

TURP & TURP Syndrome

TURP syndrome is the cardiovascular and CNS complications that occur as a result of acute changes in intravascular volume and plasma solute concentrations associated with the intravascular absorption of non-electrolyte irrigating solutions.

ANESTHETIC CONSIDERATIONS:

- Coexisting disease common in this population
 - IHD, ARF (post-renal), elderly
- Considerations of intraoperative complications
 - TURP syndrome
 - Concealed hemorrhage (avg. 2-4 cc/min, but 2.5% require pRBCs)
 - Hypothermia
 - Bladder perforation – 1%
 - Septicemia (usually gram negative)
 - DIC (rare complication associated with prostate cancer)
- Positioning: Nerve Injury; Lithotomy; Trendelenberg → CVS/Pulm effects;

ANESTHETIC GOALS:

- Optimization of co-existing disease
- Prevention or early recognition of TURP syndrome
- Attention to blood loss and appropriate replacement

CONFLICTS:

- preference for neuraxial to permit CNS monitoring vs contraindications to neuraxial technique

PATHOPHYSIOLOGY

- **Prostate Hypertrophy**
 - The prostatic gland consists of four closely integrated zones—the anterior, peripheral, central, and preprostatic zones, enclosed in one capsule
 - Gland is rich in blood supply
 - By the 4th decade of life, nodules begin to develop
- **Surgical Procedures**
 - A resectoscope inserted through the urethra and resecting with cutting-coagulating metal loop
 - Common solutions used include: (see table)
 - These solutions are purposely moderately hypotonic to preserve their transparency
 - Sterile water is still used for cystoscopy, however it is too hypotonic for TURP
 - Electrolyte solutions are not used as they disperse electrocautery current
 - Tissue is resected, but the capsule is preserved
 - If the capsule is violated, large amounts of irrigation solution are absorbed into the circulation and the periprostatic and retroperitoneal spaces
 - Factors affecting volume entrained: Gland size; Resection time; Infection; Surgeons experience; pressure of irrigating fluid.
 - Bleeding during TURP is common, but usually controllable
 - If large venous sinuses are opened, hemostasis becomes difficult
 - If bleeding is uncontrollable, terminate surgery ASAP, pass Foley into the bladder and apply traction the balloon exerts lateral pressure on the prostatic bed and reduces bleeding
 - Bleeding requiring transfusion occurs in about 2.5% of TURP procedures
- **TURP Syndrome**
 - Caused by absorption of hypotonic, non-electrolyte containing solution through open prostatic sinuses
 - An average of 20 cc/min is absorbed during procedure, max of 200 ml/min can be reached
 - Onset of TURP syndrome can be within 15 min of irrigation, or delayed 24 hours
 - Early recognition and treatment portends best chance of survival
 - Mortality after TURP is 0.2-6%
 - Hypertension, bradycardia, and mental status changes make up classic presentation triad.
 - Manifestations are those of fluid overload, water intoxication, and solute toxicity
 - **Hypervolemia** (HTN, bradycardia, CHF, MI, shock)
 - **Hypoosmolality** (pulmonary & cerebral edema → ↑ICP)
 - **Hypo-osmolality rather than hyponatremia** is the crucial physiologic derangement leading to central nervous system dysfunction during TURP (only H₂O crosses BBB)
 - **Hyponatremia** (confusion, agitation, seizures, pulm edema, dysrhythmias)
 - **Hemolysis** (can lead to hyperkalemia and ARF)
 - **Toxicity**
 - hyperGLYCINemia (visual changes, CNS changes, seizures, cardiac toxicity)
 - hyperAMMONemia (mental status changes, decreased LOC)
 - hyperGLYCemia (when sorbitol or glucose used)
 - hyperMANNITOLEmia (pulmonary edema in cardiac pts d/t volume expansion)

Solution	Osmolality (mOsm/kg)
Glycine, 1.2%	175
Glycine, 1.5%	220
Sorbitol, 3.5%	165
Mannitol, 5%	275
Cytal	178
Glucose, 2.5%	139
Urea, 1%	167

- Glycine is an **inhibitory neurotransmitter** in the brain, spinal cord, retina (can cause transient visual changes / blindness which resolve within 24 h)
- Glycine may also lead to seizures / encephalopathy via **potentiation of NMDA** (possibly treated with Mg⁺⁺ which antagonizes NMDA)
- Glycine is **converted to ammonia** in the liver which can be treated with IV arginine (speeds conversion to urea)

• **TABLE 14-15 -- Signs and Symptoms of Transurethral Resection of the Prostate Syndrome**

System	Signs and Symptoms	Cause
Cardiovascular	Hypertension, reflex bradycardia, pulmonary edema, cardiovascular collapse Hypotension ECG changes (wide QRS, elevated St segments, ventricular arrhythmias)	Rapid fluid absorption (reflex bradycardia may be secondary to hypertension or increased ICP) Third spacing secondary to hyponatremia and hypo-osmolality; cardiovascular collapse Hyponatremia
Respiratory	Tachypnea, oxygen desaturation, Cheyne-Stokes breathing	Pulmonary edema
Neurologic	Nausea, restlessness, visual disturbances, confusion, somnolence, seizures, coma, death	Hyponatremia and hypo-osmolality causing cerebral edema and increased ICP, hyperglycinemia (inhibitory neurotransmitter, potentiates NMDA receptor activity), hyperammonemia
Hematologic	Disseminated intravascular hemolysis	Hyponatremia and hypo-osmolality
Renal	Renal failure	Hypotension, hyperoxaluria (metabolite of glycine)
Metabolic	Acidosis	Deamination of glycine to glyoxylic acid and ammonia

HISTORY

- Headache, N/V, agitation are early signs of TURP syndrome
- Visual changes, decreased LOC, mental status? (risk of stroke)
- Ulcer, GI bleeding, melena? (risk of GI bleeding, anemia)
- COPD: SOB, smoking, cough, sputum? (risk of high block with regional)
- History of HTN, DM, stroke, CAD, CHF, SOB? (risk of MI, arrhythmia, hypovolemia, hyperglycemia)
- Renal failure, kidney stones, UTI? (risk of renal failure; Urosepsis)
- Back problems, arthritis, Coagulopathy? (difficult spinal / epidural; C/I to RA)

PHYSICAL

- **GENERAL:** Vitals: HTN, bradycardia and mental status change make up classic presentation triad
- **RESP:** Pulmonary edema, elevated JVP
- **CVS:** Arrhythmias, Hypotension may occur later (from shock OR hypovolemia from fluid shifts)
- **CNS:** Pupillary reflex can differentiate visual changes from either cerebral edema OR glycine
 - Pupillary reflex intact in cerebral edema / sluggish or absent with glycine

INVESTIGATIONS

- **Labs:** E-lytes:
 - Hyponatremia

Serum sodium	ECG changes	CNS changes
120	Possible QRS widening	Restlessness / confusion
115	QRS widening / ST elevation	N&V / decreased LOC
110	VT / VF	Seizures / coma

- Hyperkalemia (from hemolysis)
 - CBC (Hb, hemolysis)
 - ABG (metabolic acidosis +/- hypoxemia with pulmonary edema)
 - Cr (ARF may occur with hemolysis)
 - Coags (DIC is a rare complication of TURP)
 - Serum osmolality and ammonium
 - Type & screen
- **Imaging**
 - ECG (arrhythmias)
 - ECHO (if history of CHF / MI)
 - PFTs (only if severe respiratory compromise on history)

OPTIMIZATION

- As indicated by assessment, none specific to TURP
- Blood available if Prostate > 40g
- Note that prostatic stenting and laser resection may be considered as alternative treatments

ANESTHETIC OPTIONS

- **RA:** SAB (T 9-10) Advantages:
 - Detects CNS changes (allows early intervention) & bladder perforation
 - Decreased DVT incidence and blood loss but no mortality benefit known
 - Subarachnoid anesthesia generally preferred vs. epidural d/t:
 - Technically easier in the elderly
 - Duration of surgery not generally very long
 - Incomplete block of sacral nerve roots occasionally occurs with the extradural technique
- **General:** May be chosen if patients require ventilatory or hemodynamic support, have spinal osteoarthritis, contraindications to regional or patient preference / refusal

ANESTHETIC SETUP

- **Drugs**
 - Standard emergency drugs
- **Equipment**
 - Routine CAS with 5-lead EKG
 - Temperature (risk of hypothermia)
 - Consider CVP / PAC if severe co-existing disease
 - Arterial line if severe co-existing disease or frequent sampling anticipated

MANAGEMENT OF ANESTHESIA

- **Induction**
 - Regional requires levels T9-T10; higher level may mask symptoms of capsular perforation OR bladder perforation
 - High sympathetic block may cause undesirable bradycardia, hypotension
- **Maintenance**
 - TURP is usually performed in the lithotomy position with a slight Trendelenburg tilt
 - Can result in changes in pulmonary blood volume, ↓ pulmonary compliance, cephalad shift of the diaphragm, ↓ lung volume parameters (residual volume, FRC, Vt, VC)
 - Cardiac preload may increase
 - Nerve injuries to the common peroneal, sciatic, and femoral nerves are likely
 - **Intraoperatively prevention of TURP syndrome (mostly surgical interventions):**
 - Avoid sterile water as the irrigation agent (significant hyponatremia can result)
 - Minimize resection time (< 1 hr)
 - Achieve adequate hemostasis of venous sinuses
 - Avoid high irrigation pressures
 - limit bag height to 30-40 cm above prostate
 - surgeon must allow frequent drainage of solution from bladder
 - Avoid fluid replacement with hypotonic solutions
 - Check lytes frequently for patients who have:
 - CRF
 - Are receiving drugs that can cause hyponatremia
 - Have metabolic abnormalities
 - **Treatment of TURP syndrome intraoperatively:**
 - Early recognition is the key to successful treatment
 - Inform surgeon to complete procedure ASAP
 - Supportive care (airway control, ventilation control, BP support PRN)
 - If near normal Se Osm & asymptomatic, no interventions to correct serum sodium concentrations are recommended for asymptomatic patients even in the presence of hyponatremia.
 - Mild cases (serum Na > 120) may be managed with diuresis (furosemide 40-120 mg) and NS or fluid restriction
 - Symptomatic, life-threatening hyposmolality & serum Na < 120 (rare with modern techniques), can be treated with hypertonic saline (3%):
 - Start at rate of 50-100 cc/h (do not exceed correction of > 1.5 mEq/L/h because rapid correction of serum sodium is associated with **central pontine myelinolysis** (osmotic demyelination syndrome))
 - Diuresis with furosemide and fluid restriction
 - Stop 3% saline once symptoms subside OR serum Na > 120 – treat remaining hyponatremia with diuresis and NS or fluid restriction
 - Send off blood work (including e-lytes, BUN, Cr, CBC)
 - Seizures can be treated with benzodiazepines or STP, consider phenytoin load for longer term control: midazolam 2-4 mg, diazepam 3-5 mg, thiopental 50-100 mg, phenytoin 10-20 mg/kg IV at 50 mg/min, +/- intubation
 - Increase level of monitoring once resuscitation underway (arterial line, CVP +/- PAC)
 - Transfer to ICU for ongoing care in severe cases
 - q1h blood work (Na, K)
 - Frequent CNS assessment
- **Emergence**
 - Standard smooth emergence if GA used, postoperative Se Osm & Na if CNS changes develop

DISPOSITION & MONITORING

- HDU only if TURP syndrome develops and is severe
- Postoperative pain generally minimal, mainly due to indwelling catheter maintained with traction / continuous irrigation

PAR problems:

- **Post-op delirium** must consider drugs, glucose, sepsis, hypothermia, seizures, or TURP syndrome (low osmolality and Na⁺, increased ICP, increased glycine/ammonia).
- **Hypotension differential** should include myocardial ischemia from volume overload, hypovolemia from third spacing or hemorrhagic loss, decreased afterload from bacterial endotoxin load.
- **Respiratory distress** should consider laryngeal edema from fluid shifts, CHF from volume overload +/- myocardial dysfunction, aspiration if decreased LOC.
- **Post-op delirium (Common Differential diagnosis Post-TURP):**
 - D: Absolute or relative overdose of drugs that impair mental status
 - Anesthetic Meds; Psych Meds; ETOH; Illicit drugs
 - I: infection, sepsis, AIDS, postictal
 - M: ↓ / ↑ glucose, thyroid, Na, K, Ca, ↑CO₂, ↓ O₂, endogenous toxins uremia, porphyria, hepatic encephalopathy, hypothermia, TURP Acidosis (metabolic), withdrawal
 - S: cerebral hemorrhage / ischemia, embolism, tumor
- **Hyponatremia**
 - Symptoms when < 120 mmol/L
 - Early symptoms: anorexia, nausea, weakness
 - Progression of cerebral edema: lethargy, confusion, seizures, coma, death
 - Acute symptomatic hyponatremia requires raising plasma Na to 130 mmol/L
 - Rapid sodium replacement (see rates below) can result in central pontine myelinolysis or diffuse cerebral demyelination
 - Monitors: Foley, +/-CVP / PAC, arterial line
 - Treatment: (see above for treatment)
 - Seizures: midazolam 2-4 mg, diazepam 3-5 mg, thiopental 50-100 mg, phenytoin 10-20 mg/kg IV at 50 mg/min, +/- intubation
- **Hyperglycemia:**
 - Exaggerated in diabetic patients when sorbitol or dextrose solutions used
 - Treatment as in DKA:
 - guided by lab: glucose, ABG, Lytes, Cr, BUN
 - initially: insulin 0.1 U/kg bolus, +/- infusion
 - fluid replacement if osmotic diuresis
- **Hypothermia**
 - Large volumes of irrigation fluid to be warmed to avoid hypothermia
- **Hyperglycinemia:**
 - Glycine (HO₂-CCH₂-NH₂) is an inhibitory neurotransmitter in CNS, may cause transient blindness following TURP (recovers in 24H; reassure patient)
 - Glycine may also lead to seizures / encephalopathy via potentiation of NMDA (possibly treated with Mg⁺⁺ which antagonizes NMDA)
 - Exaggerates circulatory depression and CNS toxicity
 - May cause **hyperammonemia** due to breakdown of glycine
 - Treatment: supportive, possibly Mg⁺⁺ as above
- **Bladder Perforation**
 - Incidence 1%
 - D/t overdistention, knife electrode contact, resectoscope contact
 - **Most** perforations **extraperitoneal** resulting in pain in the periumbilical, inguinal, or suprapubic regions, nausea, diaphoresis, and irregular return of irrigating fluid
 - **Less often**, perforation is **intraperitoneal**, resulting in generalized pain in the upper part of the abdomen or referred from the diaphragm to the precordial region or the shoulder
 - Other signs and symptoms include pallor, sweating, abdominal rigidity, nausea, vomiting, and hypotension
- **Hypotension**
 - Preload: hypovolemia, vasodilation, elevated intrathoracic pressure, pericardial tamponade, PE
 - Contractility: arrhythmias, ischemia / infarction, valvular, hypoxemia
 - Afterload: anaphylaxis, endocrine abnormality (Addisonian crisis, hypothyroidism, hypoglycemia), sepsis
- **Respiratory Distress**
 - Upper
 - Postoperative stridor from laryngeal edema, obstruction, cord paralysis
 - Lower
 - Pneumothorax, pulmonary edema, bronchospasm, PE, aspiration
- **Coagulopathy**
 - DIC due to release of Thromboplastins from prostate during surgery
 - Dilutional Coagulopathy can occur secondary to both blood loss and irrigate absorption
 - Blood loss is often masked
 - Treatment: Blood products
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REFERENCES

- Roizen & Fleisher – Essence of Anesthesia Practice – p479
- Miller 6th – p2193-2194
- Coexisting
- Old seminars
- Decision making in anesthesiology
- TURP review