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Case report

OXALATE NEPHROPATHY IN ASSOCIATION WITH GASTRIC BYPASS

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Abstract

We present the case of a 46-year-old woman with a history of Roux-en-Y gastric bypass one year prior, who presented to the emergency room with vomiting and oliguria lasting 10 days. Initial evaluation revealed acute kidney injury with serum creatinine 14.9 mg/dL (normal range 0.5-0.9), serum urea 240 mg/dL (normal range 17-49), proteinuria 0.10 g/day and a glomerular filtration rate less than 10 ml/min per 1.73 m^2. Urine sediment showed 15-20 leukocytes and 25 red blood cells per field, with no cylinders or crystals observed. A renal biopsy was performed, and pathology showed oxalate crystals in renal tubules and interstitial fibrosis, confirming the diagnosis of oxalate nephropathy. Despite the administration of intravenous sodium bicarbonate, red blood cell transfusions and high doses of loop diuretics, renal failure persisted, as evidenced by the presence of oliguria, serum creatinine 13.5 mg/dL, serum urea 220 mg/dL and serum phosphate 8 mg/dL (normal range 2.5-4.5), and hemodialysis therapy was initiated 3 days after admission to the hospital until the present time.

Increased oxalate absorption secondary to fat malabsorption due to bypass gastric causes hyperoxaluria, crystal deposition and oxalate nephropathy. The aim of this report is to highlight the strong correlation between oxalate nephropathy and bariatric surgery, with their implications.

Key words: hyperoxaluria, oxalate crystals, Roux-en-Y gastric bypass, nephropathy

Resumen

Nefropatía por oxalatos asociada a bypass gástrico

Se presenta el caso de una mujer de 46 años con antecedente de *bypass* gástrico en Y de Roux un año atrás, que consultó por vómitos y oligoanuria de 10 días de evolución. En la valoración inicial se evidenció injuria renal aguda con creatinina sérica 14.9 mg/dL (valor normal 0.5-0.9), urea sérica 240 mg/dL (valor normal 17-49), proteinuria 0.10 g/día y una tasa de filtrado glomerular menor a 10 ml/min/1.73 m^2. El sedimento urinario evidenció 15-20 leucocitos y 25 hematíes por campo, sin cilindros ni cristales. Se realizó una biopsia renal y la anatomía patológica demostró depósitos de cristales de oxalato en los túbulos renales y fibrosis intersticial, confirmando el diagnóstico de nefropatía por oxalatos. A pesar de la administración de bicarbonato de sodio endovenoso, transfusiones de glóbulos rojos y

diuréticos de asa en altas dosis, la falla renal continuó, presentando oliguria, creatinina sérica 13.5 mg/dL, urea sérica 220 mg/dL y fósforo sérico 8 mg/dL (valor normal 2.5-4.5), en este contexto inició hemodiálisis 3 días luego de su ingreso al hospital hasta la actualidad.

El aumento de la absorción de oxalato secundario a la malabsorción de grasas debido al *bypass* gástrico provoca hiperoxaluria, depósito de cristales y nefropatía por oxalato. El objetivo de este reporte de caso es destacar la fuerte asociación que existe entre la nefropatía por oxalatos y la cirugía bariátrica, con sus complicaciones.

Palabras clave: hiperoxaluria, cristales de oxalato, *bypass* gástrico en Y de Roux, nefropatía

Hyperoxaluria is a medical condition that is characterized by excessive urinary excretion of oxalate, the ionized form of oxalic acid. Oxalate is derived from the liver and absorbed by the bowel from food. Sources of oxalate include leafy vegetables, nuts, fruits rich in vitamin C, and tea. Normally, only 5 to 15% of ingested oxalate is absorbed, as it binds to calcium in the bowel and is eliminated in the stools[1].

Hyperoxaluria has three main causes: excessive oxalate intake, increased intestinal absorption of oxalate (which is paradoxically observed in conditions involving intestinal malabsorption), and excessive endogenous oxalate production due to deficiency of certain hepatic enzymes (primary hyperoxaluria)[2]. Enteric hyperoxaluria occurs in the context of gastrointestinal malabsorption disorders, such as Crohn's disease, celiac disease, jejunoileal bypass, or chronic pancreatitis. The colon plays a crucial role in the hyperabsorption of oxalate, it has been demonstrated that patients with ileostomy do not experience hyperoxaluria[3].

Oxalate deposits in various organs, including heart, bone marrow, muscles, and renal parenchyma, that lead to an impairment in their function and homeostasis[4].

We present the case of a 46 -year-old woman with the Roux-en-Y gastric bypass procedure that developed oxalate nephropathy.

Clinical case

Upon admission, a 46-year-old woman with a history of Roux-en-Y gastric bypass (RYGB) surgery one-year prior, presented with symptoms of nausea, vomiting, and decreased urinary volume over the past 10 days. Physical examination revealed a body mass index (BMI) of 37 kg/m^2 and skin pallor, while other examination findings were unremarkable.

Laboratory evaluations showed the following results: hemoglobin (Hb) level was 7.2 g/dL with a mean corpuscular volume of 82.4 fl. The white blood cell count was 6280 $\times 10^9$/L and the platelet count was 214 000 $\times 10^9$/L. Serum creatinine 14.9 mg/dL (normal range 0.5-0.9), serum urea 240 mg/dL (normal range 17-49), serum sodium 119 mEq/L (normal range 136-145), serum potassium 3.9 mEq/L (normal range 3.5-5.1), serum ionized calcium 1.04 mmoles/L (normal range 1.0-1.3), serum phosphate 9.5 mg/dL (normal range 2.5-4.5), and the parathyroid hormone level was 98 pg/mL (normal range 12-88). The TSH level was normal. Venous blood gas results of pH 7.23 (normal range 7.35-7.45), pCO_2 20 mmHg (normal range 35-45), and HCO_3^- 8.2 mmol/L (normal range 22-26). Peripheral blood smear did not show schistocytes.

The total serum protein was decreased, as were albumin and gammaglobulin, without paraprotein. Blood and urine cultures were negative, and the patient tested negative for HIV antibodies, HBsAg, and HVC. The results of the antinuclear, anti-DNA, antineutrophil cytoplasmic and antiphospholipid antibodies, rheumatoid factor, cryoglobulins, and serum complement were all negative.

The urinalysis showed 15-20 leukocytes and 25 red blood cells per field, with no observed cylinders or crystals. Proteinuria was measured at 0.10 g/day and the excreted fraction of sodium was 18.8%. The glomerular filtration rate (GFR) was found to be less than 10 ml/min per 1.73 m^2. An abdominal and renal ultrasound without abnormalities.

A kidney biopsy was performed. The pathology showed an altered architecture with tubular atrophy (Fig. 1A), interstitial fibrosis, repeated deposits of calcium oxalate, most noticeable under the polarized light microscope (Fig. 1 B) and acute tubular injury, leading to the diagnosis of oxalate nephropathy.

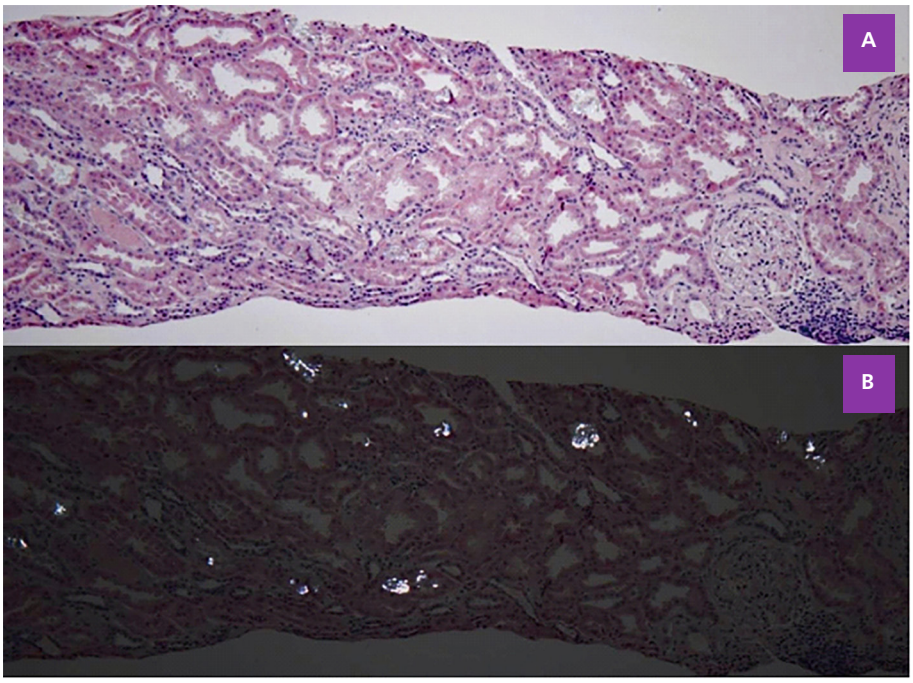
The patient persists with oliguria and kidney failure despite volume replacement (with saline solution 0.9% and Ringer's lactate), intravenous sodium bicarbonate (400 mE/q in the first 24 hours), two red blood cell transfusions and continuous infusion of high doses of loop diuretics during 48 hours (furosemide 250 mg/day), so she requires chronic hemodialysis since 3 days after her admission.

The patient signed the correspondent informed consent for the publication of the case.

Discussion

We present a case of secondary hyperoxaluria, caused by increased intestinal absorption

Figure 1 | Kidney biopsy. A: Shows acute tubular injury and calcium oxalate crystals. The crystals are clear with a refractile quality on a routine microscope. Hematoxylin and eosin (H&E) staining, 10x. B: Refractile, pale yellow, calcium oxalate crystals are seen in the renal cortex highlighted by polarized light



of oxalate due to malabsorption syndromes due to gastric bypass. In these patients, increased free fatty acids bind to calcium, leaving the oxalate available to be absorbed, mainly in the colon. Weight loss surgical procedures have been associated with enteric hyperoxaluria, oxalate nephropathy and an increased risk of kidney stones due to fat malabsorption[2].

Our patient showed some of the diagnostic criteria for oxalate nephropathy such as: oxalate crystal deposition with tubular injury and interstitial nephritis on the kidney biopsy, exclusion of other etiologies of kidney disease[1,5] and progressive kidney disease (defined as a >50% increase in serum creatinine in 1 year). We could not measure the presence of hyperoxaluria but there was an evident hyperoxaluria-enabling condition as the only identifiable trigger for kidney disease.

The kidney is the primary organ affected by the accumulation of oxalate crystals. These crystals bind to tubular epithelial cells, obstruct tubules, and trigger an inflammatory response that can result in fibrosis and, in some cases, lithiasis. When the GFR falls below 30-40 ml/min/1.73m², urinary excretion is unable to maintain normal plasma oxalate concentration, leading to the tissue deposition of oxalate crystals, surrounding them by an inflammatory response[3,6]. There exists an inverse relationship between GFR and urine oxalate excretion[7]. The risk of calcium oxalate precipitation is exacerbated by dehydration, diarrhea, bicarbonate loss, inflammation, antibiotic use, or high dietary oxalate intake[8].

RYGB is associated with an immediate increase in urinary oxalate excretion (3.1 to 7.7%) after surgery, which continues to rise until reaching a stable level 1 to 2 years after surgery. Mean urinary oxalate levels duplicate after RYGB, placing these patients at risk for the development of calcium oxalate nephrolithiasis and oxalate nephropathy beginning in the second month postoperatively[9,10]. According to these data, our patient developed oxalate nephropathy one year after RYGB.

Enteric hyperoxaluria can be treated and prevented in a few different ways. To reduce excessive urine oxalate originating from the intestines, dietary modifications are crucial. The initial step should involve reducing the intake of dietary oxalate. A diet containing less than 4 mg/day (0.045 mmol/day) oxalate has been shown to lower urine oxalate excretion into the

normal range in all subjects[11]. Another dietary strategy targeting the disease's pathophysiology is the limitation of fat intake. Oxalate absorption can be reduced by decreasing fatty acids in the intestinal lumen. Alternatively, incorporating medium-chain fatty acids can be beneficial since they are easily absorbed without requiring bile salt/micelle formation, unlike long-chain fatty acids[12].

Additionally, oxalate binding agents like calcium can be utilized. A study conducted by Penniston and Nakada found that increasing dietary calcium intake or using calcium citrate with meals can effectively reduce oxalate excretion without a significant increase in urinary calcium excretion. This suggests that the intestinal absorption of calcium remains available for oxalate binding[13,14]. A nutritional consultation was carried out.

Considering the stage of renal failure by the time of her hospitalization and the presence of dialysis criteria (oliguria, serum urea 220 mg/dL, and serum phosphate 8 mg/dL), we proceeded to initiate hemodialysis 3 days after her admission to the hospital, without the opportunity to implement treatments aimed at avoiding this course of therapy.

In certain situations, reversal of bariatric surgery may be required, but it carries significant risks and is rarely performed[2,14]. If oxalate nephropathy develops, reversing the bypass procedure may improve kidney function and reduce oxalate excretion. After consulting with specialists, we decided to continue with hemodialysis and evaluate the need for reversal in the future.

In conclusion, we present a case of a rare condition of kidney failure requiring hemodialysis due to enteric hyperoxaluria secondary to gastric bypass. Given the increasing global incidence of obesity and the resulting need for bariatric surgery, we believe that a multidisciplinary approach is necessary to prevent the condition in at-risk patients, promptly recognize it, and provide precise treatment upon presentation.

Conflict of interest: None to declare

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