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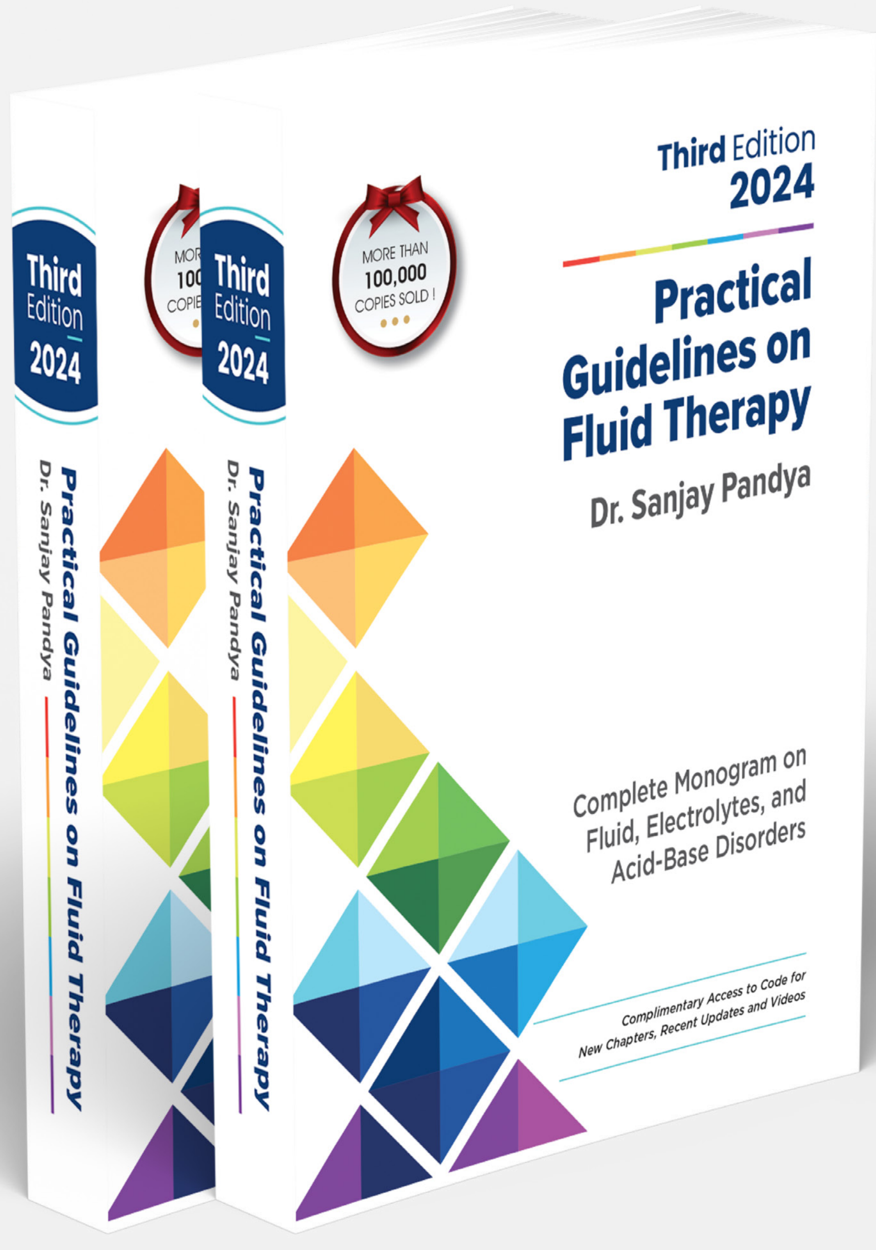
Chapter 45:

TURP Syndrome



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Transurethral resection of prostrate (TURP) is the second most common surgical procedure (after cataract extraction) done in men over the age of 65 years. Transurethral resection of prostrate syndrome is rare but potentially dreaded complication of urological endoscopic surgery [1].

DEFINITION

TURP syndrome is a distinct clinical entity characterized by a constellation of sign-symptoms secondary to neurological, cardiovascular and electrolyte imbalance resulting from the absorption of the irrigation fluid through prostatic venous sinusoids or breaches in the prostatic capsule during TURP.

INCIDENCE

The prevalence of TURP syndrome, previously reported to be as high as 2% to 12% in earlier literature, [2, 3], has significantly decreased to 1% or less with the adoption of safer techniques, as demonstrated in recent literature [4, 5].

RISK FACTORS

Following patient and technique-related factors carry a high likelihood of developing TURP syndrome [1, 6–8]:

- Patient-related factors contributing to the development of TURP syndrome include age over 80 years, prostate weight exceeding 75 gm, and resected prostate weight over 45 gm.
- Technique-related factors contributing to fluid absorption during TURP and the development of TURP syndrome include resection time over 90 minutes using Monopolar electrosurgery technique, the use of hypotonic irrigation fluid, irrigation volume greater than 30 liters, high irrigation pressure (height >70 cm), inadequate effluent through the

resectoscope, intermittent drainage of fluid, the use of a monopolar instead of a bipolar diathermy system, and an inexperienced surgeon.

ROLE OF IRRIGATION FLUID

The type of irrigation fluid used during TURP surgery can influence the risk of TURP syndrome, with hypotonic irrigation fluids specifically posing an increased risk for its development. Commonly used solutions in TURP include both non-electrolyte solutions like distilled water, 1.5% glycine, 5% dextrose, sorbitol, and mannitol solutions, as well as electrolyte solutions such as normal saline and Ringer's lactate.

A. Distilled sterile water

Due to its affordability, easy availability, and superior visualization compared to 1.5% glycine and normal saline, distilled water is frequently utilized as a substitute for glycine in TURP in resource-limited settings of low-income countries [9, 10]. Due to its extreme hypotonicity compared to glycine and other irrigation fluids, distilled water carries a higher risk of TURP syndrome, including risks of haemolysis, dilutional hyponatremia, shock, and renal failure [11]. Due to high risk of severe adverse effects, currently most of centers do not use distilled water for TURP.

B. Glycine

Irrigation fluid, specifically glycine 1.5% with an osmolality of 200 mOsm/L, is widely utilized for the traditional therapeutic endoscopic urologic procedure TURP. It is preferred due to its favorable characteristics, such as low electrical conductivity and a refractive index similar to water, ensuring clear vision during the procedure. Despite its hypotonic osmolality, glycine is nonhemolytic as it effectively penetrates red blood cells, maintaining their structural integrity and preventing cell swelling or rupture. However, it is crucial to note that the osmolality of 1.5% glycine at 200 mOsm/L can cause serum electrolyte dilution and result in hyponatremia due to its large volume absorption. It is important to be aware that the rapid absorption of glycine can be toxic, leading to increased plasma ammonia levels and potential adverse effects such as cardiodepressant effects and renal toxicity [12]. Due to potential risk of metabolic and electrolyte disturbances, and the availability of safer options, trend to use glycine as preferred irrigation fluid for TURP is declining [13, 14].

C. Normal saline

An isotonic irrigation fluid, normal saline, is commonly used as the preferred and safer choice for TURP but can only be utilized when employing the bipolar electrosurgery technique [15, 16]. The risk of hyponatremia and TURP syndrome is very low when saline is used as an irrigation fluid for TURP, due to its slightly higher sodium concentration and osmolality compared to plasma (154 mEq/L vs. 140 mEq/L and 308 mOsm/L vs. 290 mOsm/L, respectively) [13, 17, 18]. However, it is important to note that the absorption of a large volume of normal saline can lead to adverse effects such as volume overload, heart failure, and hyperchloremic metabolic acidosis [15, 19, 20].

Caution: Do not use normal saline while using monopolar electrosurgery for TURP because saline conducts electricity and diffuses the current, making conventional monopolar cautery ineffective for cutting or coagulating.

Irrigation fluids like 5% dextrose, sorbitol and mannitol are used less frequently.

PATHOPHYSIOLOGY

During a TURP procedure, irrigation fluid can be absorbed through the prostatic venous sinuses or directly into the systemic circulation via disrupted venous channels, resulting in systemic effects due to rapid changes in osmolality and circulating volume [21]. The severity of TURP syndrome is closely related to the rate, volume, and composition of the systemically absorbed irrigation fluid. Various factors influence these factors, including electrolyte concentrations, osmolality, solute content, irrigation fluid delivery pressures, surgery duration, and surgical skill.

Major disturbances due to TURP syndrome are summarized below:

A. Circulatory overload

The average rate of irrigation fluid absorption through the venous network of the prostatic bed during TURP is reported to be 10–30 ml/min of operating time [22]. Typically, approximately 1 liter of fluid is absorbed within one hour. However, when a larger volume of fluid is absorbed, it can result in increased blood volume, leading to circulatory overload. This, in turn, can cause elevated systolic and diastolic blood pressure and potentially lead to heart failure, resulting in pulmonary edema.

B. Dilution and hyponatremia

The excessive absorption of hypotonic irrigating fluids, such as distilled water, 1.5% glycine, or sorbitol, during TURP can lead to the dilution of serum electrolytes, resulting in hyponatremia. This dilution, caused by the hypotonic fluid, increases the water content within the brain, which can potentially cause neurological symptoms.

C. Hemolysis due to hypotonic fluid

When a hypotonic irrigation fluid, such as sterile water, is absorbed in a large volume, its hypotonicity can result in the movement of water into red blood cells, leading to their swelling and potential rupture, which can cause hemolysis. The release of hemoglobin from ruptured cells can contribute to complications such as renal dysfunction and coagulopathy.

SIGNS AND SYMPTOMS

TURP syndrome can manifest with variable clinical presentations, ranging from mild cases that may go unnoticed to severe and life-threatening situations. The severity of symptoms depends on the extent of the abrupt reduction in serum osmolarity, which leads to hyponatremia, as well as the severity of volume overload and intravascular hemolysis.

The earliest common clinical presentation of TURP syndrome includes headaches, anxiety, nausea, bradycardia, irritability, confusion, and visual disturbances, such as flashing lights [23, 24]. Development of intraoperative hypertension is indicative of hypervolemia.

In severe cases of TURP syndrome, the clinical presentation can be life-threatening and may include profound hyponatremia, leading to neurological symptoms such as altered mental status, stupor, seizure, and even coma. Patients may experience severe cardiovascular instability, causing dyspnea, chest pain, hypoxia, and pulmonary edema. If not treated promptly, the patient may develop cyanosis, hypotension, and even cardiac arrest. Additionally, the presence of hemolysis may manifest as hematuria, jaundice, and acute kidney injury, while hypothermia can occur due to the rapid absorption of large volumes of irrigation fluid.

Diagnosis of TURP syndrome is difficult and often delayed when TURP is done under general anesthesia. Unexplained hypertension and refractory bradycardia are the very important warning signs of TURP syndrome. Therefore, all patients undergoing TURP should be closely monitored with electrocardiogram (ECG) and frequent blood pressure monitoring.

Patients with TURP syndrome can experience symptoms related to the toxicity of solute contents in irrigation fluid, such as glycine-induced visual abnormalities and sorbitol-induced gastrointestinal disturbances.

PREVENTION

Measures used to minimize the risk of complication TURP Syndrome include [1, 5, 25–27]:

- **Patient selection:** Identify individuals at higher risk of TURP syndrome and correct possible modifiable factors. Patients with preexisting hyponatremia are at greater risk of developing TURP syndrome, so patients on a salt-restricted diet or diuretic therapy need correction before surgery.
- **Selecting an appropriate irrigation fluid:** Isotonic solutions, such as normal saline, are preferred to minimize the risk of hyponatremia [28]. To prevent TURP Syndrome, it is advisable to restrict volume or avoid using hypotonic fluids like glycine and sterile or distilled water.
- **Fluid limitation:** Careful monitoring and limiting the volume of irrigation fluid used during TURP procedure can help prevent excessive fluid absorption. Sparingly use intravenous fluids, if needed and avoid the use of hypotonic IV fluids to minimize the risk of TURP syndrome.
- **Bipolar TURP:** The new system, bipolar TURP, is preferred over the monopolar TURP system because it uses normal saline for irrigation, maintaining the balance of electrolytes and preventing TURP syndrome [29, 30]. The bipolar TURP procedure allows the use of isotonic electrolyte solutions like normal saline for irrigation, unlike the monopolar TURP technique, where non-electrolyte hypotonic irrigation fluids are used, carrying a high risk of TURP syndrome [5].
- **Operative modifications:** Various intraoperative measures that can help prevent TURP syndrome include keeping the patient horizontal and avoiding the Trendelenburg position, limiting resection time to one hour, considering staged procedures for resecting large prostates to avoid prolonged operative times, and preserving the prostatic capsule by avoiding aggressive resection near it.
- **Fluid bag height:** The rate of fluid absorption during TURP is influenced by the hydrostatic pressure of the irrigation fluid at the prostatic bed. To prevent excessive absorption, it is important to deliver the irrigation fluid at the lowest required pressure and avoid setting the fluid bag height greater than 60 cm above the patient.
- **Avoid increased bladder pressure:** Ensuring smooth bladder drainage is the most crucial factor in minimizing fluid absorption during TURP and preventing TURP syndrome, which can be achieved by implementing the following methods: suprapubic continuous drainage using Reiter's cannula or trocar cystostomy, utilizing a continuous flow irrigation system, and using a large diameter catheter to maintain low bladder pressure.
- **Experienced surgeons:** Having TURP procedures performed by experienced surgeons can reduce complications,

shorten surgical times, and improve outcomes.

- **Using regional anesthesia:** Performing a TURP under spinal or epidural anesthesia is preferred because the awake and alert state allows for early diagnosis of TURP syndrome, whereas general anesthesia may mask its symptoms [23, 24].
- **Monitoring during TURP:** Continuous monitoring of the patient's vital signs can help detect early signs of TURP syndrome. Measure the quantity of fluid absorbed and stop the procedure at predetermined absorption thresholds.
- **Early intervention:** Prompt recognition of TURP syndrome symptoms and immediate intervention including use of diuretics, can prevent the progression to severe or life-threatening complications.

MANAGEMENT

Early and prompt treatment of TURP syndrome will prevent its serious central nervous system and cardiac complications. The treatment is planned according to the severity of the symptoms, and in asymptomatic patients with mild hyponatremia, specific therapy is not necessary. The treatment of symptomatic patients is summarized below [21, 23].

A. Termination of surgery

When TURP syndrome is diagnosed, the surgical procedure is terminated as early as possible.

B. Diuretics and fluid restriction

Discontinue IV fluids and administer furosemide at 1 mg/kg to increase renal water excretion, leading to an increased urine output, which helps eliminate large volumes of absorbed irrigation fluid and reduces circulatory overload.

C. Hypertonic saline

To correct severe hyponatremia in symptomatic patients with severe neurological symptoms, such as severe headaches, confusion, altered sensorium, convulsions, and coma, administer 100 ml of 3% hypertonic saline rapidly (to be given over 20 minutes) along with IV furosemide. In cases of acute severe hyponatremia, the administration of 3% NaCl as a rapid intermittent bolus (RIB) is preferred over slow continuous infusion, as recommended for the treatment of acute hyponatremia in recent guidelines. [31–33]. To guide further administration of 3% saline, measure serum sodium and its rate of correction by frequent estimation, and closely monitor the neurological status. Continue 3% saline until neurological symptoms improve.

D. Hemodialysis

Hemodialysis is indicated in a few severe cases of TURP syndrome characterized by marked hyponatremia, volume overload, and acute kidney injury. In such cases, diuretics may be less effective, and hemodialysis effectively corrects hyponatremia, removes excess fluid, and eliminates toxic metabolites of irrigation fluids such as glycine, sorbitol, or mannitol.

E. Supportive measures

This involves administering oxygen to treat pulmonary edema and hypoxia, managing seizures with medications such as diazepam, barbiturates, or dilantin, using inotropes to treat hypotension, correcting hypocalcemia, and cautiously transfusing blood with packed red cells to manage anemia.

MONITORING

Monitoring of the management of TURP syndrome includes:

- Continuous monitoring of vital signs, such as blood pressure, heart rate, and oxygen levels, to assess the patient's overall condition.

- Assessing neurological status for any improvement or deterioration in symptoms.
- Meticulous volume assessment, maintaining strict intake-output charting and daily weight to assess the correction of volume overload, plan fluid intake, and adjust diuretic dosages.
- Closely monitoring laboratory tests, including serum electrolytes (especially sodium), osmolality, renal function tests, complete blood count (CBC), and coagulation profile.

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