

Water Intoxication during Transcervical Electrosurgical Resection of Uterine Myoma

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Submucous leiomyomas, the most common benign tumors of the female genital tract, affect 20% to 30% of all women of reproductive age. Transcervical electrosurgical resection (TCR) is usually performed for patients with chronic menorrhagia caused by submucous leiomyomas. We report a case of severe intraoperative hyponatremia resulting from water intoxication during TCR. Although water intoxication during TCR is not common due to its short surgical duration, anesthesiologists should still be alert to the manifestation of intraoperative water intoxication and surgeons should also keep in mind the possibility of water intoxication during extended surgical procedures. With appropriate procedures in place, more complications will be avoided. (*Chang Gung Med J* 2006;29(4 Suppl):54-8)

Key words: water intoxication, transcervical electrosurgical resection, submucous leiomyomas, hyponatremia.

Water intoxication is a well-recognized complication of transurethral resection of the prostate (TURP) and constitutes part of TURP syndrome. However, it should be kept in mind that water intoxication could happen during any surgical procedure that might induce rapid absorption of a large volume of hypotonic solution. Submucous leiomyomas, the most common benign tumors of the female genital tract, affect 20% to 30% of all women of reproductive age. Transcervical electrosurgical resection (TCR) is usually performed for patients with chronic menorrhagia and/or abnormal uterine bleeding caused by submucous leiomyomas, and a large volume of irrigation solution may be needed during surgery. We report a patient with severe intraoperative hyponatremia resulting from water intoxication.

CASE REPORT

A 43-year-old woman, gravida 5 para 4, had

suffered irregular menstruation, abnormal uterine bleeding and menorrhagia for many years. She did not pay undue attention to these problems and did not seek medical examination. Recently, after the removal of an intrauterine device (IUD), she agreed for uterine sonographic examination and a 3-cm x 4-cm submucous leiomyoma was diagnosed. Pelvic examination revealed an enlarged uterus with a nodular surface. The uterine corpus mass had a solid consistency. The surface of the cervix was smooth. TCR was performed to resect the submucous leiomyoma under intravenous general anesthesia. Other than the patient being moderately anemic (hemoglobin 7.6 gm/dL, hematocrit 24.7%), preoperative laboratory data (including electrolytes), electrocardiogram (ECG) and chest X-ray, showed no abnormal findings. Intravenous general anesthesia was induced with fentanyl 150 mg and propofol 80 mg. Unexpected difficulty was noted during surgery and hence the surgery duration was extended. An hour

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after the operation began sevoflurane in O₂ was given through a mask. Spontaneous respiration was maintained for the remainder of the operation because of the unexpectedly long surgery duration, in order to keep systolic blood pressure (BP) around 100-120 mm Hg and heart rate around 90 beat/min. Spot oxygen saturation (SpO₂) and end-tidal CO₂ were also monitored during the whole course of anesthesia. Approximately three and a half hours after the operation started, the patient suffered a sudden drop in BP and became restless and irritable. A blood sample was drawn for diagnostic evaluation, which revealed that her hemoglobin had fallen from 7.6 g/dL to 5.4 g/dL and serum sodium had fallen from 139 mEq/L to 107.5 mEq/L. The patient was then intubated for further treatment, the surgeon was notified and the operation was immediately concluded. During this four hour procedure the estimated blood loss was 300 ml. Ringer's lactate solution 500 ml and 5% dextrose in 0.225% saline (D5-0.225S) 600 ml were given. Two units of packed red blood cells were also transfused during surgery. More than 20 liters of distilled water were used as the distention medium during hysteroscopic myomectomy. The patient was then sent to the intensive care unit (ICU) for further treatment under the suspicion of water intoxication. A chest X-ray taken in the ICU showed a picture of interstitial pulmonary edema. Since the patient's vital signs were reasonably stable (BP around 110-150/75-95 mm Hg and SpO₂ 100% without pinkish sputum) in the ICU, she was only treated with fluid restriction along with loop diuretics. A central venous pressure (CVP) catheter was inserted through the right internal jugular vein to monitor the patient's fluid status. A Foley catheter was also inserted; the urine output over the next two hours was 2150 ml and a total of 6100 ml in the first 24 hours postoperatively. Serial serum electrolyte measurements were made and serum sodium reached 137 mEq/L by the following morning. The patient was then extubated and transferred to an ordinary ward. She was subsequently discharged three days later without any sequelae.

DISCUSSION

Submucous leiomyomas are the most common benign tumors of the female genital tract. Leiomyomas affect 20% to 30% of all women of

reproductive age and 30% to 50% of these women become symptomatic, with menorrhagia being the most frequent symptom in both reproductive and pre-menopausal women. In 1978, Neuwirth reported the first use of the resectoscope to treat menorrhagia caused by submucous leiomyomas.⁽¹⁾ Since then, hysteroscopic surgery has become the main surgical method used for menorrhagia. TCR of submucous leiomyomas is safe and effective for controlling menorrhagia, and surgery is usually completed within an hour. It is also a procedure with minimal peri-operative morbidity and allows a rapid return to a normal lifestyle. The most frequently reported complication is uterine perforation not requiring transfusion (14.2/1000). Water intoxication during such surgery is rare because of the short surgery duration. The rate of water intoxication and pulmonary edema is between 0.2% and 3.3% during TCR.^(2,3) The manifestations of water intoxication include hyponatremia, hypo-osmolality and fluid overload. Serious neurological manifestations can be caused because of the increase in intracellular water, hyponatremia and hypo-osmolality. Mild to moderate hyponatremia (Na⁺ < 125 mEq/L) is frequently asymptomatic. Serious manifestations are associated with plasma sodium concentrations of less than 120 mEq/L. Early symptoms are nonspecific and include anorexia, nausea, vomiting, vision disturbances and weakness. Further, progressive cerebral edema results in depressed level of consciousness, agitation, lethargy, confusion, seizure, coma and, eventually, death.

Most patients can be managed with fluid restriction and loop diuretics. Correction of plasma sodium concentrations higher than 125 mEq/L is usually sufficient to alleviate symptoms. Correction of hyponatremia that is performed too rapidly is associated with severe permanent neurological sequelae (central pontine myelinolysis). For mild symptoms, 0.5 mEq/L/hour or slower correction rate is suggested; for moderate symptoms, 1 mEq/L/hour or slower; and for severe symptoms, 1.5 mEq/L/hour or slower.⁽⁴⁾

Absorption of distention medium is dependent on the duration of the resection, the distention medium used and the pressure of the distention medium. The presumed mechanism of the rapid absorption of the medium is the direct entry of fluid into the circulation through uterine vessels opened by transection of the myoma. Whether the duration of the procedure

affects the occurrence of water intoxication is still controversial. However, in studies with TURP syndrome, severe TURP syndrome can occur as early as 15-20 minutes after surgery has started.⁽⁵⁾ Incidentally, morbidity and mortality of TURP patients did not correlate with length of surgery, except when surgery lasted longer than 150 minutes.⁽⁶⁾ In our case, an extended surgery duration (240 minutes) should be related to the presence of water intoxication. Large fibroids may have more vessels, larger-caliber vessels and larger resected surface areas than small fibroids, which could account for the greater propensity for absorption of the distention medium. Selecting normal saline or Ringer's lactate as the distention medium can reduce the frequency of hyponatremia. However, electrolyte solutions cannot be used for TCR because they disperse the electrocautery current. Distilled water provides excellent visibility because its hypotonicity lyses red blood cells, although significant absorption can result in acute water intoxication. A 5% dextrose water solution (D5W) and 1.5% glycine solution are also used, and both have good optical and distending qualities. However, due to hypo-osmolality, they also cause water intoxication. D5W was reported to cause severe hyperglycemia as well as dilutional hyponatremia.⁽⁷⁾ Glycine is more associated with hyponatremia than sorbitol-mannitol because glycine lacks mannitol's diuretic effect. Absorption of up to 500 ml of glycine solution leads to a mean decrease in serum sodium of 2.5 mEq/L (range 0-10 mEq/L).⁽⁸⁾ When the volume deficit of glycine is greater than 500 ml, the mean decrease in sodium will be 8 mEq/L (range 0-25 mEq/L). Due to sorbitol's relatively short intravascular half-life of 35 minutes compared with 85 minutes for glycine,^(9,10) serum osmolality falls more quickly with an excessive volume of sorbitol-mannitol than with a comparable amount of glycine.

To minimize these complications, Kim et al. instituted the following protocol for operative hysteroscopy with sorbitol-mannitol solutions,⁽¹¹⁾ and this may apply to other distention media.

1. Preoperative serum electrolyte levels are checked on all patients.
2. A warming blanket is used during the procedure for all patients.
3. Core body temperature is monitored.
4. The admission of intravenous fluid is main-

tained at the minimum rate required for vein patency unless otherwise specified by the anesthesiologist.

5. Chilled distention media are used.

6. Fluid inputs and outputs are calculated and recorded every 10 minutes, with the surgeon and anesthesiologist being informed of the results.

7. If a 500-ml deficit is noted, serum electrolytes are measured immediately.

8. If a 1-L deficit is noted, furosemide 20 mg is administered intravenously. Serum electrolytes are again measured immediately and the procedure is stopped until the results are obtained.

9. If a 2-L deficit is noted or the serum sodium is less than 120 mEq/L, the procedure is stopped.

Pre-operative serum electrolyte levels are important as a baseline reference. They were within normal limits in our patient. However, since TCR surgery duration is expected to be short, no warming blanket was provided and core body temperature was not monitored. We limit the amount of intravenous fluid used for vein patency and, in this case, a total 500 ml of Ringer's lactate solution and 600 ml 5% dextrose in 0.225% saline (D5-0.225S) were given during the four hour procedure. We did not use chilled distention media because there is no advantage in doing so during TCR. The main problem we faced in this case was that we did not monitor the input and output of the distention medium during the whole procedure and nobody knew what the fluid status was when water intoxication was suspected.

The reduction of complications from distention media absorption during TCR will depend on the availability of an "ideal" medium that has minimal side effects and is clarified, nonconductive and poorly miscible with blood. Anesthesiologists and surgeons should be alert to the manifestations of water intoxication during surgery, especially during excessively long surgery durations. We have now changed our surgery guidelines to include that every case of TCR and TURP should have fluid status monitored every 10 minutes, and the surgeon and anesthesiologist should be informed if a deficit of more than 300 ml occurs. If appropriate procedures are put in place during surgery, fewer complications will be caused.

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以經子宮頸電燒切除術切除子宮內膜下平滑肌瘤導致發生水中毒

蔡志忠 洪健朗 鍾涵濡 陳明山 黃仲衡

子宮內膜下平滑肌瘤是最常見的女性生殖道良性腫瘤，約有 20% 到 30% 的行經期女性患有子宮肌瘤。經子宮頸電燒切除術經常被使用於治療子宮內膜下平滑肌瘤所引起的慢性經痛。我們報告一位病人接受經子宮頸電燒切除術而引起水中毒，造成術中嚴重低鈉血症。一般由於施行經子宮頸電燒切除術的時間並不長，相對的導致水中毒的情況並不常見，但麻醉醫師仍然必須對術中水中毒的症狀多所注意，同時外科醫師在施行經子宮頸電燒切除術時，尤其是在困難手術且所須時間較久時，必需要記得發生水中毒的可能性；假如在發生的時候，能立刻採取適當的處理措施，便能盡量避免併發症的發生。(長庚醫誌 2006;29(4 Suppl):54-8)

關鍵詞：水中毒，經子宮頸電燒切除術，子宮內膜下平滑肌瘤，低鈉血症。

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