Miller Trans Urethral Resection of Prostate

Transurethral Resection of the Prostate

Transurethral resection of the prostate (TURP) is one of the most commonly performed surgical procedures in men older than 60 years of age. The operation is performed through a modified cystoscope and consists of excising the hypertrophied lateral and median lobes of the prostate gland with an electrically energized wire loop; bleeding is controlled with a coagulating current. Continuous irrigation is used to distend the bladder and to wash away blood and dissected prostatic tissue.

Absorption of Irrigating Solution

Because the prostate gland contains large venous sinuses, it is inevitable that irrigating solution will be absorbed. Simple principles govern the amount of absorption: (1) the height of the container of irrigating solution above the surgical table determines the hydrostatic pressure driving fluid into prostatic veins and sinuses, and (2) the time of resection is proportional to the quantity of fluid that is absorbed. On average, 10 to 30 mL of fluid is absorbed per minute of resection time, with as much as 6 to 8 L absorbed in some cases lasting up to 2 hours. 117, 118 Whether patients suffer complications as a consequence of absorption of irrigating fluid depends on the amount and type of fluid absorbed. 119

For many years distilled water was used for bladder irrigation during TURP, as it interfered least with visibility. However, absorption of large quantities of water led to dilutional hyponatremia, which resulted in hemolysis of red blood cells and CNS symptoms, ranging from confusion to convulsions and coma. Because of this, distilled water was abandoned in favor of isosmotic or near isosmotic solutions for TURP. Solutions such as normal saline and Ringer lactate would be well tolerated when absorbed intravascularly, but these electrolyte solutions are highly ionized and facilitate dispersion of high-frequency current from the resectoscope. Thus, solutions of nonelectrolytes, such as glucose, urea, glycine, mannitol, sorbitol, or Cytal (a combination of mannitol and sorbitol), have replaced distilled water. Today, glycine and Cytal are the two most commonly used irrigating solutions for TURP. 120, 121

Replacement of distilled water with near isosmotic solutions has eliminated hemolysis and its sequelae as a complication of TURP. Also, the incidence of severe CNS problems, such as convulsions and coma, associated with extreme hyponatremia has been reduced. However, the other major problem associated with absorption of large volumes of irrigating solution, overhydration, still remains. Under usual conditions, only 20 to 30 percent of a load of crystalloid solution remains in the intravascular space; the remainder enters the interstitial space. When intravascular pressure is increased, movement of fluid into the interstitial space and development of pulmonary edema are favored. Whether a given patient will develop symptoms of circulatory overload depends on his or her cardiovascular status, the amount and rapidity of absorption of irrigating fluid, and the extent of surgical blood loss. It is obvious that the situation is dynamic and that patients must be monitored carefully. In this regard, spinal or epidural anesthesia, supplemented with only light intravenous sedation, has the advantage of allowing the patient‘s subjective judgment to contribute to the assessment of his or her condition during operation. In addition, cardiovascular depression associated with administration of the potent inhaled anesthetics is avoided. Another advantage of regional anesthesia is that the sympathetic block it produces increases venous capacitance and tends to mitigate intraoperative fluid overload. A note of caution: when the block dissipates, venous capacity acutely decreases and circulatory overload can occur.

Yet another advantage of regional anesthesia for TURP is that it allows early recognition of bladder perforation, which occurs in less than 1 percent of cases. If bladder perforation occurs, patients complain of back pain, abdominal pain, or shoulder pain, depending on the site of perforation and the resultant collection of fluid intra- or retroperitoneally. It is of utmost importance to the spinal block level to T10 or below or else this very advantage is lost because the patients would no longer sense the abdominal or back discomfort. The use of nonelectrolyte isosmotic irrigating solutions has reduced the incidence of severe CNS complications because extreme extracellular fluid hypoosmolality does not occur and the subsequent development of cerebral edema is avoided. That CNS symptoms occur at all is probably because the incidence and extent of hyponatremia are unchanged. It is now proposed that the TURP syndrome occurs if hyponatremia is accompanied by hypoosmolality and that CNS signs and symptoms usually do not manifest themselves if the osmolality remains normal. Glycine, urea, mannitol, and sucrose found in irrigating solutions tend to retain near normal osmolality. 122 The concentration of extracellular sodium must be in the physiologic range for depolarization of excitable cells and for production of the action potential. When extracellular sodium levels fall below 100 mEq/L, consciousness is lost and convulsions may ensue. 123 Signs and symptoms of cardiovascular dysfunction secondary to hyponatremia also may occur, such as arrhythmias, hypotension, and pulmonary edema. 124 However, it is often impossible to separate the latter events from those due to fluid overload.

Since the early 1980s, attention has turned to the absorption of glycine (HO2 -CCH2 -NH2), a nonessential amino acid, as a possible cause of some of CNS symptoms associated with TURP. For example, in one publication, five cases of transient blindness were attributed to glycine toxicity. 125 Glycine has a distribution similar to that of ?-aminobutyric acid, the latter an inhibitory transmitter in the brain; it has been suggested that glycine also is a major inhibitory transmitter acting in the spinal cord, brain stem, and retina. Glycine induced blindness is usually partially accompanied by widely dilated pupils, absent light and accommodation reflexes but preserved blink reflex. In contrast, cortical blindness is total with loss of blink reflex but preservation of light and accommodation reflexes. 126 Normal plasma glycine levels are 13 to 17 mg/L, whereas levels as high as 1,029 mg/L were measured during one episode of blindness. 125 Twelve hours later, the glycine level in this case had fallen to 143 mg/L, by which time vision had returned. However, an overall correlation between plasma glycine levels and CNS toxicity has not been established, so the relationship, although interesting, must still be considered speculative.

Absorption of glycine may result in CNS toxicity as a result of its oxidative biotransformation to ammonia. 127, 128 In a report of delayed awakening after TURP in three patients, 127 an association with elevated blood ammonia concentrations was noted. Blood ammonia levels as high as 500 ?M were noted in this and in another case report. 128 Deterioration of CNS function is said to occur when ammonia levels exceed 150 M. In a prospective study examining glycine metabolism, blood ammonia levels were increased postoperatively in 12 of 26 patients in whom 1.5 percent glycine was used as the irrigating solution for TURP. 127 Blood glycine levels also were measured. Interestingly, glycine and ammonia levels did not correlate; in fact, the opposite relationship was prevalent. Furthermore, high ammonia levels were not necessarily associated with CNS symptoms of toxicity. Although the investigators postulated that delayed awakening and other CNS symptoms were due to ammonia toxicity, it is not at all clear that this is correct.

Perforation

Another relatively common complication of TURP is perforation of the bladder. 129 Perforations usually occur during difficult resections and are most often made by the cutting loop or knife electrode. Some, however, are made by the tip of the resectoscope, whereas others may result from overdistention of the bladder with irrigation fluid. Most perforations are extraperitoneal, and in the conscious patient they result in pain in the periumbilical, inguinal, or suprapubic regions; additionally, the urologist may note the irregular return of irrigating fluid. Less often, the perforation is through the wall of the bladder and is intraperitoneal, or a large extraperitoneal perforation may extend into the peritoneum. In such cases, pain may be generalized, in the upper abdomen, or referred from the diaphragm to the precordial region or the shoulder. Other signs and symptoms such as pallor, sweating, abdominal rigidity, nausea, vomiting, and hypotension have been reported; their number and severity depend on the location and size of the perforation and the type of irrigating fluid. In an early series of 2,015 cases that examined the incidence of complications of TURP, perforation occurred in 25 patients (1.1 percent). 130 A multicenter study conducted 25 years later confirms this. Four deaths and five additional major complications occurred in the 12 patients in whom suprapubic cystostomy was delayed more than 2 hours after perforation. Distilled water was the bladder irrigant in most of these cases, so it is not clear whether these morbidity and mortality data still are relevant. The subject of complications associated with transurethral surgery was reviewed by Marx and Orkin 117 in 1962; their discussion of the topic is still valid today. 131

Transient Bacteremia and Septicemia

The prostate harbors many bacteria, which can be a source of intraoperative and postoperative bacteremia via the prostatic venous sinuses. This risk is further increased by the presence of an indwelling urinary catheter. Bacteremia is usually asymptomatic and easily treated with commonly used antibiotic combinations that are effective against gram-positive and gram-negative bacteria. In 6 to 7 percent of patients, however, septicemia may occur. 132 Common manifestations include chills, fever, and tachycardia. In severe cases, bradycardia, hypotension and cardiovascular collapse may occur, with mortality rates between 25 and 75 percent.

Irrigating fluids stored at room temperature are frequently used during TURP. Heat loss due to irrigation and significant absorption of this fluid may result in a decrease in the patient's body temperature and cause shivering (Ch. 37). 133 Use of warmed irrigating solutions has been shown to be efficacious in reducing this heat loss and the resultant shivering. 134 Although one may believe that warming of fluids might cause increased bleeding due to vasodilation, such is not the case, as shown by the study of Heathcote and Dyer. 135

Bleeding and Coagulopathy

Hypertrophied prostate is highly vascular, and operative bleeding is usually significant (Ch. 46). The blood is washed into the draining bucket and mixed with ample quantities of irrigant fluid. Hence, estimation of blood loss is quite inaccurate and extremely difficult. Efforts have been made to quantify blood loss based on resection time (2–5 mL/min of resection time) and size of the prostate in grams (20–50 mL/g). However, these guidelines are rough estimates at best, and the patient's vital signs and serial hematocrit levels should be followed to better assess the blood loss and the need for transfusion. Because ?-adrenergic receptors are abundant in the prostate tissue, the use of ?-adrenergic agonists would cause vasoconstriction of prostatic blood vessels and a decrease in blood loss. In a 1993 study, the blood loss during TURP was reduced by 50 percent with preoperative use of methoxamine. 136

Abnormal bleeding after TURP occurs in less than 1 percent of cases. It is believed by some to be due to systemic fibrinolysis caused by plasmin. The prostate releases plasminogen activator, which converts plasminogen into plasmin. Others believe that the fibrinolysis is secondary to disseminated intravascular coagulation triggered by the systemic absorption of resected prostate tissue, which is thromboplastin-rich. 131 If primary fibrinolysis is suspected, aminocaproic acid may be effective when given intravenously in a dose of 4 to 5 g in the first hour followed by 1 g/h. 131

TURP Syndrome

TURP syndrome is a term applied to a constellation of symptoms and signs caused primarily by excessive absorption of the irrigating fluid. Neurologic manifestations such as restlessness, agitation, confusion, altered sensorium, seizure, and coma result from water intoxication and dilutional hyponatremia, which collectively produce cerebral edema. Neurotoxic effects of glycine and ammonia may further compound the clinical situation. The cardiovascular effects reflect volume overload and hyponatremia. Hypertension and bradycardia are frequently seen because of acute hypervolemia. If serum sodium levels rapidly decrease to less than 120 mEq/L, negative inotropic effects are manifest as hypotension and ECG changes of widened QRS complexes and ventricular ectopy. 131, 137 Pulmonary edema, congestive heart failure, and cardiorespiratory arrest have been reported in these patients.

The treatment of TURP syndrome consists of fluid restriction and a loop diuretic such as furosemide. Hypertonic saline (3 percent sodium chloride) is rarely if ever necessary and should be considered only in cases of severe hyponatremia. CNS complications of hypertonic saline include cerebral edema and pontine myelinolysis. 131, 137, 138

Anesthetic Technique

Spinal anesthesia is the most frequently used anesthetic for TURP in the United States 138 and is believed to be the technique of choice by many. Anesthetic level to T10 is required. A spinal anesthetic provides adequate anesthesia for the patient and good relaxation of the pelvic floor and the perineum for the surgeon. The signs and symptoms of water intoxication and fluid overload can be recognized early because the patient is awake. Accidental bladder perforation also is recognized easily if the spinal level is limited to T10 because the patient would experience abdominal or shoulder pain.

General anesthesia may be necessary in patients who require ventilatory or hemodynamic support. In a 1990 study, 139 blood loss was less with spinal than with general anesthesia. However, short-term morbidity and mortality and long-term outcome for TURP are similar for both regional and general anesthesia. 140, 141

Anesthetic considerations for TURP should include positioning. TURP is usually performed in the lithotomy position with a slight Trendelenburg tilt. This would result in changes in pulmonary blood volume, a decrease in pulmonary compliance, a cephalad shift of the diaphragm, and a decrease in lung volume parameters such as residual volume, functional residual volume, tidal volume, and vital capacity. Cardiac preload may increase. Nerve injuries to the common peroneal, sciatic, and femoral nerves are likely (Ch. 26).