Case Report

Acute pulmonary oedema and hyperchloraemic metabolic acidosis following operative hysteroscopy using sodium chloride 0.9%

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Summary

Fluid media including sodium chloride 0.9% are used during operative hysteroscopy to provide uterine distension and aid visualisation. Volume overload is a known complication of their use but is usually associated with long procedures or uterine tissue dissection. A previously well 40-year-old woman presented for hysteroscopy and evacuation of retained products of conception under general anaesthesia. On emergence, she developed respiratory compromise and a hyperchloraemic metabolic acidosis in keeping with acute pulmonary oedema induced by sodium chloride 0.9% fluid overload. Anaesthetists must remain vigilant during operative procedures using distension media. Additionally, they should be familiar with the clinical and metabolic manifestations consistent with systemic transfusion of such media.

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Introduction

Hysteroscopy is a widely performed procedure undertaken diagnostically or in conjunction with an operative procedure. During operative hysteroscopy fluid media such as sodium chloride 0.9% or glycine solution are typically employed to provide uterine distension, optimal viewing conditions and constant irrigation [1]. Although rare, large volumes of hysteroscopic fluid can reach the systemic circulation via open vasculature [1], analogous to transurethral resection of prostate syndrome. This has been termed operative hysteroscopy intravascular absorption syndrome [2]. Operative hysteroscopy intravascular absorption syndrome is most likely to occur during prolonged procedures or where there is resection of uterine tissue such as in transcervical resection of endometrium or fibroids. Low mean arterial blood pressure in conjunction with high uterine pressure will also create a pressure gradient in favour of transfusion [3]. The amount of fluid passed into the uterine cavity versus that expelled is the fluid deficit, which gives some indication of systemic absorption and is routinely recorded in the operating theatre.

In addition to volume effects, the absorption of hypotonic fluids such as glycine or sorbitol solutions can result in hyponatraemia and severe neurological sequelae [4]. In contrast, absorption of isotonic sodium chloride 0.9% can cause a hyperchloraemic metabolic acidosis [5].

We report what we believe is the first published case of operative hysteroscopy intravascular absorption syndrome following hysteroscopy and evacuation of retained products of conception with no dissection of uterine tissue.

Report

A 40-year-old, normally well, 45-kg, nulliparous woman presented to the early pregnancy clinic with light vaginal bleeding at 11 weeks gestation by dates. Ultrasonography demonstrated an incomplete miscarriage. Initial conservative management and subsequent medical management of the retained products failed. Six weeks after her initial presentation, repeat ultrasonography confirmed retained products measuring 3 cm. She was therefore scheduled for surgical evacuation of retained products of conception.

Standard monitoring was applied and an intravenous (i.v.) infusion of Hartmann's solution was commenced before the induction of general anaesthesia with fentanyl 75 µg, midazolam 1 mg and propofol 200 mg. Ondansetron 4 mg and co-amoxiclav 1.2 g were also administered. The patient's airway was maintained with a laryngeal mask (Intersurgical, Wokingham, UK) and she remained spontaneously ventilating throughout the operation. Anaesthesia was maintained with a sevoflurane end-tidal concentration of 2% and a $F_{I}O_2$ of 0.5.

The surgical team elected to perform the evacuation of retained products of conception hysteroscopically rather than with blind curettage to directly see the products and minimise the risk of incomplete removal. Hysteroscopy commenced with sodium chloride 0.9% used as the distension fluid. The surgeon found the products to be densely adhered to the uterine wall, but they were ultimately removed. Standard curetting instruments and hysteroscopic forceps were used. There was no use of electrosurgical instruments. The patient remained stable throughout the operation. The time from induction of general anaesthesia to completion of the operation was 35 min. The final hysteroscopic fluid deficit was noted to be 1500 ml. In addition, the patient received 1000 ml of the Hartmann's solution i.v.

On emergence from general anaesthesia, whilst still in the operating theatre, the patient's respiratory rate increased from 12 to 24 breaths per minute with a corresponding drop in end-tidal carbon dioxide partial pressure from 5.5 kPa to 3.0 kPa. The patient's oxygen saturations dropped from 99% to 93 % despite an increased $F_{I}O_2$ of 1.0 for emergence and her heart rate increased from 80 to 120 beats per minute. The laryngeal mask was removed in order to use a facemask connected to the anaesthetic machine circle system, allowing continuous positive airway pressure (CPAP) ventilation to be provided by titrated use of the adjustable pressure-limiting valve. Possible differential diagnoses for the observed respiratory compromise included aspiration; anaphylaxis; or acute pulmonary oedema. Concurrently, the patient passed 200–300 ml of blood per vagina and was re-examined by the surgeon to exclude uterine perforation. Tranexamic acid 1 g and oxytocin 5 international units were administered i.v. along with misoprostol rectally. Auscultation of the chest revealed widespread crepitations consistent with acute pulmonary oedema and she required CPAP to maintain her oxygen saturations.

A venous blood gas revealed a dilutional anaemia (Hb 74 g.l⁻¹; haematocrit 22.7%) upon comparison with pre-operative blood results (Hb 130 g.l⁻¹; haematocrit 39.4%) 4 weeks previously with no vaginal bleeding in the intervening period. The venous sample also demonstrated a hyperchloraemic metabolic acidosis (with an anion gap of 6.9 mmol.l⁻¹ (Table 1).

Blood results, clinical examination findings, hysteroscopic fluid deficit and volume of i.v. fluid infused supported a diagnosis of acute pulmonary oedema and hyperchloraemic metabolic acidosis secondary to fluid overload. While still in the operating

Table 1 Blood results of venous blood gas (VBG) and arterial blood gas (ABG) results at different peri-operative time-points.

	Units	VBG during event	ABG 1 h later	ABG 6 h later	ABG 24 h later
Haemoglobin	g.l ⁻¹	74	115	100	97
pH		7.18	7.23	7.40	7.42
pCO ₂	kPa	5.21	5.52	4.43	5.2
pO ₂	kPa	10.1	26.7	16	11.2
SpO ₂	%	94	99.6	99.2	98.4
Potassium	mmol.l ⁻¹	3.3	3.6	3.9	4.1
Sodium	mmol.l ⁻¹	141	138	142	144
Chloride	mmol.l ⁻¹	123	115	112	112
Lactate	mmol.l ⁻¹	2.5	1.2	1.2	0.5
Bicarbonate	mmol.l ⁻¹	14.4	16.7	21.2	24.9
Base excess	mmol.l ⁻¹	-13.7	-10.4	-4.4	0.5

theatre furosemide 20 mg was administered i.v., a radial arterial line was inserted and a mobile chest radiograph ordered, which confirmed widespread pulmonary oedema.

The patient was transferred to the postanaesthesia care unit on 15 l oxygen via a non-rebreather mask. The furosemide resulted in a diuresis of 1500 ml over the ensuing 90 min. After 1 h in the recovery room the patient was transferred to the high dependency unit. She received oxygen via a high-flow nasal device (F_{iO_2} 0.35; 40 l.min⁻¹) and was later de-escalated onto standard nasal cannula approximately 6 h after the initial respiratory compromise. A transthoracic echocardiogram was performed and was normal apart from very mild tricuspid regurgitation. A chest radiograph performed the following morning showed marked improvement and therefore oxygen therapy was stopped. She voided nearly 5 litres of urine over the 24-h admission (> 5 ml.kg⁻¹.h⁻¹). Her oxygen saturations were maintained at 99 % on air. She was discharged home later that day.

Discussion

Fluid overload is a recognised complication of hysteroscopy but is usually associated with long procedures and an exposed vascular bed. The ability of an individual to cope with a volume load will depend on the overall volume they receive; the speed of transfusion; and the patient's underlying health status. The European Society for Gynaecological Endoscopy recognises this and recommends a fluid deficit maximum of 2500 ml in healthy women of reproductive age for isotonic solutions or 1000 ml for the elderly or those with renal or cardiovascular disease (or 1000 ml and 750 ml, respectively, for hypotonic solutions due to the potential for neurological complications) [6]. In this case a young woman with no renal or cardiac history was compromised by a fluid deficit (i.e. presumed transfusion of hysteroscopic fluid) of 1500 ml in addition to the approximately 1000 ml of Hartmann's solution i.v. This lies within the limits of the guidelines, but if we estimate a circulating volume of 70 ml.kg⁻¹, that is, 3150 ml in this 45-kg patient, this represents an almost 80% increase.

In fact, the patient may have received more than 1500 ml of hysteroscopic fluid systemically. Data suggest inaccuracies in the estimation of fluid deficits are not uncommon [7]. For example, some of the unaccounted fluid may be on the floor or drapes, the 3000-ml bags which are used are commonly overfilled by 2–6% and staff vary in their ability to estimate how much fluid is left in part used bags [7].

Given that systemic absorption is more common in procedures involving tissue resection and an exposed vasculature [1] it is unusual that it occurred during an evacuation of retained products of conception procedure. We suspect that both the densely adherent products and the brisk loss of 200–300 ml of blood per vagina immediately postoperatively suggest an unusual vascularity. There are reports of patients whose retained products of conception are associated with enhanced myometrial vascularity and an appearance which mimics arteriovenous malformations on Doppler ultrasonography [8]. Some perceive these individuals to be at risk for significant postoperative bleeding [8].

This is a case of fluid overload and metabolic changes in a normally well woman undergoing hysteroscopy and evacuation of retained products of conception. Fluid overload can occur in short hysteroscopic procedures with minimal tissue disruption. The metabolic abnormalities which result may not necessarily include hyponatraemia but rather will reflect the qualities of the hysteroscopic fluid inadvertently transfused, including a hyperchloraemic metabolic acidosis in the context of sodium chloride 0.9%. We must be alert to the possibility of systemic absorption of hysteroscopic media and we should be judicious in our use of i.v. fluid therapy even in short surgical procedures, recognising that estimates of fluid deficits may not be accurate. Retained products of conception may have an unpredictable vascularity potentially permitting systemic transfusion.

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