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Reminder of important clinical lesson

TURP syndrome and severe hyponatremia under general anaesthesia

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Summary

Transurethral resection of prostate (TURP) syndrome is a complication characterised by symptoms changing from an asymptomatic hyponatremic state to convulsions, coma and death due to absorption of irrigation fluid during TURP. The syndrome appears to be related to the amount of fluid that enters the circulation via the blood vessels in the resection area. The first step in the course of action for therapy is to control bleeding and suspend the operation. In the case presented, we aimed to emphasise the importance of an early diagnosis and treatment of TURP syndrome in a patient that developed hyponatremia (90 mmol/l) while under general anaesthesia during a TURP procedure. In addition, multiple cystoscopic applications in the same session may facilitate development of the TURP syndrome.

BACKGROUND

Transurethral resection of the prostate (TURP) is the most common surgical procedure performed on male patients over 60 years of age. Irrigation of closed body spaces may lead to perioperative fluid and electrolyte shifts.[1] During TURP, the wide plexus of venous sinuses is often opened and the absorption of the irrigation fluid causes a group of symptoms and findings that is called TURP syndrome.[2] Absorption of the irrigation fluid (2000 ml or more) may lead to TURP syndrome which causes headaches, anxiety, confusion, dyspnoea, arrhythmia, hypotension and seizures and can be fatal if not treated. The symptoms of TURP are generally caused by an excessive fluid load in circulation. Different symptoms may occur depending on the solute used in the irrigation fluid.[3 4] Excessive absorption of the irrigation solutions used during TURP, which are highly hypotonic can cause dilutional hyponatremia and hypo-osmolality resulting in severe neurological symptoms. Hyponatremia symptoms do not generally manifest until serum sodium concentrations are below 120 mmol/l. If the plasma is severely hypotonic (Na+ <100 mmol/l), acute intravascular haemolysis may occur.[5–8]

The most important point in the treatment of TURP syndrome is early diagnosis. The treatment must be arranged according to the severity of the symptoms. First, the absorbed water must be eliminated and hypoxaemia and hypoperfusion must be prevented. Loop diuretics such as furosemide can be used to eliminate excess fluid.[3] If severe symptomatic hyponatremia is present with impaired consciousness and convulsions, hypertonic saline solutions can be administered. The amount and rate of the hypertonic saline solution (3% or 5%) to treat hyponatremia is adjusted according to the patient's serum sodium concentration.[9] It is recommended that the rate of the hypertonic saline solution infusion must not be higher than 100 ml/h if serum sodium concentration is above 120 mmol/l to avoid circulatory overload. The hyponatremia must be treated aggressively to avoid intravascular haemolysis if serum sodium concentration is below 100 mmol/l.[3]

In this case report, the development of TURP syndrome in a patient undergoing TURP under general anaesthesia and the risk factors, symptoms and the importance of early diagnosis and treatment of the syndrome is presented.

CASE PRESENTATION

The ultrasound findings of a 78-year-old patient diagnosed with benign prostatic hyperplasia (BPH) included an increased size of the prostate and bladder stone. The patient was scheduled to undergo TURP and endoscopic cystolithotripsy under regional anaesthesia but the patient did not agree to have regional anaesthesia; therefore, general anaesthesia was administered.

The preoperative laboratory findings of the patient were normal. The patient's arterial blood pressure was 135/95 mm Hg. The duration of the surgery was 165 min and the patient was administered a 2000 ml crystalloid and 1000 ml colloid replacement solution during the operation. A volume of 42 litres of irrigation fluid (Resectisol, 3000 ml, Eczacıbaşı, Baxter, Türkiye) was used perioperatively. In the 155th minute of the surgery, the patient became cyanotic (SpO_2: 88) and bradycardic (HR 38/min) and hypotension (blood pressure 68/35 mm Hg) developed; therefore, the patient was administered atropine (0.5 mg) and ephedrine (10 mg). The surgical team was warned and the operation was terminated. The airway pressure of the patient increased (Pplat 35 cm H_2O, Ppeak40 cm H_2O), and the peripheral oxygen saturation decreased and the patient had bilateral wheezing upon auscultation. The patient was administered aminophylline and methylprednisolone, for bronchospasm was considered. The patient did not respond to treatment so 0.5 mg epinephrine was administered and a norepinephrine infusion (0.5 μg/kg/min) was started. Later, we suspected that the patient may have developed TURP syndrome. A central venous catheter was placed and central venous pressure was measured as 14 mm Hg. Simultaneous blood gas analysis results were as follows: Na 90 mmol/l, K 5.2 mmol/l, pH 7.125, pO_2

Table 1 The arterial blood gas analysis and electrolyte levels of the patient

	Preoperative	During operation	1 h	4 h	8 h	12 h
pH		7.12	7.18	7.22	7.30	7.42
PCO_2 (mm Hg)		33.20	48.60	32.20	37.10	32.10
PO_2 (mm Hg)		78.20	60.70	141.00	82.40	92.90
Hct (%)		20.10	43.50	48.40	46.50	41.90
K^+ (mmol/l)	4.20	5.20	4.00	4.50	4.30	3.80
Na^+ (mmol/l)	142.00	90.00	105.00	110.00	115.00	127.00
Glucose (mg/dl)		152.00	124.00	151.00	173.00	175.00
Osmolality (mmol/kg)		192.00	210.00	227.00	239.00	263.00
Lactate (mmol/l)		0.90	1.10	3.20	4.90	2.00
HCO_3 (mmol/l)		11.30	15.30	14.40	14.30	21.40
BE (mmol/l)		−17.00	−10.30	−13.10	−12.10	−4.50

Hct, haematocrit.

70.5 mm Hg, pCO_2 33.2 mm Hg, HCO_3 11.3 mmol/l, base excess−17.0 mmol/l, osmolality 192 mmol/kg, haematocrit 20.1% (table 1). The patient was diagnosed with TURP syndrome and was administered diuretics (furosemide, 20 mg). A sodium bicarbonate ($NaHCO_3$ 8.4%) infusion was started for metabolic acidosis. The patient had spontaneous bleeding from his nose and from the surgical site. A hypertonic saline solution infusion (150 ml 3% NaCl over 2 h) was started. The patient, still intubated, was taken to the intensive care unit. Ventilator settings were (SIMV mode, Vt 7 ml/kg, f 12/min, Drager Evita XL). The patient was unconscious and his arterial blood pressure was 190/100 mm Hg in the intensive care unit, so a nitroglycerine infusion was started. An infusion at 100 ml/h of 0.9% NaCl was continued as an intravenous maintenance fluid. The patient gained consciousness after 4 h and was extubated. Arterial blood gas analysis was performed regularly to evaluate his acid base and electrolyte status (table 1). In the first postoperative day, the vital signs of the patient were stable, his central venous pressure was 7 mm Hg and the laboratory findings were Na 127 mmol/l and K 3.8 mmol/l. The patient was discharged from the intensive care unit. On the third day after the surgery the laboratory findings were Na 143 mmol/l and K 3.6 mmol/l and follow-up of the patient was continued in the hospital. A week after surgery, the patient was discharged without a problem such as neurological damage and fluid–electrolytes imbalance.

DISCUSSION

BPH causes symptomatic obstruction of the cervix vesicae in men older than 60 years of age. It is the most common benign enlargement of the prostate.[4] Its incidence is about 0–1.1%.[10] TURP syndrome can cause a wide variety of symptoms that include asymptomatic hyponatremia, ECG changes, fatigue, vomiting, confusion, visual loss, coma and death.[9]

In conscious and alert patient, changes in the mental state of may be the first sign of TURP syndrome and bladder perforation. But, the symptoms of TURP syndrome and bladder perforation may be masked under sedation and general anaesthesia.[4] Regional anaesthesia was suggested to our patient but he did not agree to the operation under regional anaesthesia, so general anaesthesia was performed. The patient developed cyanosis, bradycardia and hypotension and his peripheral oxygen saturation was decreased on the 155th min of surgery, but his mental status could not be evaluated because he was under general anaesthesia. When these symptoms were considered, the patient was thought to have TURP syndrome and a rapid intervention was performed.

The major risk factors for TURP syndrome include the size of the opened venous sinuses, the amount of the irrigation fluid used, using excess amounts of hypotonic intravenous fluids and most importantly, the duration of the resection. The risk is increased if the duration of the resection is longer than 60 min. Approximately 10–30 ml of fluid is absorbed during resection. Thus, 1800 ml of fluid can be absorbed if the resection lasts for 1 h. It was planned not only to conduct TURP surgery but also an endoscopic cystolithotripsy on the patient. First, endoscopic cystolithotripsy was applied by the surgery team and this application was continued until the 100th min of the surgery. At the 100th min resection of the prostate was performed. A measure of 42 000 ml of irrigation solution was used for our patient and the resection lasted for 165 min (the bladder stone was also removed). Mild-to-moderate TURP syndrome may occur in 1–8% of patients. The overall mortality is 0.2–0.8%. It may present as early as 15 min after resection starts or as late as 24 h after operation. Severe TURP syndrome is now rare; however, it carries a mortality of up to 25%.[11] Our patient's perioperative sodium concentration was 90 mEq/l and he had non-specific symptoms due to hyponatremia. The most critical intervention in the treatment of TURP syndrome is early diagnosis. The treatment must be arranged according to the severity of the symptoms. First, the absorbed water must be eliminated and hypoxaemia and hypoperfusion must be prevented and must be administered fluids which contain NaCl. Loop diuretics can be used to eliminate excess fluid. The patient was administered 2000 ml of crystalloid and 1000 ml of colloid replacement solutions perioperatively, and furosemide was administered after the onset of symptoms because a fluid overload was suspected. If severe symptomatic hyponatremia is present with impaired consciousness and convulsions, hypertonic saline solutions can be administered.

The amount and rate of the hypertonic NaCl solution (3% or 5%) must be adjusted according to the serum sodium concentration of the patient for safely correcting hyponatremia. The rate of the hypertonic saline solution infusion must not be above 100 ml/h to avoid increasing the fluid overload.[12] The hyponatremia must be treated aggressively to avoid intravascular haemolysis, if serum

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sodium concentration is below 100 mmol/l.[13] Our patient was administered 150 ml of 3% hypertonic NaCl for 2 h and 150 ml of 3% NaCl was added to the management fluid. With this treatment, the patient recovered. Hypertonic solutions are used when serum sodium levels are below 120 mmol/l. Acute neurological symptoms (such as confusion and coma) must be treated rapidly, especially if the patient has central pontine myelinolysis which is associated with depressed awareness, difficulty speaking and swallowing, impaired thinking, weakness or paralysis in the arms and legs, stiffness, impaired sensation and difficulty with coordination.[2]

Bladder perforation has an incidence of 1% and may cause vomiting, excessive sweating and retropubic and lower abdominal pain depending on the level of regional anaesthesia in conscious patients. Perforation is suspected during TURP if sudden hypotension or hypertension occurs together with bradycardia.[8] Since our patient was under general anaesthesia, he only displayed bradycardia and hypotension.

In patients under spinal anaesthesia, neurological symptoms including vomiting, confusion and irritability can easily be noticed. Early changes under general anaesthesia are related to the cardiorespiratory system and include decreased oxygen saturation and ECG changes.[9] ST segment changes in the ECG support the diagnosis. The peripheral oxygen saturation of all patients must be monitored. Our patient was under general anaesthesia, therefore it was not noticed, impaired consciousness and the impairment of haemodynamic parameters led us to the diagnosis of TURP syndrome. Using mannitol as the first drug of choice in patients with fluid overload may worsen the clinical state of the patient and furosemide as a must choice.[12] Furosemide was used as a diuretic for our patient because TURP syndrome was suspected.

In conclusion, noticing the clinical symptoms of patients with TURP syndrome during the early stages, making the right diagnosis and rapid, accurate interventions for the treatment are important in the management of TURP syndrome. In our patient, we had to administer general anaesthesia, because the patient did not want regional anaesthesia administered. Operating on patients under regional anaesthesia aids in the early diagnosis and treatment of TURP syndrome. Therefore, regional anaesthesia should be preferred in TURP surgery. However, in the patient, duration of surgery was delayed due to endoscopic cystolithotripsy as well as prostate resection, and TURP syndrome was noticed during the 50 min of prostate resection. We thought that added and prolonged surgery and increased use of irrigation fluid associated with additional surgery facilitated the development of the TURP syndrome, when TURP surgery was combined with another cystoscopic application. So, it was concluded to be more careful about time in the multiple cystoscopic procedures applied in the same session.

Learning points

- Transurethral resection of the prostrate (TURP) syndrome can cause a wide variety of symptoms that include asymptomatic hyponatremia, ECG changes, fatigue, vomiting, confusion, visual loss, coma and death.
- General anaesthesia may mask some of the TURP syndrome's symptoms. Operating on patients under regional anaesthesia aids in the early diagnosis and treatment of TURP syndrome. Therefore, spinal anaesthesia should be preferred during TURP procedure.
- The hyponatremia must be treated aggressively to avoid intravascular haemolysis, if serum sodium concentration is below 100 mmol/l.
- The time factor is very important, if multiple cystoscopic is applied in the same session.

Competing interests None.

Patient consent Obtained.

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