

A Case of Fluid Embolism from Transcervical Endometrial Resection

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Abstract

Hysteroscopic transcervical endometrial resection (TCER) using a urological resectoscope offers an alternative to hysterectomy for some women with menorrhagia. The advantages of this technique are a shorter operating time and a rapid postoperative recovery and discharge. However, this procedure is not without risk of complications and one of them is related to dilutional hyponatraemia from absorption of the irrigation solution. This report describes a patient who experienced such a problem.

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Case Report

A 34-year-old Chinese ASA II (asthmatic under control) female patient was admitted for an elective transcervical resection of submucosal fibroid.

No premedication was prescribed. An epidural catheter was placed at L2-3 level and a total of 24 ml of 0.5% bupivacaine was administered slowly for the surgery which lasted nearly 3 hours. Routine monitoring with pulse oximetry, electrocardiography and non-invasive blood pressure monitors was done.

When an adequate level of epidural anaesthesia was established, the patient was placed in a lithotomy position and the bladder catheterised. The uterus was assessed to be bulky, equivalent of a 14-week pregnancy. The cervix was dilated and a Storz 26G continuous flow resectoscope was used for the resection using glycine 1.5% as irrigation solution. A 6-cm diameter size fundal submucosal fibroid was identified and vasopressin injected into it before resection was attempted.

After 130 min of resection, the systolic blood pressure fell to 100 mm Hg and the mean blood pressure fell from a baseline of 85 to 75 mm Hg. During this period, the patient complained of dyspnoea. The oxygen saturation (SpO₂) however, remained between 96% and 100% while breathing room air throughout the procedure. No rhonchi or lung crepitations were heard on auscultation of the chest. The total irrigation volume used was 18 L and the volume of fluid returned from the endometrial cavity was 15.8 L. Hence, there was a fluid deficit of 2.2 L.

Intravenous frusemide 40 mg was given. The procedure was stopped and the patient was sent to the recovery room.

Her total urine output during the procedure was 800

ml against a fluid intake of 1000 ml of lactated ringers solution. The mean blood pressure continued to fall to 50 mm Hg and the systolic blood pressure dropped to 70 mm Hg. Intravenous ephedrine 24 mg was given in titrated doses to keep the blood pressure up. At this time the patient became drowsy and lethargic. She was admitted to the Intensive Care Unit (ICU) for further management.

During her stay in the ICU, the SpO₂ remained at 100% with oxygen supplementation of approximately 40% via a Hudson Mask. Her biochemistry on admission was:

urea	: 3.4 mmol/l (range 2.8-7.7)
sodium	: 102 mmol/l (range 125-145)
potassium	: 3.8 mmol/l (range 3.3-4.9)
total calcium	: 1.88 mmol/l (range 2.1-2.6)
magnesium	: 0.38 mmol/l (range 0.7-1.05)
phosphate	: 0.98 mmol/l (range 0.77-1.38)
glucose	: 6.0 mmol/l (range 3-10)
serum osmolarity	: 262 mOsm/l
osmoticgap	: 48.7 mmol/l

Although the baseline serum sodium was not taken preoperatively, it was assumed that it was within the normal range as she was otherwise a healthy patient. Since she was symptomatic, an infusion of 100 ml of 3% NaCl solution was given over a period of 1 hour. The plasma sodium levels were checked and had increased to 114 mmol/l. Another 100 ml of 3% NaCl solution was given over a period of 1 hour. The checked plasma sodium reached 123 mmol/l after a period of six hours from replacement with a total of 200 ml of 3% NaCl solution. Fluid was then administered at 100 ml/h of normal saline or dextrose saline solution. 500 ml of lactated ringers solution was used to provide some

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potassium to the patient as she was noticed to be diuresing a substantial amount (200 ml to 300 ml per hour) at that time. Calcium, potassium and magnesium were replaced accordingly in the infusion fluid when the serum levels were obtained.

During the following 24 hours, the patient's haemodynamic parameters improved gradually with the mean blood pressure climbing to 70 mm Hg without further use of vasopressor or diuretics. There was no clinical or radiological evidence of pulmonary fluid overload. During her stay in the ICU of 18 hours she was given a total of 2.6 L of fluid and 5.7 L of urine was produced.

The following morning, her biochemistry returned to normal with:

urea	: 4.7 mmol/l (range 2.8-7.7)
sodium	: 138 mmol/l (range 135-145)
potassium	: 4.9 mmol/l (range 3.3-4.9)
total calcium	: 2.33 mmol/l (range 2.1-2.6)
magnesium	: 0.85 mmol/l (range 0.7-1.05)
phosphate	: 1.25 mmol/l (range 0.77-1.38)
glucose	: 7.4 mmol/l (range 3-10)
serum osmolarity	: 294 mOsm/l
osmotic gap	: 5.9 mmol/l

She was more alert and orientated and was discharged to the ward the next day.

Discussion

In 1976, Neuwirth¹ described a method of removing pedunculated submucosal fibroids via hysteroscopic electrosurgical excision. He found that this method could be selectively applied to patients who desire to maintain reproductive potential. Hysteroscopic transcervical endometrial resection (TCER) with the use of diathermy was first reported by DeCherny and Polan in 1983 using a urological resectoscope as an alternative to hysterectomy for women with menorrhagia. This method was further popularised by Magos in 1989 who coined the term TCER.

Since the procedure appears somewhat similar to that of transurethral resection of the prostate (TURP), it may be associated with complications related to dilutional hyponatraemia from absorption of the irrigation solution.² Transurethral resection of the prostate syndrome is associated with the use of hypotonic solution for irrigation.³ (Glycine 1.5% solution is about 200 mOsm/l). Symptoms from hyponatraemia are related to the plasma sodium concentration and the rate of its fall. Dilutional hyponatraemia, cardiac overload and cerebral oedema are considered to be the main characteristics of the syndrome.⁴

In TCER, although hyponatraemia and hypervolaemia are the main problems, high plasma levels of glycine and ammonia have also been reported.⁵ One of the metabolites of glycine i.e. ammonia has also been impli-

cated in a case of cerebral irritability in a patient recovering from fluid overload following TCER.

The actual incidence of transurethral resection syndrome after TCER is unknown. The full-blown syndrome is perhaps rare. Although many of the incidences described had isolated biochemical derangement or mild fluid overload, there are, reports of more severe outcome requiring ventilatory support and specific treatment for the hyponatraemia.^{6,7}

In TCER, the mechanism of fluid absorption is different. Although there is no equivalent to the prostatic venous sinuses in the myometrium, higher irrigating pressures (100 to 110 mmHg) are required to identify the tubal orifices as the uterus is less compliant. Two important routes for irrigation fluid absorption have been postulated; intravascular (taken up directly by the bloodstream through open veins in the uterus) and extravascular (taken up slowly into the bloodstream from the abdominal cavity). Olsson and Hahn⁸ found the rate of intravascular absorption to be 26 ml/min in TCER, a figure somewhat similar to that in TURP.⁹

In TURP, it has been recommended that the resection time be kept as short as possible. Istre et al¹⁰ however, did not find that postoperative hyponatraemia correlated with the operating time or the amount of irrigant fluid used in TCER. When fibroids were resected, no significant increase in glycine deficit was found but the mean operative time and the mean amount of glycine used were significantly increased.

The maximum allowable limit for fluid deficit is also not known. Some recommend intermittent monitoring of fluid deficit after each administration of 500 ml and stopping the procedure after 1000 ml is absorbed.^{10,11} Others suggest a maximum limit of 2000 ml deficit.¹² In retrospect, intermittent monitoring of fluid deficit could have been used for this patient to avoid exceeding these recommended limits.

The decrease in serum sodium is shown to be proportional to the amount of glycine absorbed.^{12,13} This is because glycine, which is an amino acid, is metabolised in the liver into carbon dioxide, water and ammonia. To reduce glycine absorption, it is suggested that the irrigation pressure be maintained as low as is compatible to provide an adequate surgical field. Pyper and Haeri¹¹ found that by using a rotary pump which allows adjustment of the flow rate and maintenance of a constant intrauterine pressure, they could limit excessive glycine absorption to below 1000 ml.

On the other hand, calculating the ongoing deficit intermittently may help to monitor the ongoing fluid deficit. However, it gives belated and inaccurate estimations. Marking the irrigating fluid with ethanol and detecting it in the expired breath with a breath-analyser may offer a better non-invasive and continuous method

of detecting small amounts of fluid absorbed as well as quantifying the amount.¹⁴ Unlike measurement of the volumetric fluid balance, this method is not affected by blood loss and spillage on the floor.

The use of regional anaesthesia may be preferred in high-risk patients¹⁵⁻¹⁸ since it allows earlier recognition of the problem as was shown in this case. Having a central venous pressure catheter would also be appropriate in this group of patients.¹⁸ Istre et al¹¹ however, believed that the classical features of cerebral oedema associated with TURP syndrome are not common in younger women undergoing transcervical resection of the endometrium probably due to differences in general health. Instead, they found that only postoperative nausea was a reliable indicator of hyponatraemia.

There has been some concern regarding the treatment of hyponatraemia in these patients.¹⁹ In severe cases with neurological and haemodynamic derangement, active therapy with diuretics and hypertonic saline has been used. In milder cases, it is unclear whether immediate intervention after the operation is necessary. If hypertonic saline solution is used, there is a risk of precipitating pulmonary oedema. One should use it carefully in pseudohyponatraemia i.e. when the hyponatraemia is due to the presence of osmotically active ions such as glycine rather than due to the excess in free water as in dilutional hyponatraemia. Calculating the osmotic gap may help estimate the dilutional component of the hyponatraemia. If the osmolar gap is high, as in our case (normal value is up to 10 mOsm/kg), one would suspect pseudohyponatraemia, wherein the serum sodium concentration decreases by 1.6 mmol/l for every 5 mmol/l increase of osmolar gap.²⁰ In our patient with an osmotic gap of 49 mmol/l, the predicted serum sodium would be 125 mmol/l which is higher than the measured value of 102 mmol/l. Hence, a component of dilutional hyponatraemia as well as pseudohyponatraemia had accounted for the low serum sodium levels in our patient. This could be explained by the fact that the absorbed glycine solution, which has a half-life of 85 minutes, had been metabolised to free water. Hence, with the confirmation of pseudohyponatraemia and the presence of adequate diuresis of free water, serum levels of sodium could be restored even without replacement with hypertonic saline. This may explain why, with the addition of only 100 mmols of hypertonic saline, the serum sodium level in our patient was restored to a level of 123 mmol/L when a calculated 800 mmols of sodium ions is required.

Finally, vasopressin which was used in this case, is sometimes injected to control bleeding after resection.²¹ Some recommend that it should, however, not be used routinely as it can potentially increase fluid retention.²²

In conclusion, this case report highlights one potential complication of TCER. The magnitude of this problem may be underestimated since menstruant women have been shown to be more prone to cerebral oedema than elderly men when postoperative hyponatraemia develops.²² As more reports of this danger are now appearing in the literature, it is important that those taking part become aware of the potential risk.

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