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Sizable retrograde transtubal leakage of saline during bipolar hysteroscopic myomectomy: A potential cause of hypoxia

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Abstract

This case report discusses a bipolar hysteroscopic myomectomy procedure for a type II FIGO submucous myoma using 0.9% saline as a distension medium. Following the successful excision of the myoma, a significant decrease in oxygen saturation was observed, confirmed by blood gas analysis, urgent X-ray, and echocardiography. Despite the absence of acidosis or pulmonary edema, emergency abdominal ultrasonography revealed a large volume of intraperitoneal fluid. Approximately one liter of intraperitoneal saline was drained during an emergency laparoscopic intervention, leading to a notable improvement in the patient's hypoxia. This case highlights the importance of considering retrograde transtubal leakage of saline as a potential cause of intraoperative hypoxia, particularly in patients undergoing advanced hysteroscopic procedures with suspected patent fallopian tubes.

Keywords: hysteroscopy, saline, hypoxia, fallopian tube, myomectomy

Introduction

Saline is commonly used as an electrolyte-rich distension medium for bipolar or mechanical hysteroscopic surgery due to its isotonic nature, which eliminates the risk of hyponatremia or hypokalemia. However, its low viscosity can lead to mixing with blood, requiring higher infusion volumes for adequate visualization. Exceeding the maximum fluid deficit of 2500 mL in healthy individuals or 1500 mL in cardiac patients or those with comorbidities can result in complications such as left-sided heart failure, pulmonary edema, or even mortality [1]. Previous studies have primarily focused on calculating fluid outflow using suction bottles, urine output bags, and perineal bags, neglecting intraperitoneal leakage during endometrial cavity distension [2]. This case report highlights a significant retrograde transtubal leakage of saline into the peritoneal cavity, leading to severe intraoperative hypoxia during advanced hysteroscopic myomectomy.

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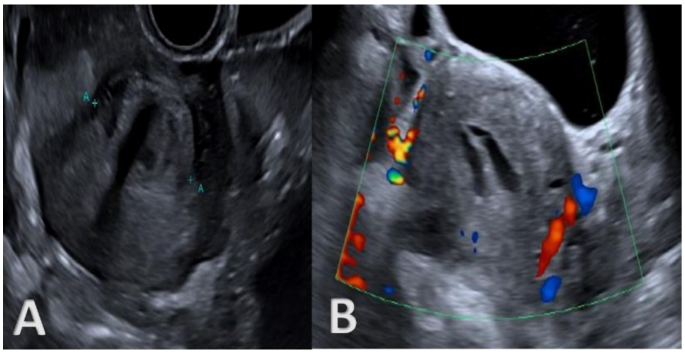
Case presentation

The patient, a 36-year-old woman, P (1+0), had a cesarean delivery six years ago during her previous marriage. She visited the outpatient department due to severe episodes of vaginal bleeding, particularly menorrhagia and dysmenorrhea, accompanied by colicky pain. Despite using oral contraceptive pills, she did not actively seek fertility. During the clinical assessment, she weighed 54 kg and did not exhibit any obvious signs of systemic bleeding. She was 158 cm tall with a waist circumference of 61 cm. A Type II FIGO submucous anterior wall myoma measuring 3.5 x 3 cm was identified through abdominal and vaginal ultrasonography (Figure 1-A). The recommendation was for her to undergo a hysteroscopic myomectomy instead of an open myomectomy. The patient was provided with detailed information about the benefits of a hysteroscopic myomectomy, taking into account the extensive experience of the senior surgeon (AD) in hysteroscopic intrauterine procedures spanning 34 years.

Figure 1: A: Preoperative transabdominal ultrasonography shows an anterior wall type II fibroid. B: Postoperative transabdominal ultrasonography (with Doppler) shows complete resection of the fibroid with intrauterine hypoechogenic shadow at site of resection (mild bleeding).



She underwent evaluation and preparation for hysteroscopic intrauterine surgery during the follicular phase after receiving approval from her insurance provider. She was assessed at the anesthesia clinic and classified as ASA class 1. Her initial vital signs were within normal limits, with a blood pressure of 130/80, heart rate of 80 bpm, and SpO2 of 98% on room air. Following a detailed explanation using a uterine model, the patient and her husband signed a comprehensive consent form outlining all potential complications of the procedure, including the need for laparoscopy or laparotomy in case of perforation or other issues. After obtaining approval from both her insurance company and the Institutional Review Board (IRB #23125), the patient was scheduled for the surgery. She was informed that the procedure would be performed using bipolar resectoscopy with 0.9% saline distending media due to its established safety profile compared to monopolar resectoscopy. The patient received 200 micrograms of misoprostol sublingually six hours before the procedure to aid in cervical dilatation, as previously recommended. Although spinal anesthesia was recommended, the patient opted for general anesthesia, which was induced with 100 mg of fentanyl, 150 mg of propofol, and 35 mg of esmeron administered intravenously. A size 7.5 mm endotracheal tube was inserted and secured for airway protection, and standard monitoring devices were applied. Anesthesia was maintained with sevoflurane 1%, a mixture of oxygen and air (50%:50%), and mechanical ventilation in volume control mode. Intravenous Ringer Lactate infusion was limited to 300 ml/h.

A diagnostic hysteroscopy was performed to locate and determine the size of the myoma. The procedure took two minutes. Cervical dilatation up to Hegar's 10 was done to insert a bipolar resectoscope (Olympus bipolar resectoscope, Hamburg, Germany). A resectoscopic myomectomy was carried out (Figure 2-A) with a concurrent intramuscular injection of one ampoule of ergometrine to aid in the myoma's protrusion into the endometrial cavity. Saline was infused using a mechanical distension media machine, and the procedure lasted 20.30 minutes. The machine was not automated, and the flow rate was chosen arbitrarily without specifying fluid pressure. There was an overall fluid deficit of 2500 mL, calculated by adding the suction unit amount, urine outflow, and the amount collected in the perineal bag.

The anesthesiologist observed a gradual decline in vital signs without a clear explanation. EtCO2 decreased from 40 to 25 mmHg, SpO2 dropped from 100% to 84%, blood pressure was 70/35 mmHg, heart rate increased to 100 bpm, and airway pressure rose to 38 cmH2O. As a precaution, the anesthesiologist administered a 40 mg IV bolus of furosemide, but there was no improvement in hypoxia. The O2 flow was increased to 100%. Fortunately, the procedure was completed at that time (Figure 2-B), allowing the observation of tightness and distention in the abdomen when the drapes were pulled back. A code blue was called immediately. Chest examination, blood gas analysis, urgent X-ray, and echocardiography all indicated no signs of pulmonary edema or acidosis, as confirmed by the pulmonologist and cardiologist. An urgent abdominal ultrasound by a radiologist revealed a significant amount of free intraperitoneal fluid, which could explain the hypoxia. Following an urgent diagnostic laparoscopy that confirmed the presence of free intraperitoneal fluid (Figure 3-A), there was a significant improvement in hypoxia after aspirating at least one liter of clear free fluid (Figure 3-B). SpO2 increased to 95%, BP to 100/65 mmHg, and heart rate to 90–100 bpm.

The patient was placed on mechanical ventilation for approximately thirty minutes. Sugammadex 100 mg was administered to reverse the effects of a muscle relaxant, and the patient was extubated once she demonstrated effective breathing. Her oxygen saturation levels (SpO2) ranged between 96% and 92%. Subsequently, she was transferred to the high care unit (HCU) and provided with 10 L/min of 100% oxygen via a face mask. Postoperative chest CT scan and X-ray results were normal. A thin intrauterine hypoechogenic shadow suggestive of some bleeding was detected on the second day through abdominal ultrasonography, confirming complete excision of the myoma (Figure 1-B). Two days later, she was discharged from the hospital in good health.

Figure 2: A: Bipolar resectoscopic excision of the fibroid using slicing technique. B: fibroid tissues after resection.

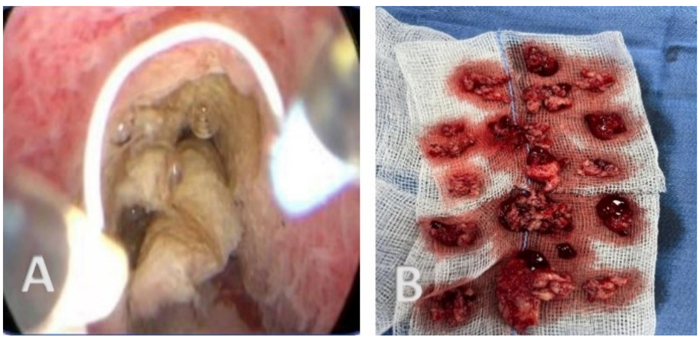


Figure 3: A: Diagnostic laparoscopy revealed free intraperitoneal saline. B: Suction of about one liter of 0.9% saline.

Discussion

Bipolar electrosurgery is known for its safety compared to monopolar electrosurgery. One of the key advantages of bipolar electrosurgery is the avoidance of electrolyte-free solutions, which can lead to risks such as hyponatremia and systemic consequences. This is particularly beneficial in advanced intrauterine procedures like hysteroscopic myomectomy. Previous studies have shown that bipolar resectoscopy is superior to monopolar resectoscopy [3]. Since then, we have been using bipolar electrosurgery with saline distension media. While 0.9% saline is generally safe, excessive infusion can potentially lead to fluid overload, resulting in complications such as pulmonary edema, left-sided heart failure, or even death, especially in complex hysteroscopic surgeries like type II or III myomectomy. The miscibility of saline with blood may require the surgeon to use a larger volume for better visualization, contributing to the risk of saline fluid overload.

Safety considerations for intrauterine surgery include selecting an appropriate size and type of myoma (type II), completing the procedure efficiently, opting for saline in bipolar resectoscopy instead of glycine in monopolar resectoscopy, and scheduling the procedure in the immediate postmenstrual period to minimize fluid absorption. Therefore, when the patient experienced sudden hypoxia, the surgeon considered the possibility of fluid overload and took appropriate action.

Due to the direct connection of the normally patent fallopian tubes with the endometrial cavity and the increased intrauterine pressure during hysteroscopic surgery, most women with patent tubes undergoing hysteroscopy experience accumulation of distension media in the pelvis (RTL). The lack of routine use of intraoperative ultrasonography and the short duration of hysteroscopic procedures often result in incomplete exploration of this inevitable intraoperative fluid leakage, which could potentially lead to fluid overload or dissemination of cancerous cells [4]. It is advisable to perform hysteroscopic intrauterine surgeries in the postmenstrual phase, as demonstrated in this case, as premenstrual individuals tend to have higher rates of fluid passage and speed [5]. Several factors influence RTL during hysteroscopy, including the procedure duration, distension media flow rate, intrauterine pressure (IUP), type of surgery (e.g., myomectomy), lesion size, and residual myometrial thickness (RMT). A lower RMT may require more time for excising a type II or III myoma, as illustrated in this type II myoma case. The intratubal opening pressure has been reported as 75 mmHg [6], suggesting that RTL may occur if IUP is ≥75 mmHg. Studies have indicated that RTL occurs when IUP exceeds 80 mmHg [7], although a study involving 164 patients undergoing diagnostic hysteroscopy found no correlation with IUP [8]. Another study on 64 cases undergoing hysteroscopy alone or with laparoscopy did not show a relationship between IUP and RTL. However, the limited sample size and diverse study population in these studies underscore the variability of results. Intraabdominal pressure (IAP) typically ranges from 0 to 5 mmHg, with a slight increase (10–15 mmHg) maintaining cardiac index. A moderate increase in IAP (15–25 mmHg) during laparoscopy may necessitate surgical decompression, while an IAP ≥25 mmHg defines abdominal compartment syndrome requiring decompression [9]. Ensuring the safety of endoscopic procedures and providing simultaneous laparoscopic supervision for advanced hysteroscopic intrauterine procedures is crucial. Laparoscopic monitoring allows for aspiration of intraperitoneal fluid collections and enhances surgical safety to prevent inadvertent uterine perforation. Alternatively, intraoperative ultrasound surveillance, particularly during prolonged intrauterine procedures, is emphasized in this case study. Availability of an ultrasound machine in the operating room for intermittent monitoring of intrauterine surgeries and final checks is essential.

We reported aspiration of over one liter of intraperitoneal saline, which is more than double the volume reported in a previous study [10]. This can be attributed to several risk factors in this case for RTL. The lack of automatic hysteromat usage led to an inaccurate assessment of the flow rate and IUP. The nature of the lesion as a type II myoma penetrating the myometrium, along with the inevitable prolonged procedure duration, was an additional factor. The patient's thin build and small waist circumference indicated a small peritoneal cavity, increasing the likelihood of hypoxia due to limited space. The patient's loss of consciousness during the procedure, as she opted for general anesthesia over spinal anesthesia, delayed the recognition of hypoxia. Lastly, since she was not trying to conceive and only presented with abnormal uterine bleeding and pain, it is likely that both of her fallopian tubes were patent.

Conclusion

RTL of saline, which can occur during advanced hysteroscopic surgery, should be anticipated, especially if the patient experiences unexplained hypoxia. It is important to consider this when calculating fluid deficit in advanced hysteroscopic procedures. Utilizing sonographic or laparoscopic monitoring during advanced hysteroscopic surgery can help prevent unexpected intraoperative complications. Increased awareness among gynecologists and anesthesiologists about potential hysteroscopic complications can lead to early detection and timely interventions for optimal outcomes. Experienced hysteroscopists are encouraged to conduct further research on RTL following various types of intrauterine hysteroscopic surgeries and to compare outcomes based on patient and surgical factors.

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