Published in final edited form as:

Am J Med Sci. 2015 November ; 350(5): 427–428. doi:10.1097/MAJ.0000000000000576.

Severe Azotemia and Hyperchloremic Metabolic Acidosis Associated With Reverse Flow Enterovesical Fistula

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A 55-year-old woman underwent uneventful transurethral resection of a squamous cell carcinoma of the bladder. She presented to the emergency department 2 weeks after the procedure with complaints of frequent, almost “nonstop” watery diarrhea and fecal incontinence. Stool was brownish, and there was no hematochezia and no melena. There were no reported fevers, nausea or vomiting. She had decreased urine output, but there was no dysuria or hematuria. Physical examination: Blood pressure was 94/77 mm Hg, heart rate 103 beats/minute and respiratory rate 22/minute. Cardiopulmonary examination was normal. She had dry oral mucosa with poor skin turgor. The abdomen was soft and not distended; however, bowel sounds were hypoactive. There was mild tenderness in the periumbilical and suprapubic regions. There was no edema. Laboratory studies included: serum sodium (Na) concentration of 133 meq/L, potassium (K) 3.6 meq/L, chloride (Cl) 113 meq/L, bicarbonate 12 meq/L, blood urea nitrogen (BUN) 100 mg/dL, serum creatinine (SCr) 0.7 mg/dL and plasma anion gap 8 meq/L. Arterial blood gases (ABG) performed soon after starting an isotonic sodium bicarbonate infusion revealed pH 7.32, pCO₂ 27 mm Hg, pO₂ 155 mm Hg and calculated bicarbonate 16 meq/L. Urine studies were ordered; however, could not be performed because of absence of urinary output even after placement of a Foley catheter. Stool studies showed negative bacterial cultures and analysis for ova and parasites. Measurement of creatinine in the diarrhea fluid was not performed. Computed tomography of the abdomen and pelvis revealed a markedly contracted and nodular bladder with a large bladder wall defect with the Foley catheter extending through the bladder wall into a small bowel loop (Figure 1). A diagnosis of enterovesical fistula (EVF) with reversal of urine flow from the bladder into the intestine was made. Intravenous isotonic bicarbonate solution at the rate 125 mL/min was initiated for the treatment of hyperchloremic metabolic acidosis and azotemia, followed by partial cystectomy with creation of an ileal conduit and resection of portions of the jejunum and ileum invaded by the cancer with bowel-to-bowel anastomoses. These treatment measures led to both the resolution of diarrhea and to a rapid resolution of azotemia and metabolic acidosis within 24 hours after surgery. On postoperative day 1, serum Na was 142 meq/L, Cl 103 meq/L, bicarbonate 26 meq/L, BUN 21 mg/dL and creatinine 0.6 mg/dL. On the 4th day after surgery, BUN and bicarbonate normalized to 10 mg/dL and 29 meq/L, respectively.

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The authors have no financial or other conflicts of interest to disclose.

EVF is a fistulous communication between the intestine and the bladder. It is a rare condition with an estimated 2 to 3 patient per 10,000 surgical hospital admissions.¹ EVF is usually caused by an inflammatory or malignant bowel etiology, such as diverticulitis, colorectal carcinoma or Crohn's disease. Other causes include bladder cancer and general surgical and urological procedures.² Patients with EVF commonly present with pneumaturia, fecaluria, frequency, urgency, suprapubic pain and recurrent urinary tract infections, often with multiple organisms.² These symptoms occur as the most common direction of flow in EVF is fecal flow from the intestine into the bladder. The present case describes an unusual clinical and laboratory presentation of EVF with anuria and persistent watery diarrhea, occurring because of complete reversal of urine flow from the bladder to the intestine. The reversal of the typical direction of flow in EVF can occur as a result of high intravesical pressure, such as in the current patient who had a markedly contracted and nodular bladder. In this scenario, the stool urea and creatinine concentrations, if measured, will be much higher than plasma concentrations, confirming the presence of urine in the diarrheal fluid. The exposure of the gut to urine, subsequently, leads to severe azotemia and hyperchloremic metabolic acidosis.

Hyperchloremic metabolic acidosis in reverse flow EVF is due to 2 primary mechanisms. First, the diverted urine bathes the intestinal mucosa and urine Cl is absorbed in exchange for bicarbonate by the Cl/HCO₃ anion exchanger located both in the ileum and the colonic epithelial cells. The bicarbonate is then lost in stool with accumulation of chloride.³ Additionally, a large amount of ammonium (NH₄⁺) is absorbed by the colonic epithelium. This ammonium is derived, both, from the urine itself and from conversion of urine urea by bacterial urease in the colon. The absorbed NH₄⁺ is metabolized in the liver to ammonia (NH₃) and hydrogen ion H⁺. Subsequently, H⁺ production leads to depletion of body bicarbonate and development of hyperchloremic normal anion gap metabolic acidosis.⁴ The severity of normal anion gap metabolic acidosis with urine to bowel communication depends on contact time and to the amount of bowel surface exposed to the urine. This explains why ureterosigmoidostomy frequently leads to this complication, whereas urine drainage into an ileal pouch less likely leads to metabolic acidosis. In the patient, urine was exposed to a large bowel surface area, including both small intestine and colonic epithelia leading to severe metabolic acidosis.

The markedly elevated BUN, despite normal serum creatinine concentration was a result of gut urea reabsorption due to the high urea concentration gradient between the luminal fluid and the intestine and regeneration of urea in the liver from the ammonia generated during metabolism of NH₄⁺. The patient was also volume depleted, and this may have further contributed to her elevated BUN by enhanced renal tubular urea reabsorption.

The patient had low normal serum potassium of 3.6 meq/L on presentation. The presence of normal or low potassium concentration in the setting of normal plasma anion gap metabolic acidosis suggests the presence of total body potassium depletion. In this setting, intracellular buffering of hydrogen ion occurs in exchange for intracellular potassium, which typically leads to mild increases in plasma potassium concentration. Rapid correction of hyperchloremic metabolic acidosis with alkali therapy, particularly in the setting of total body potassium deficiency, can precipitate severe hypokalemia due to associated

intracellular movement of potassium which can lead to associated symptoms, such as muscle weakness and cardiac arrhythmias. Therefore, repeat measurements of serum potassium concentration are mandatory during correction of normal anion gap metabolic acidosis. With the correction of the metabolic acidosis, the patient's serum potassium dropped to 3.0 meq/L. She was given potassium chloride supplementation with resolution of the hypokalemia.

In conclusion, EVF commonly presents with lower urinary tract symptoms and infection. In patients with high intravesical pressure, there can be reversal of flow from the bladder to the intestine with resultant development of oliguria and even anuria, profuse diarrhea, hyperchloremic metabolic acidosis and markedly elevated BUN, despite normal renal function. Surgical repair of the EVF leads to rapid correction of both the diarrhea and the metabolic abnormalities.

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FIGURE 1.

Computed tomography of pelvis: Transverse view at the level of the bladder. The balloon of the Foley catheter and the catheter tip is seen within the lumen of the small intestine. B, bladder; EVF, enterovesical fistula; F, Foley catheter balloon; I, intestine.