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Isotonic Fluid Absorption during Hysteroscopy Resulting in Severe Hyperchloremic Acidosis

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HYSTEROSCOPIES are well-established diagnostic and therapeutic procedures with low complication rates. Complications such as cervical laceration, uterine perforation, and absorption of irrigation solutions have an overall incidence of less than 5%.[1–3] Traditionally, electrolyte-free hypotonic solutions containing a mixture of mannitol and sorbitol or glycine are used as distending media allowing for monopolar electrical systems to be used for coagulation and tissue resection. However, these low-viscosity fluids carry a substantial risk of rapid fluid absorption resulting in fluid overload, dilutional hyponatremia, and a variety of concomitant side effects. Recently, the development of new operative hysteroscopic tools based on bipolar electrical systems has allowed for electrolyte-containing isotonic solutions, such as 0.9% sodium chloride, to be used as distending media, thus limiting the risk of dilutional hyponatremia.[4]

We describe the case of a patient undergoing hysteroscopic myomectomy in whom massive fluid absorption resulted in severe hyperchloremic metabolic acidosis and dilutional coagulopathy that resolved with diuretic therapy.

Case Report

A 36-yr-old, previously healthy woman (160 cm, 52 kg) presented for hysteroscopy and myomectomy because of dysfunctional uterine bleeding. After induction of general anesthesia with propofol and fentanyl, a laryngeal mask airway was inserted uneventfully. Anesthesia was maintained with propofol by infusion and fentanyl. For surgical hysteroscopy, commercial equipment was used, which consisted of a roller pump (VersaPoint®; Johnson & Johnson Gateway, Somerville, NJ) and a hysteroresectoscope (Olympus Winter & Ibe GmbH, Hamburg, Germany) that allowed for infusion pressure control of low-viscosity fluid in a continuous-flow hysteroscopy system. Isotonic sodium chloride, 0.9% (154 mM sodium, 154 mM chloride), was used as the distending solution.

Within 10 min after the start of the hysteroscopy, a progressively increasing tachycardia of up to 120 beats/min developed. The tachycardia was first attributed to a superficial level of anesthesia unresponsive to additional anesthetics. Thereafter, massive facial edema developed rapidly, and signs suggestive of pulmonary edema were present on auscultation. Only then, approximately 30 min after the start of the hysteroscopy, was a deficit in distending fluid balance of almost 7.5 l noticed; it was unidentified before despite the presence of a system-based warning system. Because fluid overload was suspected as the most likely diagnosis, intravenous furosemide (20 mg) was given to enhance diuresis, and the hysteroscopy was discontinued. Laboratory investigations revealed a hyperchloremic metabolic acidosis enhanced by a small respiratory component (fraction of inspired oxygen, 1.0; pH, 7.12; HCO_3^-, 15.5 mmHg; base excess, −13.3 mM; partial pressure of carbon dioxide, 48.7 mmHg; partial pressure of oxygen, 185.2 mmHg; sodium, 141 mM; potassium, 3.2 mM; chloride, 122 mM; anion gap, 3.5 mM). There were also signs of dilutional coagulopathy (international normalized ratio, 1.4; activated partial thrombin time, 59 s). Fifty milliliters intravenous sodium bicarbonate, 8.4%, and 20 mmol potassium chloride were given as a part of corrective treatment. In the absence of signs of respiratory compromise, the laryngeal mask was removed when the patient was awake. She was agitated and somewhat confused, and her blood pressure was 150/90 mmHg. An additional dose of intravenous furosemide (20 mg) was administered. On arrival in the intermediate care unit, an oxygen saturation of 98% was achieved with 10 l oxygen *via* facemask. Within 4 h, the patient's condition improved, and all hemodynamic and laboratory values were within the normal range; in particular, the laboratory indices of hyperchloremic acidosis had disappeared (chloride, 110 mM; pH, 7.42; base excess, −1 mM).

Discussion

Hysteroscopic resection of myomas and polyps in the uterine cavity is a well-established method in minimally invasive gynecologic surgery and is beneficial in terms of postoperative morbidity.[5] However, absorption of irrigating fluids used as distending media can result in fluid overload in 3–6% of patients.[6]

Traditionally, electrolyte-free hypotonic solutions were used as distension media containing a mixture of mannitol and sorbitol or glycine; they carried the risk of fluid overload, dilutional hyponatremia, toxicity of glycine and its metabolites, and associated problems in the case of massive fluid absorption. Recently, isotonic electrolyte-containing distending media, *e.g.*, lactated Ringer's solution and 0.9% sodium chloride, were introduced into practice to limit the risk induced by a severe electrolyte imbalance such as hyponatremia.[4] This change in fluids was made possible by advances in technology and development of new surgical instruments, such as a bipolar hysteroscopic system (VersaPoint®) and hysteroresectoscopes (Olympus®), allowing for improved surgical conditions.[7] Fluid overload by intravasation can still occur, although the risk of hyponatremia should be theoretically abolished when isotonic electrolyte-free fluids are used as irrigating medium.[8] However, neither the occurrence of severe hyperchloremic metabolic acidosis

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nor other types of electrolyte imbalances have been reported when 0.9% sodium chloride solution is used as a distending medium for operative hysteroscopy. Therefore, as the current case shows, caution is also warranted when using electrolyte-containing irrigating media, because severe hyperchloremia and acidosis developed within a few minutes after the start of surgery. Severe hyperchloremic acidosis might impair myocardial contraction and increase the risk of ventricular fibrillation or heart failure, especially in the presence of fluid overload. Nonetheless, large volumes of normal saline infusions resulting in moderate metabolic acidosis (pH 7.28) do not seem to cause any major adverse effects in humans.[9,10]

In the current case, severe acidosis (pH 7.12) was combined with a massive fluid overload (+7.5 l) leading to hemodynamic changes (tachycardia, hypertension). Intraoperative tachycardia at first was falsely attributed to a superficial level of anesthesia rather than a volume problem. The development of metabolic acidosis was further increased by the inadequacy of compensatory respiratory mechanisms during anesthesia.

In conclusion, this case shows that the risk of fluid overload complicated by severe metabolic acidosis and coagulopathy is present during minimally invasive operative hysteroscopy, even if 0.9% sodium chloride is used as a physiologic distension medium. Therefore, monitoring of perioperative fluid balance is of paramount importance. Screening for early signs of fluid overload can reduce the risk of severe hyperchloremic acidosis that in itself might be nonhazardous but can worsen rapidly to a life-threatening condition if not treated in time. Such a treatment might also include tris-hydroxymethyl aminomethane instead of sodium bicarbonate as a buffer.[11,12]

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