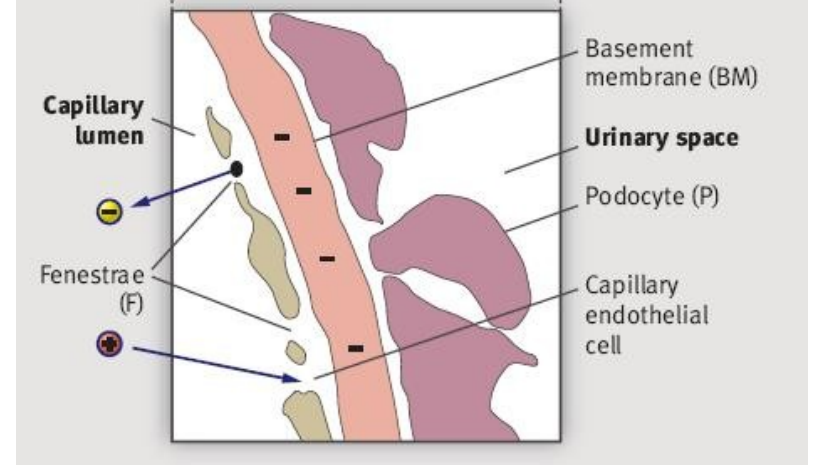
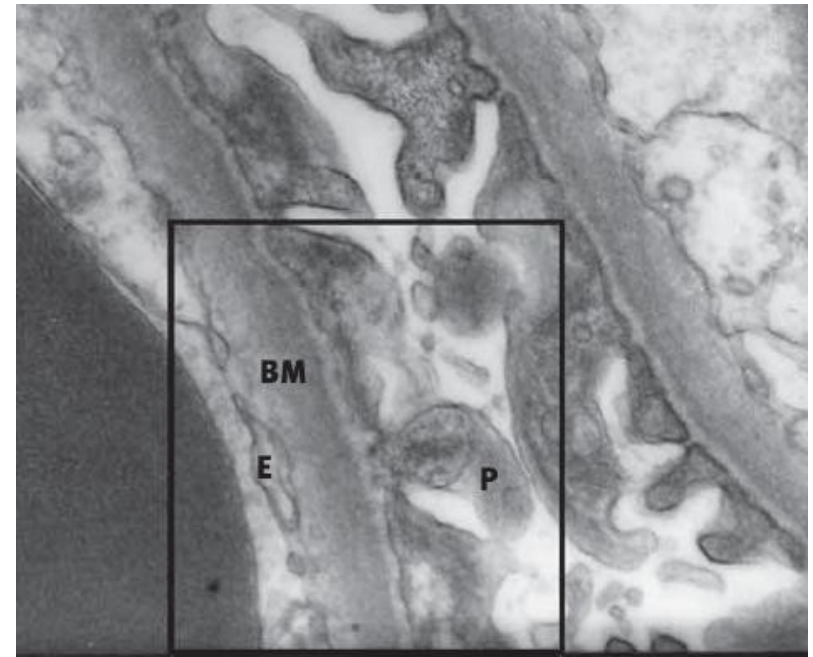
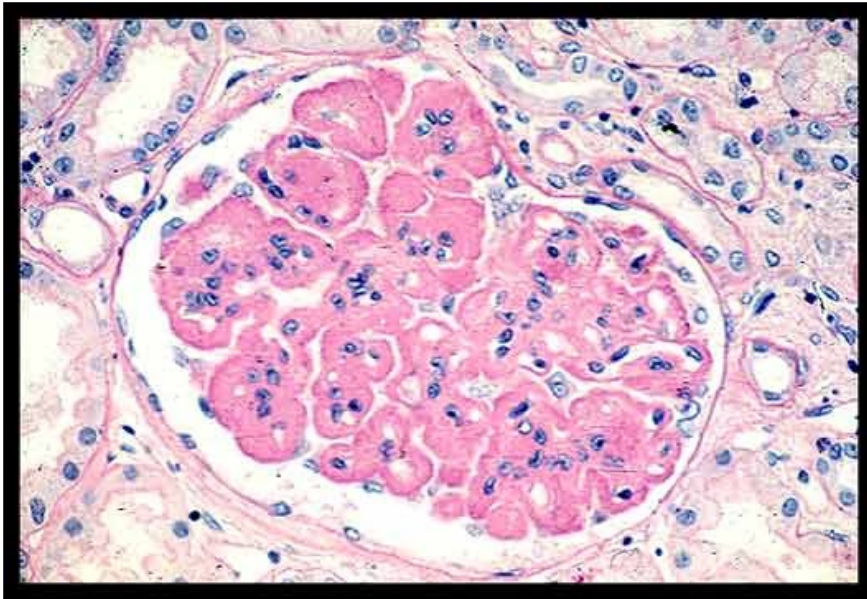
- Heavy proteinuria and lipiduria but few casts or cells
- If casts present, granular/waxy or fatty
- Absence of inflammatory cells
- Absence of RBC casts
- Rare RBC can be present

Nephrotic syndrome

- The primary disorder is **an increase in glomerular permeability to proteins**
- Massive proteinuria results and leads to a decline in serum proteins, especially albumin
- Plasma oncotic pressure is diminished, resulting in a shift of fluid from the vascular to the interstitial compartment and a contraction in plasma volume
- The reduction in effective blood volume activates the RAA system and increase the reabsorption of tubular sodium chloride which worsens the oedema
- Hypoproteinemia stimulates hepatic lipoprotein synthesis, while lipid metabolism is diminished



Nephrotic Syndrome



Common Causes in Children

- Minimal change disease
- Focal segmental glomerulosclerosis
- Membranous nephropathy

Differential diagnosis

- **Transient proteinuria** (febrile, dehydrated or after vigorous exercise)
- **Orthostatic proteinuria**
- **Glomerular proteinuria** (MILD: pyelonephritis, renal cystic diseases, obstructive uropathies, glomerulonephritis; MODERATE: acute post-streptococcal GN, Henoch-Schonlein nephritis, sever pyelonephritis, chronic GN and HUS; severe: nephrotic syndrome)

Case Presentation

- Assessment: 4 year old child with history of face/leg swelling, edema/creps on exam, hypertension and proteinuria
- Blood pressure: 160/100
- Urinalysis:
 - 4+ protein, 2+ blood
- Microscopy:
 - Granular and fatty casts
 - 5-10 RBC's, no red cell casts
 - No WBC's seen

Diagnosis?

- Nephrotic syndrome
- Why?
 - No red blood cell casts
 - No inflammatory cells (WBC) seen
 - Fatty casts present (hyperlipidemia)
 - Accompanying edema
 - Hypertension (more common in nephrotic sx)

Complications of Nephrotic Syndrome

- Infection: Bacteriemia and peritonitis particularly with *Streptococcus pneumoniae* & *Escherichia coli*
- Thromboembolism; the loss of proteins might lead to a hypercoagulable state
- Protein malnutrition
- Hypovolemia as a result of diarrhea or use of diuretics

Treatment

- Nephritic Syndrome
 - Largely supportive care
 - Renal dialysis
 - Renal transplantation
- Nephrotic Syndrome
 - Steroids (Prednisone: 2 mg/kg/day)
 - Frusemide
 - Be very careful! Give initially only if child unstable!
 - Water and salt restriction
 - Prophylactic penicillin

Treatment

- Steroid therapy
 - Prednisone 1-2mg/kg/day for 2-3 months until proteinuria resolved for 2 weeks
 - Then taper prednisone over 2 months
- Approximately 60% of children will respond to this therapy, but the rest may have multiple relapses

Hypertensive Encephalopathy

- BP 160/100
- Hypertensive Emergency
 - High BP with clinical symptoms
 - Headache, dizziness, blurry vision, altered MS
- Exam
 - Fundoscopy to look for increased ICP
 - Measure BP with appropriate sized cuff
 - Cuff that is too large is better than one that is too smallusyy

Hypertensive Encephalopathy

- Treatment:
 - Call your registrar or consultant
 - Remember if chronic, brain has gotten used to elevated BP and may not be well perfused if BP drops quickly
 - Medications:
 - Nifedipine-fast acting, PO
 - Hydralazine-fast acting, IV or PO
 - Beta blockers (propranolol) PO
 - ACE inhibitors-use with caution in renal failure
 - Frusemide

Thank You

Any Questions?

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