Hyponatremia and Volume Overload as a Complication of Transurethral Resection of the Prostate

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Transurethral resection of the prostate (TURP) is a common surgical procedure, and most primary care physicians will therefore be involved at some time with patients who are pre- or post-TURP. The TURP procedure is generally well tolerated; however, as with all surgery, there is the potential for complications. Unique to patients who have a TURP is a syndrome characterized by hyponatremia, volume overload, neurologic deficits, and other symptoms that is known as the TURP syndrome. The morbidity and potential mortality associated with this syndrome make it necessary for the primary care physician to be alert to its development and able to intervene effectively should it occur.

Case Presentation

A 79-year-old patient with a 2-month history of progressive urinary retention necessitating the placement of an indwelling urinary catheter was admitted the afternoon before elective TURP. The patient also had chronic obstructive pulmonary disease (FEV = 52% predicted) and mild iron deficiency anemia. At the time of admission, the following medications had been prescribed: theophylline 300 mg twice daily, ferrous sulfate 300 mg daily, albuterol by metered dose inhaler (MDI) 4 times a day, ipratropium MDI 4 times a day, and a multivitamin daily. The physical examination was significant for mild bibasilar rales with an increased expiratory phase, and a smooth, symmetrically enlarged prostate. Laboratory results at the time of admission included a serum sodium of 138 mmol/L (138 mEq/L), a hematocrit of 0.38 (38.5%), a serum albumin of 24 g/L (2.4 g/dL), and a theophylline level of 3.9 μmol/L (0.7 mg/L). A urinalysis showed 200 white blood cells and 10 red blood cells per high power field and 3+ bacteria.

Following admission, gentamicin (70 mg given intravenously every 12 hours) and cefazolin (500 mg given intravenously every 8 hours) were prescribed for a urinary tract infection. The patient was also given D5 ½ normal saline with 20 mEq/L potassium at 75 mL/h after being given nothing by mouth for 12 hours before surgery. On the following day he underwent a transurethral resection of the prostate during which he received spinal anesthesia. The procedure took less than 1 hour to complete. While in surgery, the intravenous fluid rate to the patient was increased to 100 mL/h. In the recovery room he became noncommunicative and unable to follow commands. The patient's vital signs were stable, but a neurologic examination revealed diminished pupillary, corneal, and gag reflexes, and withdrawal only to pain. Laboratory values immediately after the operation revealed severe hyponatremia with a serum sodium of 119 mmol/L (119 mEq/L). Intravenous fluid administration was restricted to 50 mL/h of normal saline, and the patient was given intravenously two doses of furosemide 10 mg. There was a diuresis of greater than 4 L during the 12 hours following the procedure. Twelve hours postoperatively, the patient's physical condition was unchanged, his serum sodium level was 126 mmol/L (126 mEq/L), and his serum ammonia level was 35.8 μmol/L (61 μg/dL). Twenty-four hours postoperatively the patient was communicating and following commands, and his laboratory values had returned to normal. The patient was discharged 5 days after surgery with complete recovery of preoperative functioning.

Discussion

This patient developed severe, symptomatic hyponatremia over a period of approximately 18 hours, during

Submitted, revised, March 26, 1991.

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ISSN 0094-3509

which he underwent TURP. The causes of hyponatremia in a postsurgical patient include syndrome of inappropriate antidiuretic hormone secretion (SIADH), infusion of hypotonic solutions, excessive diuretics, congestive heart failure, renal disease, and addisonian crisis. An additional cause unique to patients undergoing TURP, and what we believe to be the cause of this patient's hyponatremia, is the "TURP syndrome."

The TURP syndrome results from absorption of the irrigant solution used during the procedure to distend the urethra and clear fragments and blood from the operative field. It has been reported to occur in 5% to 10% of TURP cases.[1] The most commonly used solution in the United States for irrigation during TURP is 1.5% glycine. Glycine has the advantages of being isosmotic (thus it does not cause hemolysis) and nonconducting (thus allowing for electrocoagulation without charge dispersal). During resection, prostatic venous channels are opened and bleeding occurs, requiring that the hydrostatic pressure of the irrigant be greater than the venous pressure in order to keep the operative field visually clear. As much as 6 to 8 L of the irrigant may be absorbed during a TURP procedure.[2] The rapid increase in intravascular volume associated with the absorption of a large amount of fluid dilutes plasma electrolytes and proteins, resulting in a decreased oncotic pressure and movement of fluids into the extravascular space (third-spacing of fluids). All patients will develop some dilutional hyponatremia, the severity of which is related to the amount of irrigating solution absorbed. Absorption is influenced by the vascularity of the prostate, the hydrostatic pressure of the irrigant, and the duration of the procedure.[3]

The signs and symptoms of the TURP syndrome are often first noted in the operating or recovery room. Patients may complain of headache or visual changes. Other early symptoms, including confusion, agitation, vomiting, and muscle twitching, are often mistaken for the effects of anesthesia. Additional symptoms, including bradycardia, widened QRS complexes, ST elevation, and T wave inversions, can develop, and can be confused with the onset of a myocardial infarction or a pulmonary embolus.[4] Common physical findings are agitation or lethargy, diminished visual acuity and pupillary reflexes, hypertension, and respiratory distress with pulmonary rales. Laboratory findings include hyponatremia and hyperammonemia.[5]

Encephalopathy appears attributable to several factors. Acute hyponatremia with resultant transcellular fluid shifts and cerebral edema has been postulated as the primary cause. Recent studies also suggest, however, that glycine and its breakdown products including ammonia may have a direct effect on cerebral function.[6] Central nervous system changes can sometimes progress to convulsions, coma, or death.[7] Visual disturbances are thought to be both secondary to edema in the occipital region and a direct effect of glycine on the retina.[8] Acute hyponatremia may also cause decreased cardiac contractility, which, when combined with pulmonary edema due to fluid overload, can lead to hypoxia, hypotension, and shock.[3]

The fundamental pathology in the TURP syndrome is volume overload and dilutional hyponatremia. The appropriate treatment consists of supportive care, fluid restriction, and diuretics. Rarely, in extreme hyponatremia (<110 mmol/L [110 mEq/L]) hypertonic saline is used.[6] The patient who has seizures, is in respiratory distress, or is hypotensive must be stabilized until fluid and electrolyte imbalances are corrected.

The primary care physician has an important role in preoperative identification of high-risk patients scheduled to have a TURP procedure and in intervening to reduce these risks. One study[9] identified the following patient risk factors for developing the TURP syndrome: presurgical hyponatremia, myocardial ischemia, congestive heart failure, chronic obstructive pulmonary disease, malnutrition, and anemia. Hepatic disease may contribute to hyperammonemia and also increase a patient's risk.[5] Retrospectively, this patient had at least three presurgical risks: chronic obstructive pulmonary disease, malnutrition, and anemia. Improving the patient's pulmonary function and/or correcting his hypoalbuminemia and anemia before surgery may have prevented the development of the TURP syndrome.

Measures can also be taken at the time of surgery to prevent the TURP syndrome. The use of epidural or spinal anesthesia will allow early symptom recognition. Using low-pressure irrigation and limiting the procedure to less than 1 hour may decrease the degree of volume overload.[10]

The incidence of TURP syndrome may diminish as new irrigating solutions are developed and nonsurgical treatments for prostatic hypertrophy become widely used. At this time, however, presurgical assessment of patients undergoing transurethral resection of the prostate and evaluation of post-TURP complications require an awareness and understanding of the TURP syndrome.

Key words: Prostate; hyponatremia; surgery; postoperative complications.

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