Glomerulonephritis

Nephritis – inflammation of the kidney.

Glomerulonephritis – inflammation of the tiny filtering units found throughout the cortex of both kidneys.

Bright’s Disease – historical classification that denotes albumin in the urine along with hypertension and edema.
15 year old female with sudden swelling around the eyes. Parents and PCP first thought the teen had an allergic reaction. Urinary protein 4+ and normal creatinine. BP also normal. In a week, there was a weight gain of 10 lbs.

70 year female had been experiencing fatigue for the last month. She went to an urgent care and was given antibiotics for presumed sinus infection. Sees her PCP and the lab shows creatinine of 1.8 mg/dl and urine with 15 RBC/hpf, protein 100.
Dialysis membrane

Globular macromolecule
(IgG, 160Å, 150kDa)

Membrane pore
(24Å)

Small molecule
(β-ME, ~5Å, 78Da)

Salt ion
(Na⁺, < 1Å, 23Da)
Glomerular Patterns of Injury

**Acute Glomerulonephritis (GN)**
- Classic Acute GN – Nephritic Presentation
- Rapidly Progressive GN
- Intermittent gross hematuria or asymptomatic microscopic hematuria

**Chronic Glomerulonephritis**
- Nephrotic Syndrome
- Asymptomatic albuminuria and/or hematuria
- Intermittent hematuria
<table>
<thead>
<tr>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal change nephropathy (MCN)</td>
</tr>
<tr>
<td>Focal segmental GS (FSGS)</td>
</tr>
<tr>
<td>Membranous GN (MGN)</td>
</tr>
<tr>
<td>Membranoproliferative GN (MPGN)</td>
</tr>
<tr>
<td>Mesangial GN (MeGN)</td>
</tr>
<tr>
<td>Crescentic GN (CGN)</td>
</tr>
<tr>
<td>Microscopic polyangiitis (MP)</td>
</tr>
</tbody>
</table>
Classification of Glomerular Disease

Primary
- MCN, MGN, MPGN, MeGN, FSGS

Secondary
- MCN – NSAIDS, lymphoma, lupus
- MGN – drugs, malignancies, hepatitis B, lupus
- MPGN – hepatitis C, endocarditis, lupus, immunoglobulin deposition, TMA
- FSGS – reflux nephropathy, IV heroin use, HIV, obstruction, hypertension
Nephrotic Syndrome

- Albuminuria > 3.5 gm/d
- Edema
- Elevated Cholesterol
- Hypertension
- Hypoalbuminemia
- Acute Kidney Injury
- Thrombosis
- Increased risk of Infection
Nephritic Presentation

- Hypertension
- Hematuria
- Flank Pain
- Fatigue
- Edema
- Dark Urine
Glomerulonephritis – What Patients want to know

✓ Why?
✓ What is causing it?
✓ How did it start?
✓ How can I cure this?
What Tests to Order?

- Urine Analysis
- Imaging study – if acute kidney injury is present
- Complete blood count with platelets
- Complete chemistry panel – serum creatinine, electrolytes, albumin, hepatic enzymes, Ca
- Protime
### What Tests to Order?

<table>
<thead>
<tr>
<th>Test</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANA</td>
<td>looking for lupus or other autoimmune diseases</td>
</tr>
<tr>
<td>ANCA Ab</td>
<td>looking for polyangiitis (with or without granulomatosis)</td>
</tr>
<tr>
<td>C3, C4 complement</td>
<td>depressed in MPGN, immune complex RPGN, endocarditis, lupus, cryoglobulinemia</td>
</tr>
<tr>
<td>ASO or Anti-DNAse Ab</td>
<td>evidence of recent streptococcal infection</td>
</tr>
<tr>
<td>Serum and Urine Protein electrophoresis with kappa/lambda ratio</td>
<td>screening for a monoclonal protein</td>
</tr>
<tr>
<td>Hepatitis virus profile</td>
<td>chronic hepatitis associated with GN</td>
</tr>
<tr>
<td>HIV Ab</td>
<td>often associated with GN</td>
</tr>
<tr>
<td>LDH, haptoglobin, platelet count, Hgb</td>
<td>screening for hemolysis</td>
</tr>
</tbody>
</table>
## Pulmonary Renal Syndromes

- Microscopic polyangiitis (with or without granulomatosi
- Goodpastures Disease (basement membrane disease)
- Lupus
- Right-sided endocarditis with septic emboli
- Malignant hypertension with acute heart failure
- Thrombotic microangiopathy with thrombocytopenia
- Malignancy with pulmonary primary or metastases
- Pneumonia with secondary GN (Strep, TB, Fungal, Viral)
Glomerulonephritis Treatment

- Control blood pressure (<130/80)
- ACEI/ARB to lower the pressure inside glomeruli
- Quit smoking
- Control diabetes
- Lose weight and restrict dietary caloric intake to less than 35 kcal/kg/day using either the DASH (Dietary Approaches to Stop Hypertension) or Mediterranean diet
- Exercise
- Reduce salt
# Glomerulonephritis Treatment

<table>
<thead>
<tr>
<th>Histology</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal Change Nephropathy</td>
<td>Steroids, cyclosporine, cyclophosphamide</td>
</tr>
<tr>
<td>Membranous Glomerulonephritis</td>
<td>Steroids, mycophenolate, cyclophosphamide, ACTH injections, cyclosporine</td>
</tr>
<tr>
<td>Lupus Nephritis</td>
<td>Steroids, cyclophosphamide, mycophenolate, cyclosporine, azathioprine, rituximab</td>
</tr>
<tr>
<td>Microscopic Polyangiitis</td>
<td>Steroids, cyclophosphamide, mycophenolate, azathioprine, rituximab, plasmapheresis</td>
</tr>
<tr>
<td>IgA Nephropathy</td>
<td>Fish oils, steroids, cyclophosphamide</td>
</tr>
<tr>
<td>Drug</td>
<td>Condition</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Prednisone</td>
<td>MCN, MGN, FSGS, MeGN, MPGN, ANCA+, SLE, Goodpastures, CGN</td>
</tr>
<tr>
<td>Mycophenolate, Imuran</td>
<td>MGN, FSGS, SLE, ANCA+, and other relapsing GN’s</td>
</tr>
<tr>
<td>Cyclophosphamide</td>
<td>MCN, MGN, ANCA+, Goodpastures, CGN</td>
</tr>
<tr>
<td>Cyclosporine, Tacrolimus</td>
<td>MCN, MGN, FSGS, SLE</td>
</tr>
<tr>
<td>Rituximab</td>
<td>ANCA+, SLE</td>
</tr>
</tbody>
</table>
Bad Effects – Volume Excess

- Nephrotic syndrome
- Hypertensive heart disease
- Drugs – steroids, diabetic agents
- Liver disease - hepatitis
Bad Effects – CV Disease

- DM and HTN
- Inflammation
- Hyperlipidemia
- Uremic Toxins, ie homocysteine, phosphorus
- Drugs – steroids, CNI’s
Bad Effects – Thrombosis

- Nephrotic syndrome
- Drugs – steroids, lenalidomide
- Lupus with anticoagulant
- Inflammation
### Bad Effects – Other

<table>
<thead>
<tr>
<th>Bone and Mineral Disorders</th>
<th>Anemia</th>
<th>Albumin</th>
</tr>
</thead>
<tbody>
<tr>
<td>High parathyroid hormone</td>
<td>Inflammatory effects</td>
<td>Nephrotic syndrome</td>
</tr>
<tr>
<td>Uncontrolled phosphorus</td>
<td>Medication – mycophenolate, azathioprine, steroids, rituximab</td>
<td>Inflammatory effects</td>
</tr>
<tr>
<td>Steroid effects</td>
<td>Blood loss due to GI bleeding</td>
<td>Anorexia</td>
</tr>
</tbody>
</table>