Nephrocalcinosis:

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SUPERSATURATION
Nephrocalcinosis is characterized by the deposition of calcium in the kidney parenchyma and tubules.

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The term nephrocalcinosis is used to describe the deposition of both calcium oxalate and calcium phosphate. But the majority limit the definition of nephrocalcinosis to the deposition of calcium phosphate and refer to the deposition of calcium oxalate as oxalosis.

Nephrocalcinosis often suggests a serious metabolic defect, whereas nephrolithiasis is commonly observed in otherwise healthy individuals.

Case 1

A 42 y/o lady was referred by Rheumatology with a past medical history consistent with persistent joint pain in hands and knees since the age of 20. She has been evaluated in the past by several internists and rheumatologists that prescribed analgesics and muscle relaxants.

One month before being sent to nephrology she developed severe sciatic pain following intensive Yoga and Pilates.

A bone survey was recommended by rheumatology.
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Blood work performed showed a white count of 4,700 with 45% neutrophils and 43% lymphocytes. A comprehensive metabolic panel showed a BUN of 28, creatinine of 1.29, sodium of 136, potassium of 4.7, chloride of 116, CO2 of 19, calcium of 9.1 mg/dL.

The urinalysis was notable for 3+ white blood cell esterase, pH 7.0, trace occult blood, 6-10 white blood cells, over 10 epithelial cells, and moderate bacteria.

Work-up for lupus, vasculitis, rheumatoid arthritis and scleroderma were negative. Complement was normal and hepatitis B and C tests were negative.
A 42 y/o lady who was referred by Rheumatology with a past medical history consistent with persistent joint pain in hands and knees since the age of 20. She has been evaluated in the past by internists and rheumatologist that prescribed analgesics and muscle relaxants.

Four weeks before being sent to nephrology she developed severe sciatic pain following intensive Yoga and Pilates.

Blood work performed showed a white count of 4,700 with 45% neutrophils and 43% lymphocytes. A comprehensive metabolic panel showed a BUN of 129, sodium of 136, potassium of 4.7, chloride of 116, CO2 of 19, calcium of 9.1 mg/dL.

The urinalysis was notable for 3+ white blood cell esterase, pH 7.0, trace occult blood, 6-10 white blood cells, over 10 epithelial cells, and moderate bacteria.

Other laboratory data was as follows: Work-up for lupus, vasculitis, rheumatoid arthritis and scleroderma were negative. Complement was normal and hepatitis B and C tests were negative.

Fasting urine pH 7.0

Blood Gases
pH 7.31
P02: 98 mmHg
PC02: 25 mmHg
HCO3: 17 mEq/L

Type I Renal Tubular Acidosis

[Image of renal tubular acidosis diagram]
Renal Tubular Acidosis

RTA promotes stone formation both by increasing calcium phosphate release from bone during bone buffering of retained acid and by direct reduction in the tubular reabsorption of these ions.

Two other factors also contribute importantly to stone formation:

1. The persistently high urine pH, which favors the precipitation of calcium phosphate (but not calcium oxalate)

2. Reduced citrate excretion, since acidemia enhances proximal citrate reabsorption.

Distal RTA may be the presenting manifestation of autoimmune diseases such as Sjögren’s Syndrome. Thus, adults with seemingly idiopathic distal RTA should be evaluated for Sjögren’s syndrome.

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Normal Range</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-DNA (SS) Ab Qn</td>
<td>0 - 9 IU/mL</td>
<td>4</td>
</tr>
<tr>
<td>RNP Ab</td>
<td>0.0 - 0.9 AI</td>
<td>0.4</td>
</tr>
<tr>
<td>Smith Antibodies</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Scleroderma (Scl-70) Ab</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Sjögren’s Antibodies (SSA)</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Sjögren’s Antibodies (SSB)</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Antichromatin Antibodies</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Anti Jo-1 IgG</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Anti-Centromere B Antibodies</td>
<td>0.0 - 0.9 AI</td>
<td>&lt;0.2</td>
</tr>
</tbody>
</table>
Case 2

A 58-year old white female was referred for evaluation of unilateral kidney stones detected following an abdominal ultrasound to evaluate non-specific abdominal pain.

She denied any previous urinary symptoms, specifically urinary tract infections, gross hematuria, or symptoms of urolithiasis. No family history of nephrolithiasis including an identical twin sister.
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She denied any previous urinary symptoms, specifically urinary tract infections, gross hematuria, or symptoms of urolithiasis. No family history of nephrolithiasis including an identical twin sister.

Before being evaluated by us she was seen by Urology and a percutaneous nephrolithotomy was performed. After the intervention (no kidney stones were extracted) she developed massive hematuria, shock and urosepsis and was admitted for more than a month in the ICU.
Congenital hemihypertrophy (Beckwith-Wiedemann syndrome) is characterized by asymmetry of the body as a result of hypertrophy of all somatic elements (muscles, bones, nerves, vessels) of one or more body parts.

Deregulation of imprinted genes within the chromosome 11p15.5 region results in the BWS phenotype.

Adult patients with congenital hemihypertrophy are at risk for male infertility, hearing loss, and increased risk for adult-onset malignancies.

In addition, there is an association with medullary sponge kidney, nephrocalcinosis, and in some patients chronic kidney disease.
Medullary Sponge Kidney
Cacchi-Ricci Disease

Medullary Sponge Kidney is a rare disorder characterized by the formation of cystic malformations in the collecting ducts.

The initial symptoms of this disorder may include hematuria, calcium stone formation and nephrocalcinosis.

Congenital disorder, not to be confused with medullary cystic kidney disease (autosomal dominant disorder) or with Nephronophthisis (autosomal recessive disorder).

Summary Stone Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine Volume (mL/d)</td>
<td>2.01</td>
</tr>
<tr>
<td>Urine Calcium (mg/d)</td>
<td>3.02</td>
</tr>
<tr>
<td>Urine Oxalate (mg/d)</td>
<td>296</td>
</tr>
<tr>
<td>Urine Creatine (mg/d)</td>
<td>376</td>
</tr>
<tr>
<td>Urine Citrate (mg/d)</td>
<td>460</td>
</tr>
<tr>
<td>Urine pH</td>
<td>6.42</td>
</tr>
<tr>
<td>24 Hour Urine pH</td>
<td>5.762</td>
</tr>
<tr>
<td>Urine Uric Acid (mg/d)</td>
<td>0.18</td>
</tr>
<tr>
<td>Urine Uric Acid (mg/d)</td>
<td>0.835</td>
</tr>
</tbody>
</table>
Case 3

Patient is a 35-year-old Brazilian male, hair stylist, with significant history of hypercalcemia, bilateral nephrocalcinosis and progressive chronic kidney disease for almost 5 years.

He was admitted for severe back pain, and a consult was placed for significant hypercalcemia and worsening kidney function.

In the past, he has been worked up for multiple conditions but no clue as to the etiology or treatment of the condition has been given.

At the time of admission the patient was complaining of progressive weakness, polyuria, and decreased strength. The patient has also experienced severe back pain in the past, and was on NSAIDs (diclofenac 100 mg) daily one week before admission to the ER.
Giant Cell in Granuloma
Nephrocalcinosis is characterized by the generalized deposition of either calcium phosphate or calcium oxalate in the kidney medulla or cortex. Patients who develop nephrocalcinosis may have acute or chronic kidney injury, or may have normal renal function. Nephrocalcinosis is often incidentally detected by imaging studies that are obtained for reasons unrelated to the kidney.

The prognosis of nephrocalcinosis depends on the underlying cause. While most patients do not progress to end-stage renal disease, patients with primary hyperoxaluria, hypomagnesemic hypercalciuric nephrocalcinosis and Dent’s disease often result in end-stage renal disease.

Nephrocalcinosis may be detected by plain x-rays, ultrasound, and CT imaging but less often by magnetic resonance imaging.

The underlying cause of nephrocalcinosis should be determined and treated if possible since the renal prognosis is determined by the underlying disease. No specific treatment has been shown to prevent progression of nephrocalcinosis.