Acute tubular necrosis following Transurethral Resection of the Prostate using Glycine as irrigating fluid

Nécrose tubulaire aiguë après résection transurétrale de la prostate utilisant la glycine comme liquide d'irrigation

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RÉSUMÉ

La résection trans-urétrale de la prostate est actuellement le gold standard pour le traitement chirurgical de l'hyperplasie bénigne de la prostate. Cette chirurgie peut se compliquer rarement d'un TURP (Trans Urethral Resection of the Prostate) syndrome à l'origine exceptionnellement d'une nécrose tubulaire aigue. Nous rapportons le cas d'une nécrose tubulaire aigue au décours d'une résection trans-urétrale de la prostate utilisant la glycine comme liquide d'irrigation.

Il s'agissait d'un homme de 64 ans admis pour une résection trans-urétrale de la prostate. En préopératoire, l'examen physique initial était normal avec au bilan biologique une natrémie à 140 mEq/L, une urée sanguine à 0,6 g/L, une créatinine à 0,7 mg/dL et une hémoglobine à 12,9 g/dL. Quelques heures après l'intervention, le patient est devenu incohérente et a développé une oligurie, des nausées et des vomissements. Les données du laboratoire ont révélé une élévation rapide de l'urée sanguine et de la créatininémie (urée 2,4 g/L; la créatinine 6.1 mg/dL), une baisse de la natrémie de 14 mEq/L et une diminution du taux d'hémoglobine (7,4 g/dl) avec des lactates déshydrogénases élevées à 665 U/L. L'échographie rénale était normale. Le diagnostic d'une nécrose tubulaire aigue compliquant un TURP syndrome a été retenu. L'évolution était favorable après traitement symptomatique et quatre séances d'hémodialyse. L'utilisation de la glycine comme irrigant pour la résection trans-urétrale de la prostate peut provoquer une hyponatrémie, une hémolyse et exceptionnellement une insuffisance rénale aiguë, en particulier en cas d'une durée prolongée de la résection.

Mots-clés

Résection transuréthrale de prostate - Hyponatrémie - hémolyse - insuffisance rénale.

SUMMARY

Transurethral resection of the prostate is currently the gold standard for the surgical treatment of the benign prostatic hyperplasia. This surgery may lead transurethral resection of the prostate (TURP) syndrome and in some cases, acute tubular necrosis can develop. We report a patient who developed hyponatremia, hemolysis and oliguric acute renal failure as a major complication following TURP using glycine as irrigating fluid.A 64-year-old man was admitted for a prostate resection procedure. Physical examination revealed a healthy elderly man. Preoperative laboratory data showed serum sodium 140 mEq/L, blood urea nitrogen (BUN) 0.6 g/L, creatinine 0.7 mg/dL and hemoglobin 12.9 g/dL. Few hours after, the patient becomes incoherent and developed oliguria, nausea and vomiting. The laboratory data revealed rapidly elevating BUN and creatinine levels (BUN 2.4 g/L; creatinine 6.1 mg/dL), the serum sodium concentration decreased by 14 meq/L. A decreased hemoglobin level (7.4 g/dL) with an elevated lactate dehydrogenase level (665 U/L) was observed. Renal ultrasonography was normal. The diagnosis of acute tubular necrosis complicating TURP syndrome was retained. The hyponatremia was slowly corrected to 132 mmol/L by diuresis and fluid restriction. The renal function recovered after four hemodialysis sessions. Using glycine as an irrigant for TURP may cause hyponatremia, hemolysis and also acute renal failure, especially in patients with longer resection time. It is necessary to carry out every effort to shorten resection time and avoid extravasation during surgery.

Key-words

Transurethral Resection of Prostate - Hyponatremia - Hemolysis - Renal Insufficiency.

Benign prostatic hyperplasia (BPH) is the most common nonmalignant disorder of the prostate, affecting almost 25% of the aging male population.(1,2) Transurethral resection of the prostate (TURP) is currently the gold standard for the surgical treatment of this disorder when conservative medical treatment fails.(3) The term TURP syndrome was used to describe various complications involving both the neurologic, renal and cardiovascular systems. It occurs in 10% to 15% of patients after the procedure, with a mortality rate ranging from 0.2% to 0.8%.(4) Acute renal failure (ARF) after TURP has also been reported.(5,6) It is suggested that hypotonicity and hypervolemia with subsequent increased vascular leakage leads to hypotension and rapidly impaired renal function.(4) However, ARF directly caused by hemolysis is rare after TURP.(7) We report the development of an ARF after TURP in a patient with BPH.

CASE REPORT

A 64-year-old man with 6 years with symptomatic benign prostatic hyperplasia was admitted in the urology department for a prostate resection procedure. Physical examination revealed healthy state with a blood pressure 130/70mmHg, a pulse rate 68 beats/min, body temperature 37°C, and a respiratory rate 18/min. No other abnormalities were revealed on the physical examination. Preoperative laboratory test showed serum sodium 140 mEq/L, potassium 4.1 mEq/L, chloride 104 mEq/L, blood urea nitrogen 0,6 g/L, creatinine 0,7 mg/dL, hemoglobin 12.9 g/dL, hematocrit 41.2% and white blood cell count 6840 /mm3 with a normal differential count. The chest radiography and electrocardiogram were normal.

Few hours later, the patient initially felt hard to arouse and then he becomes unresponsive and mildly confused. An oliguria was noted and he had nausea and vomiting several times. The arterial blood pressure decreased to 100/60 mmHg and the oxygen saturation measured with pulse oximetry decreased from 99% to 92%.

The laboratory test revealed rapidly elevating blood urea nitrogen (BUN) and creatinine levels (BUN 2,4 g/L; creatinine 6.1 mg/dL), decreased of serum sodium concentration to 126 meq/L, hemoglobin 7,4 g/dL, an elevated reticulocyte count (30000/mm3) with elevated lactate dehydrogenase level (665 U/L). Renal ultrasonography didn't show any hydronephrosis, stone, or other significant abnormalities. The patient was transferred to the intensive care unit. The hyponatraemia was slowly corrected to 132 mmol/L by diuretics and fluid restriction. Although hemolysis remained and the follow-up BUN and creatinine levels continued to rise (BUN 2,6 g/L; creatinine 8.2 mg/dL), the patient's mental status improved and he was transferred to the nephrology department for further management.

Four hemodialysis sessions were performed. Then renal function went down continuously and his urine output increased on the 14th hospital day. Additional follow-up one month later, serum creatinin level was at 1.05 mg/dL, natremia was at 141 meq/L and hemoglobin at 10.5 g/dL.

DISCUSSION

Transurethral resection of the prostate is still the standard surgical procedure for treatment of benign prostate hyperplasia. This intervention remains associated with significant morbidity and the occurrence of TURP syndrome can be fatal.(8,9) Indeed, the inherent physical properties of conventional monopolar TURP systems necessitate the use of nonconductive fluid irrigation such as glycine, sorbitol, or mannitol. Historically sterile water, glucose, and urea were also used.(10) In fact, all are nonconductive fluids that allow for electrocautery resection. In the present case, glycine was used as the irrigating fluid. TURP syndrome is due to absorption of irrigation fluid via open prostatic venous sinuses in sufficient quantities to cause hypervolemia, hyponatremia leading to encephalopathy and cardiac, respiratory and renal failure.(11) The amount of absorbed fluid varied depending on the height of irrigating fluid, the pressure in the prostatic cavity, the time used for resection, the weight of the resected prostate and the skill of the operator.(12) Otherwise, the hemodynamic signs of the TURP syndrome consist of an arterial hypertension that may be hidden if the bleeding is profuse. This is usually followed by more prolonged hypotension. In fact, release of prostatic tissue substances and endotoxins into the circulation might contribute to this hypotension. Sometimes the procedure is associated with bladder perforation and retroperitoneal hematoma which may be the cause of hypotension.(11) In our case, the patient developed hypotension few hours postoperative.

Intraoperative absorption of irrigant causes fluid overload and electrolyte imbalance, namely dilutional hyponatremia (serum sodium less than 130 mmol/L) which is the hallmark of TURP syndrome. Dilutional hyponatremia leads to cerebral edema, manifesting by restlessness, agitation, confusion, seizures and coma. Volume overload may also cause hypertension and bradycardia.(7,13) In our case, the serum sodium concentration decreased by 14 meq/L (from 140 meq/L preoperatively to 126 meq/L postoperatively) and the patient becomes unresponsive and mildly confused.

Several methods have been recommended to decrease the fluid absorption and overload. These include maintaining low intravesical pressure by using low inflow pressure, continuous flow resectoscopy, and/or suprapubic catheter. Perioperative diuretics are also recommended. Despite these measures, the incidence of significant TURP syndrome is 2% in recent reports. Theoretically, normal saline is the ideal irrigation fluid for TURP. However, its electrical conducting properties prohibit its use with conventional monopolar TURP

systems.(14) Recent technological and design advancements have led to the development of a new bipolar resectoscope that allows resection using normal saline.(13)

Other that hyponatremia, some patients developed hemolysis. Distilled water serving as irrigating fluid would theoretically lead to osmotic hemolysis; and irrigating solutions such as 3% sorbitol, 5% mannitol, and 1,5% glycine have been used to avoid these complications.(7,15) However, Grundy and al reported that the alternative osmotic bladder solutions such as glycine had no significant advantage.(16) In the present case, the other causes of hemolysis were eliminated and hemolysis was developed despite the use of glycine.

Although different mechanisms have been considered, hemolysis seemed to be the most important cause of ARF after TURP in our case. Although literature review revealed that hemolysis-associated ARF was rare.(7) The damaging effects of hemolysis on renal function might be multifactorial. Goodwin and al have suggested that hemoglobinemia may induce renal damage.(17) Hemoglobin itself may occlude renal tubules and cause injury. Besides, reactive oxygen species (ROS) may also injure the kidney following hemolysis. In fact, heme proteins produced by hemolysis can directly induce renal vasoconstriction and promote free radical formation that result in renal tubular injury.(18) Renal distal tubule and collecting duct obstruction occurs after hemolysis and also predisposes the patient to ARF.(18) This situation could be explained as follows. First, acute tubular necrosis may occur in severe volume depletion and in ischemic episodes after TURP. Epithelial cell debris forms within the tubular space, resulting in ductal obstruction. Second, methemoglobin deposition can lead to tubular ductal obstruction.(19,20) Third, under aciduric conditions after hemolysis, TammHorsfall proteins have the characteristic ability to aggregate with heme proteins to form casts.(18,21) Finally, the liberation of tissues factors after hemolysis may initiate disseminated intravascular coagulation.(19)

CONCLUSION

Transurethral prostatectomy (TURP) is the commonest therapeutic urological surgery performed and the unequivocal gold standard treatment for lower urinary tract symptoms (LUTS). However, TURP syndrome can be life threatening, so early recognition and prompt treatment is vital. In fact, using glycine as the irrigant for TURP might cause hyponatremia and rarely hemolysis, and patients are vulnerable to ARF. So the serum hemoglobin, lactate dehydrogenase, sodium concentration, and serum osmolarity would be monitored to determine the severity of the TURP syndrome, and we believe a detailed evaluation before and after TURP will allow the lowest incidence and prevent most occurrences. The use of bipolar diathermy with saline can avoid the complications associated with glycine toxicity and hyponatraemia and may signal the end of TURP syndrome.(22)

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