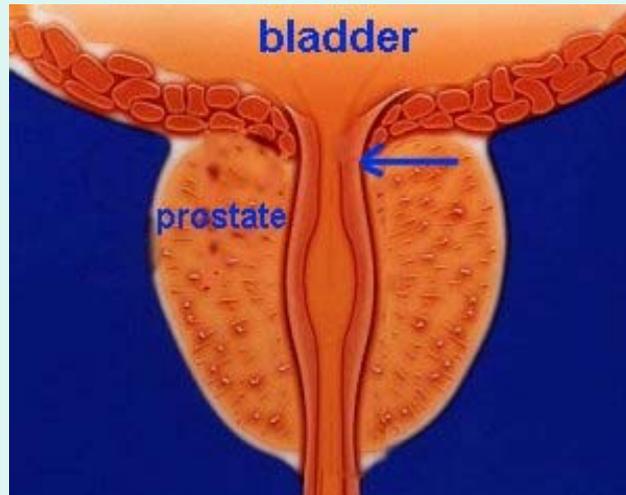


Transurethral Resection of the Prostate Anesthetic Considerations

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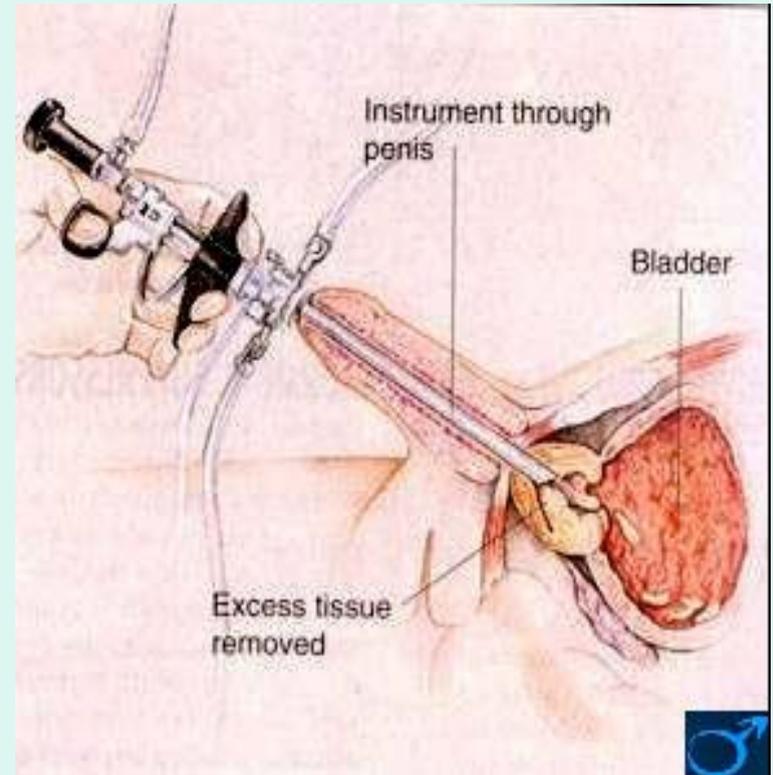


TURP - Introduction

- TURP - second most common surgical procedure in men over age 65.
- TURP - surgical procedure of choice in men with symptomatic bladder outlet obstruction secondary to benign prostatic hyperplasia, cancer, or bladder neck contracture.
- This patient population has a greater anaesthetic risk because of a greater prevalence of coexisting cardiovascular and pulmonary problems.
- TURP carries unique complications because of the need to use large volumes of irrigating fluid for the endoscopic resection.

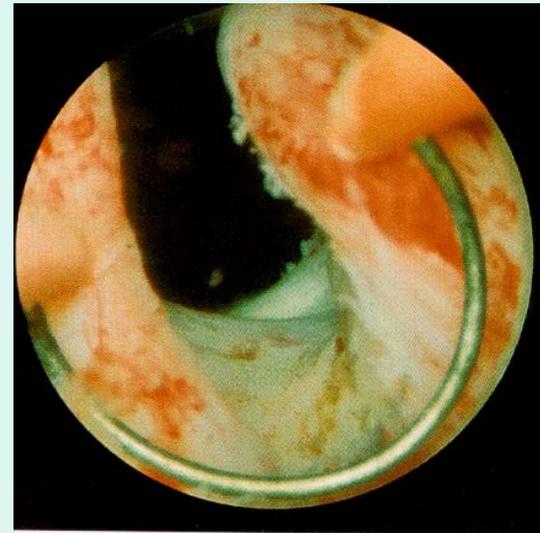
TURP - surgical Procedure

- The operation is performed through a modified cystoscope (resectoscope).
- Prostatic tissue is resected using an electrically energized wire loop.
- Bleeding is controlled with a coagulation current.
- Continuous irrigation is necessary to distend the bladder and to wash away blood and dissected prostatic tissue.



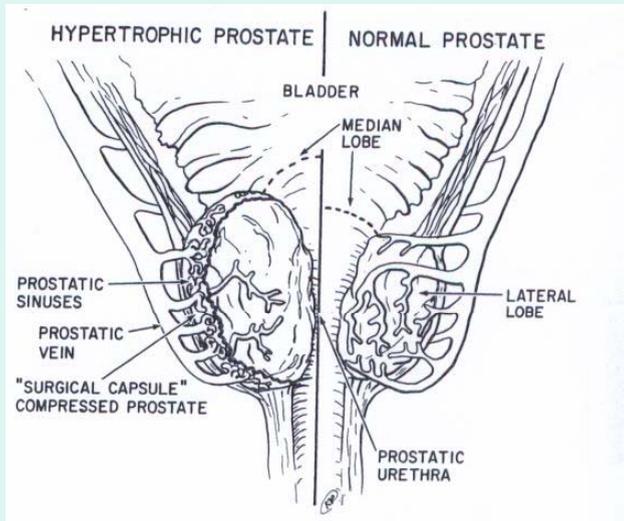
TURP - irrigating solution

- Irrigation fluid must be non-conductive so that the diathermy current is concentrated at the cutting point.
- Irrigation fluid has to be non-haemolytic so that haemolysis does not occur if it enters the circulation.
- Irrigation fluid must have neutral visual density so that the surgeon's view is not distorted.
- Most commonly used irrigants are glycine 1,5% in water (230 mOsm/L) or Cytal a mixture of 2,7% sorbitol and 0,54% mannitol (195 mOsm/L).



TURP - irrigating solution

- Keep in mind:



- The most commonly used irrigants are still hypotonic so that significant absorption of water nevertheless can occur.
- During a TURP - procedure 20 ml/min of irrigant solution is normally absorbed. This is a total of 1 - 1.5 litres for the average case.
- Absorption up to 5 litres has been recorded.
- In clinical practice it is almost impossible to accurately assess the volume absorbed.

TURP - preoperative Considerations

- Patients for TURP are frequently elderly with coexistent diseases.
 - - cardiac disease 67%
 - - cardiovascular disease 50%
 - - abnormal electrocardiogram (ECG) 77%
 - - chronic obstructive pulmonary disease 29%
 - - diabetes mellitus 8%
- Occasionally patients are dehydrated and depleted of essential electrolytes (long-term diuretic therapy and restricted fluid intake).
- Long standing urinary obstruction can lead to impaired renal function and chronic urinary infection.
- About 30% of TURP patients have infected urine preoperatively.

TURP - preoperative Considerations

- - Antibiotic prophylaxis (120 - 240 mg gentamicin) is required for patients with a proven urinary tract infection or a potential risk for infection (indwelling catheter or urinary obstruction).
- - antihypertensive and antianginal drugs should be continued until the day of surgery to prevent rebound hypertension and tachycardia (may result from sudden withdrawal of these drugs - ACC/AHA guidelines).
- - antiobstructive drugs for pulmonary disease treatment should be continued.
- - routine ECG and chest x-ray should be obtained before surgery.
- - check FBC, electrolytes, creatinine and coag-tests (INR,PTT) preoperatively.
- - for most patients type and screen is sufficient .
- - blood should be available and crossmatched for anemic patients and patients with large glands (> 40 g).
- Keep in mind: the transfusion rate for TURP-surgery is about 6%.

TURP - anaesthetic techniques

- - regional or general anaesthetic techniques are possible.
- - spinal anaesthesia is the anaesthetic technique of choice for patients undergoing TURP.

- - sensory supply to the urethra, prostate and bladder neck is from S2 - S4.
- - sensory supply to the bladder is from T10 - T12.
- - for a satisfactory anaesthesia, a block to T10 is required.
- - for spinal anaesthesia an appropriate dose of heavy bupivacaine 0,5% is 3 ml.
- - if isobaric bupivacaine 0,5% is used 3-4 ml are suitable.

- - regional anaesthesia does not abolish the obturator reflex (external rotation and adduction of the thigh secondary to stimulation of the obturator nerve by electrocautery current through the lateral bladder wall). The reflex is reliably blocked only by muscle paralysis during general anaesthesia; another option is an obturator nerve block using the nerve stimulator.

TURP - anaesthetic Techniques

- - Patients with chronic chest disease tend to cough on lying flat. Sedation can help to reduce coughing.
In elderly people 1 - 2 mg midazolam (+ fentanyl 50 mcg) is usually adequate. Higher dose may result in loss of airway control, confusion and restlessness. A low - dose propofol infusion is an alternative (target concentration of 0.5 - 2.5 mcg/ml).
- - in very obese or mentally handicapped (communication difficult) patients, general anaesthesia may be a better option (ETT, LMA). Intraoperative fentanyl or morphine (plus diclofenac 100 mg PR) provides adequate analgesia.
- Surgery is performed in lithotomy position - Keep in mind: Functional residual capacity decreases, predisposing patients to atelectasis and hypoxia. Rapid lowering of the legs at the end of the operation acutely decreases venous return and can result in severe hypotension, especially when combined with blood loss during surgery.

TURP - intraoperative Considerations

- Because of the characteristics of the prostate and the large amount of irrigation fluid often necessary TURP can be associated with a number of complications:
- TURP Syndrome (2%)
- Haemorrhage
- Bladderperforation (1%)
- Hypothermia
- Septicemia (6%)
- Disseminated intravascular coagulation



- - the main challenges are blood loss and TURP Syndrome due to excessive absorption of irrigant fluid.

TURP Syndrome

- - TURP often opens the extensive network of venous sinuses in the prostate and allows systemic absorption of irrigation fluid.
- - absorption of large amounts of irrigants (> 2 L) results in a constellation of symptoms commonly described as TURP Syndrome.
- - manifestations of this syndrome are primarily a circulatory fluid overload, water intoxication, and occasionally, toxicity from the solute in the irrigation fluid.
- Manifestations of the TURP Syndrome:
 - - acute hypo-osmolality
 - - acute hyponatremia
 - - congestive heart failure
 - - pulmonary edema
 - - hypertension
 - - hypotension
 - - solute toxicity:
 - hyperglycinaemia (glycine)
 - hyperammonaemia (glycine)

TURP Syndrome

- Normally about 20 ml/min of irrigation fluid is absorbed (1 - 1,5 L for the normal case - resection time about 45 - 60 min). In clinical practice almost impossible to assess accurately the volume absorbed.
- The amount absorbed depends upon the following factors:
 - - hydrostatic pressure of the irrigation infusion: the bag must be kept as low as possible to achieve adequate flow of irrigant (usually 60-70 cm, never more than 100 cm above the prostate) - bladder should not be allowed to overdistend
 - - venous pressure: more fluid is absorbed if the patient is hypovolemic or hypotensive.
 - - duration of surgery/large prostate: problems are more common with surgery lasting more than an hour or with a prostate weighing more than 50 g.
 - - blood loss: large blood loss implies a large number of veins open.
 - - surgical skills: the most important preventive measure during surgery is preservation of the prostatic capsule because violation of the prostatic capsule promotes entry of irrigation fluid into the periprostatic and retroperitoneal space.

TURP Syndrome

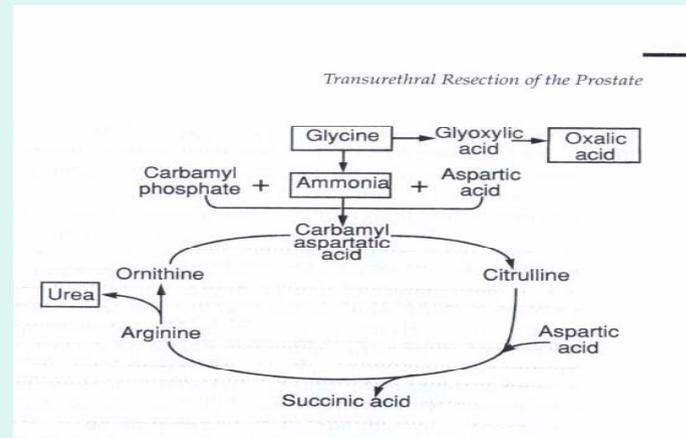
- - the TURP syndrome consists of pulmonary oedema, cerebral oedema and hyponatraemia due to absorption of large amounts of hypotonic irrigation fluids.
- - the crucial physiological derangement of CNS function is not hyponatraemia, but acute hypo-osmolality because the blood - brain barrier is essentially impermeable to sodium but freely permeable to water.
- - cerebral oedema caused by acute hypo-osmolality can increase intracranial pressure with bradycardia, hypertension and neurologic symptoms.
- - when serum sodium level falls to less than 120 mEq/L, signs of cardiovascular depression can occur.- less than 115 mEq/L causes bradycardia, widening of the QRS complex, ST-segment elevation, ventricular ectopic beats and T-wave inversion. A serum sodium level less than 110 mEq/L can cause respiratory and cardiac arrest.

TURP Syndrome

- - toxicity may also arise from absorption of the glycine in the irrigation fluid.
- - glycine is a non - essential amino acid which acts as an inhibitory neurotransmitter.
- - when absorbed in large amounts direct toxic effects on heart and retina.
- - in patients who have undergone TURP, glycine absorption has been shown to cause an average decrease of 17.5% in cardiac output.
- - in animal studies the administration of arginine reversed the myocardial depressing effect of glycine.
- - hyperglycinemia may cause transient visual disturbance (blindness) during TURP.
- - glycine may also cause encephalopathy and seizures via its ability to potentiate the effects of N-methyl D-aspartate (NMDA), an excitatory neurotransmitter.
- - in summarize glycine toxicity in patients who have undergone TURP is uncommon.

TURP Syndrome - Glycine Metabolism

- - in some patients excessive absorption of glycine leads to hyperammonemia (>500 mmol/L)
- - they become nauseated and comatose. (for 10 -12 hours).
- - they awake when ammonia blood level < 150 mmol/L.
- - explanation: arginine deficiency.
- - while having arginine deficiency during TURP they cannot detoxify the excess ammonia produced from glycine metabolism and thus develop hyperammonemia.
- - most common metabolites of glycine are ammonia, glyoxylic acid and oxalic acid.
- - the ornithine cycle in the liver converts ammonia to urea.
- - arginine is an important intermediate product of the cycle.



TURP Syndrome - clinical Signs and Symptoms

- - early clinical signs and symptoms of TURP syndrome are: restlessness, headache and tachypnea.
- - may progress to respiratory distress, hypoxia, pulmonary oedema, nausea, vomiting, confusion and coma.
- - the syndrome has a significant mortality unless it is recognized and treated promptly.
- - signs will be detected earlier in the awake patient.
- - in the anaesthetized patient the only clue may be tachycardia and hypertension.
- - diagnosis can be confirmed by finding a low serum sodium. An acute fall to < 120 mEq/L is always symptomatic.

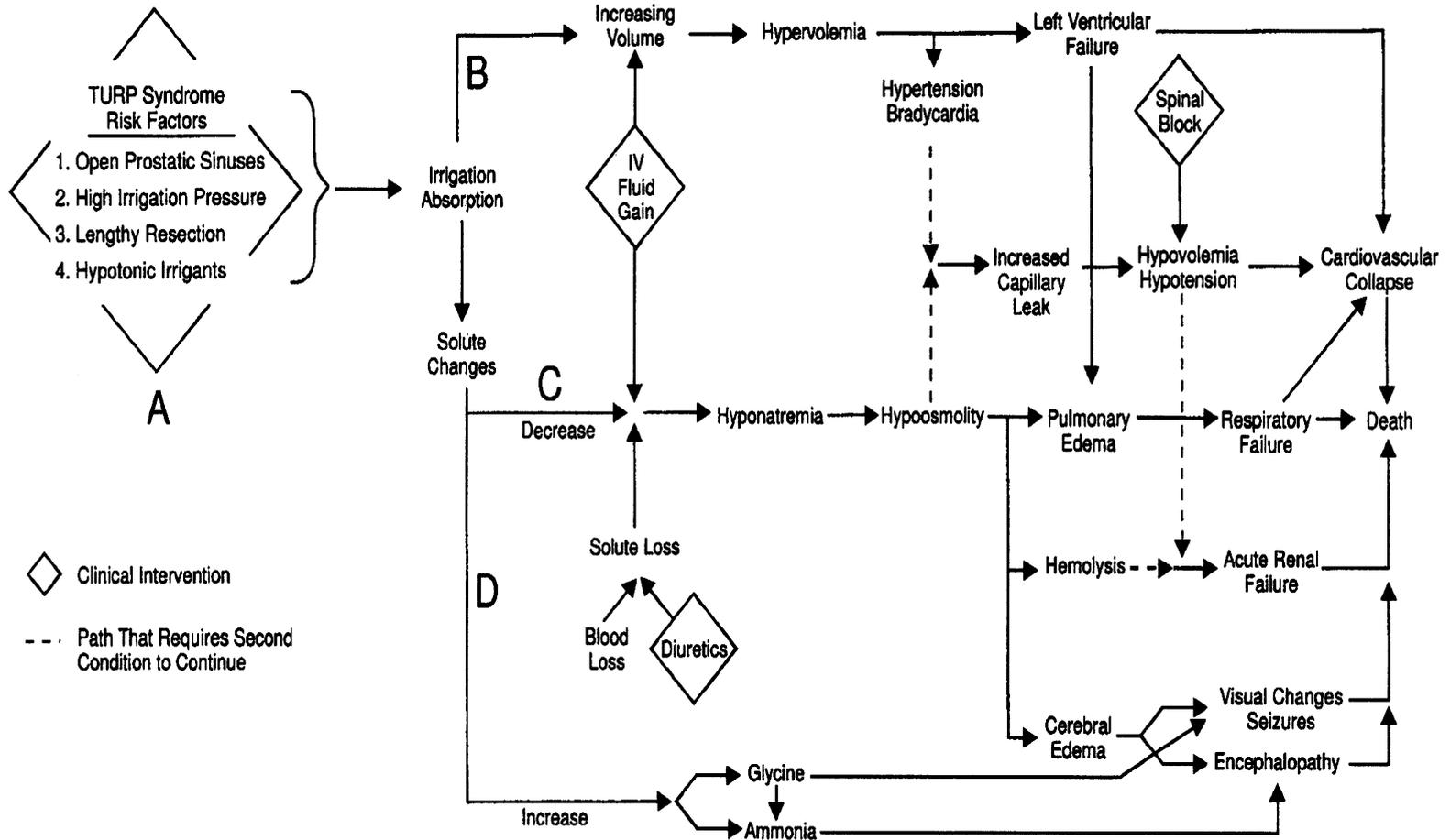
TURP Syndrome - Treatment

- - treatment of TURP Syndrome depends on early recognition and should be based on the severity of symptoms.
- - if detected intra-operatively bleeding points should be coagulated, surgery terminated as soon as possible and iv.fluid should be stopped.
- - the absorbed water must be eliminated : furosemide 40 mg iv.
- - check arterial blood gas, serum sodium and Hb.
- - support respiration with oxygen (nasal cannula or face mask) or intubation and ventilation if required.
- - most patient can be managed with fluid restriction and a loop diuretic.
- - if pulmonary edema or hypotension develops, invasive hemodynamic monitoring is recommended as a guide for pharmacologic support and fluid management.

TURP Syndrome - Treatment

- - symptomatic hyponatremia resulting in seizures or coma should be treated with hypertonic saline (NaCl 3% = 0.513 mmol/ml) until symptoms resolve.
- - the rate of correction should not be more than 12 mmol/L in the first 24 h - rapid administration of hypertonic saline has been associated with central pontine myelinolysis (osmotic demyelination syndrome).
- - seizure activity can be terminated with small doses of midazolam (2-4 mg), diazepam (3-5 mg) or thiopental (50 - 100 mg).
- - endotracheal intubation is advisable to prevent aspiration until the patient's mental status normalizes.
- - in the American Urological Association cooperative study (1989), the incidence of intraoperative TURP Syndrome was 2%, and in 66% of the cases it was corrected simply with diuretics and observation.

TURP - flow chart



TURP - Blood Loss

- - blood loss is difficult to quantify, particularly in prolonged cases. Visual estimation of haemorrhage may be difficult due to dilution of blood with irrigant solution.
- - usual warning signs (tachycardia and hypotension) may be overshadowed by overhydration due to irrigant absorption and effects of the spinal anaesthesia.
- - checking the patient's Hb with a bedside device (*Haemacue*) is useful.
- - blood loss is generally related to the size and weight of prostate tissue excised (normally 15-60 g), the duration of the resection, and the expertise of the operator (blood loss should lie within the range of 7-20 ml per gram of resected tissue).
- - the presence of infection will cause local congestion and hyperaemia, leading to increased bleeding.
- - blood transfusion intraoperatively should be based on the preoperatively hemoglobin, the duration and difficulty of the resection and the clinical assessment of the patients condition.

TURP - Coagulopathy

- - disseminated intravascular coagulation (DIC) appeared to be responsible for severe postoperative bleeding after TURP. (release of thromboplastins from the prostate into the circulation during surgery).
- - up to 6% of patients may have evidence of subclinical DIC.
- - contrary to common misconception systemic coagulopathy is due to DIC, rather than primary systemic fibrinolysis.
- - coagulation profiles of DIC are: low platelets, decreased concentration of fibrinogen, factor V and VIII and high titer of fibrin degradation products.
- - treatment of DIC includes administration of FFP, clotting factors, platelets and blood if necessary - Heparin administration is controversial - consultation with a hematologist is advisable.
- - local release of fibrinolytic agents (plasminogen,urokinase) causes bleeding from the raw surface of the prostatic gland during and immediately after TURP.

TURP - Bladder Perforation

- - the incidence of bladder perforation during TURP is about 1%.
- - perforations mostly occurs during difficult resections (by the cutting loop), some results by overdistention of the bladder with irrigation fluid.
- - can be difficult to recognize in the presence of a spinal block (may mask abdominal pain).
- - perforation extraperitoneal - pain inguinal, periumbilical and maximal suprapubic).
- - perforation intraperitoneal - generalized abdominal pain, shoulder tip pain due to fluid tracking up to the diaphragm, signs of peritonism.
- - small perforations are treated by urethral catheter drainage and antibiotic cover.
- - major perforations are treated by suprapubic cystotomy or formal exploration, repair of the perforation, drainage of the perivesical space.

TURP - transient Bacteremia and Septicemia

- - the prostate is often colonized with bacteria and harbors chronic infections (30% of patients for TURP have infected urine before surgery).
- - TURP facilitates the entry of these bacteria into the bloodstream via open prostatic venous sinuses.
- - bacteremia following TURP is usually asymptomatic and easily treated with antibiotic combinations effective against gr+/gr- bacteria.
- - in 6 to 7% of patients septicemia occur (chills, fever, tachycardia).
- - in severe cases a septic-shock develops with mortality rates between 25 to 75%.
- - in recent years sepsis was the most common cause of death after TURP (American Urological Association cooperative study from 1989).

TURP - Hypothermia

- - elderly patients have a reduced thermoregulatory capacity.
- - appropriate measures to reduce heat loss are: warming blankets (Bear Hugger), heated irrigating solution and warm intravenous fluids.
- - unintentional hypothermia is associated with a significantly higher incidence of postoperative myocardial ischemia.
- - postoperative shivering associated with hypothermia can dislodge clots and promote postoperative bleeding.

TURP - Summary

- - TURP is a common operation performed in an elderly population with many co-morbidities.
- - 7% sustain major complications and about 1% die perioperatively.
- - the main challenges are blood loss and TURP - Syndrome due to excessive absorption of irrigation solution.
- - spinal anaesthesia is the anaesthetic technique of choice, it allows to recognize early signs of TURP - Syndrome and bladder perforation.
- - treat hypotension associated with spinal anaesthesia with vasopressors rather than large amounts of IV crystalloid solution.
- - give blood, rather than further clear fluid, if blood loss appears large and the patient is hypotensive.
- - be happy to have an experienced urologist who cooperates with you during the procedure.