Case 17076

Chronic Lithium-induced Nephropathy
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Section: Uroradiology & genital male imaging
Area of Interest: Kidney
Imaging Technique: CT
Imaging Technique: MR
Imaging Technique: Ultrasound
Case Type: Clinical Cases
Authors: Bram Miseur, Prof. R. Oyen
Patient: 48 years, female

Clinical History:

A 48-year old woman was referred for nephrological evaluation of progressive renal function impairment over several years. Previous medical history includes appendectomy, partial gastrectomy and long-standing bipolar disorder treated with lithium. The patient currently suffers from polyuria and polydipsia. Serum creatine is 1.42 g/dl with eGFR of 44 ml/min/1.73m² at presentation.

Imaging Findings:

Ultrasound of the kidneys showed small anechoic cysts bilaterally, increased cortical echogenicity, increased corticomedullar differentiation, echogenicity and hyperechoic punctate foci scattered throughout both kidneys. Renal size and parenchymal thickness were normal. (Figure 1)

Contrast-enhanced CT showed normal kidney volumes and multiple cortical cysts. These larger cysts (>3mm) are readily visualized on contrast-enhanced T1 weighted vibe sequences while some additional microcysts (1-2 mm) are much less conspicuous, the additional microcysts are better shown on a coronal heavily T2 weighted MRI slice at the same level. (Figure 2A-C)

T2-weighted MRI reveals innumerable microcysts (1-2 mm) in addition to these larger cysts (>3mm). These microcysts are better visualized on more heavily T2-weighted images (Figure 3A and 3B). A T2 single-shot RARE myelographic images from an MRI exam of the lumbar spine displays these microcysts even more clearly, providing a global view of the number and distribution of microcysts. (Figure 3C)

Discussion:

Background: definitions, disease description, pathophysiology

Lithium toxicity may present with three different clinical manifestations. Acute lithium intoxication causes gastro-intestinal, neurological and systemic symptoms. Lithium-induced diabetes is a common and reversible syndrome of polyuria and polydipsia resulting from decreased urine concentration. Chronic lithium therapy may result in a mostly irreversible, chronic tubulo-interstitial nephritis with damage to the distal tubules and microcyst formation. [1]
Clinical Perspective: typical or usual clinical presentation, clinical problem, indication for imaging, radiological report

Clinical and biochemical findings in addition to a history of lithium therapy are usually suggestive for the diagnosis of lithium-induced nephropathy. However, when clinical and/or biochemical findings are ambiguous, further investigation may be warranted. Renal biopsy provides direct evidence of chronic tubulo-interstitial nephritis but is invasive and the biopsy core samples only a fraction of the involved kidney(s). Imaging is non-invasive and provides an assessment of the extent of involvement. [1]

Imaging Perspective: diagnostic pearls, key findings, useful diagnostic procedures, how is the final diagnosis obtained

Renal ultrasound is the first-line modality in most cases. US typically shows normal or decreased kidney volume, normal or increased parenchymal echogenicity, multiple small renal cysts and punctate echogenic foci. These punctate foci represent microcysts smaller than the spatial resolution of ultrasound and are hyperechoic because of the interfaces of the tiny cysts. [2]

Contrast-enhanced CT generally shows similar findings, although very small microcysts may be difficult to demonstrate.

MRI is a good second-line modality in cases where ultrasound and/or clinical setting are inconclusive for a confident diagnosis. Especially when there is a clinical history of bipolar disorder and/or long-term lithium usage and ultrasound findings are inconclusive, MRI should be recommended as a second-line investigation. Heavily T2-weighted sequences are best suited to demonstrate the typical finding of diffuse microcysts. Coronal thick section single-shot T2 weighted images may show the extent of these microcysts even more clearly and convincingly.

Lithium-induced nephropathy presents with a multi-microcystic pattern (1-2 mm), larger cysts (>3 mm) are often present but are non-specific. Microcysts demonstrate a symmetric distribution in the renal cortex and medulla, in contrast to glomerulocystic kidney disease in which cysts are limited to the cortex, although cases of early lithium-induced nephropathy typically show a peripheral cortical predilection. Renal volume is normal or decreased, in contrast to autosomal dominant polycystic kidney disease (ADPKD) in which kidney volume is generally increased and hepatic cysts are associated in most cases. [3, 4]

Outcome: therapeutic options, prognosis, impact of imaging on therapy planning

Lithium-induced diabetes insipidus and acute lithium toxicity are reversible while renal function impairment in chronic lithium-induced interstitial nephritis tends to be irreversible and slowly progressive. Treatment includes cessation of lithium intake, although this is not always feasible, and avoidance of other nephrotoxic medication.

Take-Home Message/Teaching Points

Imaging may be necessary when clinical and biochemical findings are insufficient for the diagnosis of lithium-induced chronic interstitial nephritis. Typical findings of normal to decreased renal volume and symmetric abundant microcysts distributed in the renal cortex and medulla are best demonstrated on MRI, although ultrasound generally is the first-line modality.

Written informed patient consent for publication has been obtained.

Differential Diagnosis List: Lithium-induced chronic interstitial nephropathy, Glomerulocystic kidney disease,
Acquired cystic kidney disease, Medullary cystic kidney disease, Autosomal dominant polycystic kidney disease

**Final Diagnosis:** Lithium-induced chronic interstitial nephropathy

**References:**


Description: Ultrasound of the right kidney - Coronal ultrasound of the right kidney showing increased cortical echogenicity, increased corticomedullar differentiation and hyperechoic punctate foci (one shown, arrowhead) scattered throughout both kidneys. Renal size and parenchymal thickness are normal. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020
Description: Coronal CT slice - Coronal 3 mm CT slice showing small cortical cyst in the midpole of the right kidney. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020
Description: Coronal contrast-enhanced T1W (vibe) image - Coronal contrast-enhanced T1W (vibe) image showing a small cortical cyst in the right interpolar region and some tiny cysts in the left kidney (arrowheads). Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020
Description: Coronal heavily T2 weighted MRI slice - Coronal heavily T2 weighted MRI slice at the level of the kidneys showing a small cortical cyst in the right interpolar region and multiple tiny microcysts, most clearly visible peripherally in the left kidney. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020
Figure 3

a

Description: Axial T2 weighted MRI slice - Axial T2 weighted MRI slice at the level of the lower renal poles showing small cortical cyst in the right kidney and multiple tiny microcysts in both kidneys. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020

b

Description: Axial heavily T2 weighted MRI slice - Axial heavily T2 weighted MRI slice at the level of the lower renal poles showing a small cortical cyst in the right kidney and more clearly shows the diffuse tiny cortical and medullary microcysts in both kidneys, with a peripheral cortical predilection. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020
Description: Coronal thick section single-shot T2 weighted myelographic MR-image - Coronal thick section single-shot T2 weighted myelographic MR-image of the lumbar spine showing the extent of the renal microcysts even more clearly. Origin: © Department of Radiology, Universitair Ziekenhuis Leuven, 3000 Leuven, België, 2020