

Hypertension and Acid-Base/Electrolyte Disorders

Acute Electrolyte and Acid-Base Disorders in Patients With Ileostomies: A Case Series

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Background: Patients with ileostomies are well known to be susceptible to extracellular fluid volume depletion as a result of fluid and solute losses that are greater than intake. However, electrolyte and acid-base disorders accompanying these episodes of volume depletion are not well delineated.

Study Design: Case series.

Setting & Participants: 7 patients with hospitalization because of acute acid-base disturbances at an academic medical center.

Outcomes: In all patients, serum and urine creatinine and electrolytes were measured. In 2 patients, arterial blood pH and P_{CO_2} and ileal drainage electrolytes also were measured.

Results: 2 patients presented with severe metabolic alkalosis, and the remaining 5 patients had low serum total carbon dioxide values in association with hyperkalemia. All 7 had acute renal failure. Pathophysiological characteristics, diagnosis, and management of these disorders are discussed, along with considerations for long-term management of fluid and electrolyte balance.

Limitations: This report illustrates electrolyte and acid-base disorders encountered in patients with ileostomies from our clinical experience. We have no data about the incidence of these disorders.

Conclusion: Patients with ileostomies can develop diverse and potentially life-threatening acute electrolyte and acid-base disorders when ileostomy drainage increases. Either metabolic acidosis or metabolic alkalosis can occur, depending on the nature and duration of the losses. These cases emphasize the need to be aware of the variety of acute electrolyte and acid-base disorders that can occur in this group of patients and to intervene rapidly when they develop.

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Removal of the colon and construction of an ileostomy invariably results in new challenges for acid-base and electrolyte equilibrium. Even in patients with intact ileums and well-functioning ileostomies, 200 to 1,000 mL of fluid is lost daily, containing 40 to 100 mmol of sodium, 15 to 30 mmol of bicarbonate, and 5 mmol of potassium.¹⁻³ Most patients adapt to these daily losses through subtle changes in salt and water intake, as well as changes in urine volume and electrolyte and acid excretion,^{3,4} and thereby can maintain electrolyte

and acid-base equilibrium.^{1,2} However, the new equilibrium is fragile, particularly in patients with daily ileostomy drainage of 1 L or greater. These patients often have Crohn disease and may have lost part of the ileum to disease.² Despite the appearance of normality, measurements in apparently healthy patients with ileostomies show a 7% to 11% decrease in total body sodium and water, indicating the presence of stable modest extracellular fluid volume depletion.⁴ Not surprisingly, symptomatic volume depletion is not uncommon, occurring when either ileostomy drainage abruptly increases or dietary intake is disrupted or in the presence of excessive sweating.^{3,4}

Although much has been written about volume depletion in patients with ileostomies,^{1,3-7} acid base and electrolyte disorders in these patients have received less attention. In newborn infants with ileostomies, both metabolic acidosis and alkalosis have been reported to occur.^{8,9} In adults, there have been only rare single patient case reports.^{10,11} In this report, we describe 7 adult patients with functioning ileostomies who

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Table 1. Clinical Features of 2 Patients With Ileostomies Presenting With Metabolic Alkalosis

Patient No.	Sex	Age (y)	Indication for Ileostomy	Time From Ileostomy Placement to Disorder	Inciting Incident	Long-term Treatment
1	M	56	Crohn disease	22 y	↑ Ileostomy output	Hemodialysis*
2	F	66	Crohn disease	<3 mo	↑ Ileostomy output	Ileostomy closure and ileocolic anastomosis†

Note: Both patients were volume depleted and had acute renal failure on admission.

*Started after 6 months of repeated episodes of metabolic alkalosis, volume depletion, and acute renal failure to assist in repleting extracellular fluid volume in a patient with advanced chronic kidney disease.

†Procedure performed after 7 months of repeated episodes of metabolic alkalosis, volume depletion, and acute renal failure. The patient died of complications in the postoperative period.

developed a wide array of serious acute acid-base and electrolyte disorders in association with volume depletion.

METHODS

Acute acid-base and electrolyte disorders requiring hospitalization in patients with functioning ileostomies were identified during 2 years by the Renal Consult Service at Fletcher Allen Health Care, the tertiary medical center of the University of Vermont College of Medicine. Two patients presented with recurrent episodes of severe metabolic alkalosis. The remaining 5 patients were admitted with acute renal failure, severe hyperkalemia, and low total carbon dioxide values. In all except 2 of these 7 patients, the precipitating factor was an increase in ileostomy drainage volume.

RESULTS

Table 1 lists clinical features of the 2 patients presenting with recurrent episodes of metabolic alkalosis and acute renal failure. Both had ileostomies placed for Crohn disease, and both had had part of the ileum removed. Neither patient was receiving diuretic therapy. In the first patient, the ileostomy was in place for 22 years, and electrolyte abnormalities were triggered by a sudden unexplained increase in ileostomy drainage in association with abdominal pain. A diagnosis of chronic pancreatitis was made based on fluctuating increases in serum lipase levels. Several of his admissions were preceded by vomiting, but never in an amount that could explain the severity of alkalosis. Moreover, on 3 occasions when he presented with serum total carbon dioxide values greater than 40 mmol/L, there was no preceding history of vomiting. In the second patient, high drainage volumes were a problem from the time of ileostomy placement, possibly because of the short segment of ileum (10 cm) remaining. There was no history of vomiting in any of this patient's admissions with

high serum total carbon dioxide values. In both patients, high-volume drainage persisted for months, causing repeated admissions with volume depletion, acute renal failure, and metabolic alkalosis.

Table 2 lists representative laboratory data for both patients. During other admissions with the same problem, serum total carbon dioxide levels were 33 to 45 mmol/L. In both patients, the acid-base diagnosis was confirmed by measurements of arterial pH and PCO₂. As listed in Table 2, these episodes were all associated with laboratory evidence of acute renal failure. Ileostomy drainage fluid in both patients had chloride concentrations that were high relative to sodium concentrations (Table 2). Acute treatment with intravenous sodium chloride reversed the volume depletion and metabolic alkalosis in both patients, only to have it recur after discharge from the hospital. Treatment with proton pump inhibitors and drugs to decrease intestinal motility failed to stem the problem in either patient.

Patient 1 had only 1 kidney because the other was removed for renal cell carcinoma, and he had chronic kidney damage caused by interstitial kidney disease in the remaining kidney. His creatinine level was 2.0 mg/dL (177 μmol/L) when alkalosis was first noted and increased gradually to 5.3 mg/dL (468 μmol/L) during the course of the illness. After repeated attempts to manage the high ileostomy output with medications, he was started on hemodialysis therapy 7 months after the onset of the increase in ostomy drainage, in part to replenish extracellular fluid volume on a regular basis 3 times weekly. Shortly after initiating this treatment, the disorder abated and ileostomy drainage decreased to 1 to 2 L/d. He continues on long-term hemodialysis therapy.

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