Transurethral Resection of the Prostate

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Introduction

Transurethral resection of the prostate (TURP) is a commonly performed surgical treatment for benign prostatic hyperplasia. Although in recent years technical innovation on several nonablative treatment options has become available, TURP remains the gold standard to date.

Worldwide comparison of different techniques has shown that ablative treatment produces the best outcome. Although the nonablative treatment options have the advantage of minimally invasive surgery, very often patients develop complications (such as urinary retention) that require further intervention.

TURP with currently available equipment remains a safe procedure and has a high success rate. However, it is important to learn this procedure with a strict routine in order to avoid complications and to handle difficult cases such as a large adenoma.

Preoperative Preparation

- Stop aspirin 1 week before operation.
- Rule out and treat any urinary tract infection by urine culture and sensitivity.
- Thrombosis prophylaxis should be started the evening before operation (low-molecular-weight heparin).
- Rectal enema is used the day before the operation.
- Intravenous single dose antibiotics are started at induction.

Anaesthesia

Spinal anaesthesia (for the cooperative patient, maintain intraoperative communication with patient and provide postoperative analgesia) or general anaesthesia.

Strong Indications for Surgery (according to the EAU-Guidelines)

- Refractory urinary retention.
- Recurrent urinary retention.
- Recurrent haematuria refractory to medical treatment with 5-alpha reductase inhibitors.
- Bladder stones.
- Renal insufficiency.

Relative Indications

- Morphological changes in bladder or upper urinary tract secondary to bladder outlet obstruction, such as bladder diverticulum and hydronephrosis.
- Constant and increasing postvoid residue greater than 100 ml.
- Recurrent urinary infection secondary to bladder outlet obstruction.
- Urodynamic findings and prostatic size alone are not absolute indications for surgery. The final decision also depends on the patient’s willingness for surgery.

Limitations and Risks

- Size of adenoma: greater than 50 ml not for beginners, greater than 100 ml only for advanced endoscopic surgeons; the alternative is open adenomectomy.

Contraindications

- Absolute contraindications are active urinary tract infection and uncorrected coagulopathy.
- Relative contraindications: large bladder stone (two-stage procedure—cystolitholapaxy and TURP—recommended), anaesthetic contraindications, acute renal insufficiency secondary to bladder outlet obstruction.
Instruments

- Resectoscope 24-Fr single-flow or 27-Fr/24-Fr continuous-flow rotatable resectoscope (Olympus OES Pro standard resectoscope) with 12° or 0° optics.
- Video camera with rotatable camera head (Olympus Visera).
- HF resection electrodes: band electrode (preferred), thin loop (optional for precision cuts) and roller electrode (coagulation).
- 100-ml bladder syringe.
- 20-Fr irrigation catheter.
- Optional suprapubic catheter (12-Fr) for continuous irrigation during resection.
- Lubricant.
- Electrolyte-free and sterile irrigation fluid, positioned at a height of 50–60 cm above the pubic symphysis.

Operative Technique (Step by Step)

- Lithotomy position.
- Either introduce the sheath of the cystoscope blindly with a trocar or under direct vision (urethroscopy).
- Perform urethrocystoscopy, identify the anatomical landmarks: the verumontanum (seminal colliculus), the prostatic urethra, the bladder neck and the ureteric orifices.
- If prolonged resection is anticipated (adenoma >100 ml), insert a suprapubic catheter to create a low-pressure continuous-flow circuit during resection.
- Check the position of the ureteric orifice before beginning resection at the 6 o’clock position. Resect a trench from the bladder neck to the verumontanum for orientation.
- Cutting technique: hold the sheath with the nondominant hand and fix it with the little and ring fingers onto the pubic area, so that the tip of the sheath lies at the level of the verumontanum so as to stop the loop resecting distally from the verumontanum.
- Enlarge the trench from 5 to 7 o’clock, to the circular muscle fibres of the bladder neck (internal sphincter) and the fibres of the prostatic capsule are visible. Beware: undermining of the bladder neck can happen with overzealous resection.
- With a prominent median lobe, start resecting the median lobe first.
- Beware: start resection of the median lobe from the surface and not the base. Otherwise a big median lobe remnant will fall into the bladder and it will be difficult to retrieve.
- Resection of the left lobe: starting from the established trench, the direction of resection is from 5 to 2 o’clock. At any point, deepen the resection from the adenoma surface down to the capsule.
- Refrain from resecting the bladder neck and apical region at this stage.
- Resection of the right lobe: the same technique as the left lobe, except starting from 7 to 10 o’clock.
- During resection of the lateral lobe, a tilting movement of the sheath should accompany the outward movement of the loop, because the prostate is apple-shaped rather than a cylinder.
- Resection of ventral tissue: position the sheath at the level of the verumontanum, then rotate the sheath 180° to start from 10 to 2 o’clock.
- Beware: secure the sheath at the level of the verumontanum by fixing it with a nondominant hand onto the pubic symphysis. Distal migration of the sheath may cause inadvertent resection and damage to the urethral sphincter.
- Apical resection: for a small piece of residual tissue, grasp it between the loop and the end of the sheath before resecting it by activating the current through the loop.
- Resection at the posterior bladder neck: identify the ureteric orifices first, then resect any residual obstructing tissue to create a smooth
transition from the bladder to the prostatic cavity.

- Finally, ensure hemostasis, in particular venous bleeding, by using the roller ball and stopping the irrigation fluid temporarily.

- Introduce a 20-Fr three-way catheter, inflate the balloon with 30 ml water. Apply slight traction on the catheter so that the balloon is positioned at the bladder outlet (to occlude the prostatic cavity) by tying a gauze swab on the catheter right at the tip of the penis, and then start irrigation.

**Operative Tips**

- With a band electrode, an electro-vaporization effect can be achieved with improved coagulation and concurrent cutting. (Tip: to produce an optimal vaporization effect, apply slow movement of this resection loop.)

- Do not resect in several places, as bleeding will obscure the view and it becomes difficult to control.

- Check completeness of resection with an empty bladder.

- Large adenomas:
  - To create a long resection trench, one can move both the loop and the sheath in a craniocaudal direction during resection. (Beware: sheath movement may make orientation more difficult during resection).
  - Follow exactly the same resection technique as described above. At any time, sufficient haemostasis should be achieved after complete resection of one lobe. This enables stopping the procedure if necessary when complications occur.
  - Differential resection: quick resection over the surface of the adenoma is possible without adequate coagulation; however, as the capsule is being approached, slower resection with adequate haemostasis is necessary.

- Two-stage resection: if necessary a second resection can be performed 2–3 days after the first procedure. (A second intervention is not a sign of shame but a sign of wisdom).

- Capsular bleeding can be aggravated by excessive coagulation which causes capsular rupture. Instead, coagulation should avoid the vascular lumen but aim at the area around the blood vessels.

- Check the patient’s blood pressure with the anaesthetist near the end of the procedure, as hypotension can obscure any bleeding point.

- To control persistent bleeding from the prostatic capsule, position and inflate a catheter balloon in the prostatic cavity. Inflate the balloon to 10 ml in the bladder first and then pull it into the prostatic cavity before further inflation of the balloon. A safer and better way is to place the catheter and balloon in the prostatic cavity under radiographic monitoring (or digital rectal control). No catheter traction should be applied in these cases.

- It is important to safeguard the catheter while the patient is transferred off the operating table, as inadvertent traction of the catheter can cause bleeding.

- Fixation of the resectoscope by the nondominant hand of the operator.

- The tip of the sheath of the resectoscope is fixed at the level of the verumontanum by maintaining a constant position with the middle and ring finger at the region of the symphysis pubis. In this position, one is able to rotate the resectoscope without any longitudinal shift in position. An injury to the external sphincter causing incontinence is thereby avoided.

- The correct fixation of the resectoscope is especially important to the beginner during resection of the lateral lobes and the ventral part of the adenoma. During these steps of the procedure, the verumontanum is not visible. Repeated visualization of the verumontanum
during the procedure is recommended to ensure a safe anatomical reference point.

**Postoperative Care**

- When the irrigation fluid becomes clear, catheter traction can be released up to 4 h.
- Continue irrigation of the bladder overnight.
- If there is no complication, the catheter can be removed 2 days after operation.

**Common Complications**

- **Bleeding:** Watch out for macroscopic haematuria in the recovery area, endoscopic re-interventions may be necessary. Bleeding requiring transfusion occurs in 3.9% of patients [3].
- **Undermining of the bladder neck:** If the defect is large, stop the procedure after haemostasis, insert a guidewire into the bladder through the sheath, remove the sheath and then slide a catheter over the guidewire into the bladder. Leave the catheter in for 5 days before further intervention.
- **Inadvertent peritoneal puncture during suprapubic catheter insertion** may cause intraperitoneal fluid leakage during TUR with continuous irrigation. Stop resection, insert a 10-mm laparoscopic port midway between the umbilicus and the anterior superior iliac spine, insert a drain through the port before port removal.
- **Capsular perforation with entry into the periprostatic venous plexus** may lead to TUR syndrome.

**TUR Syndrome**

Intravascular absorption of a large volume of irrigating fluid without electrolytes during transurethral resection of the prostate can cause a so-called TUR syndrome.

- **Pathophysiology:** hypo-osmolar, electrolyte-free, hypotonic hyperhydration (hypervolaemic, hypo-osmolar, hyponatraemia, acidosis). First of all, nonspecific clinical symptoms (frequent yawning, agitation, feeling cold, periphery cyanosis), sudden development of hyper- or hypotension with bradycardia, then quick development of circulatory disturbance, hyponatraemic shock with kidney failure, brain and lung oedema possible.
- **Treatment:** patient should be managed in the intensive care unit, given 100% oxygen, replace sodium only if serum sodium is below 120 mmol/l and at a rate of not more than 10 mmol/h (very slow infusion with 200 ml hypertonic 3% normal saline). Give Lasix in every case and in certain cases also give mannitol. To improve left ventricular function, give nitrate and dobutamine.
- **Prophylactic measures:** limit the hydrostatic pressure of the irrigating fluid to 50–60 cm water, limit the operating time of resection (60 min of resection time) and close patient monitoring, optimized by regional anaesthesia.
- **2% volume ethanol** can be added to the irrigation fluid routinely. With the concurrent measurement of expiratory alcohol concentration with an alcometer, real-time monitoring of the absorption of irrigation fluid (Widmark-formula) can be measured and then TUR syndrome can be avoided [1, 2].

**Postoperative Complications**

- **Haematuria** (beware: recurrent bleeding is possible weeks after operation).
- **Clot retention** (3.3% [3]) leading to a blocked irrigation catheter. Beware: the clot may lead to short-circuiting of the irrigation fluid and can give a false impression of clear effluent.
- **Urinary tract infection** (documented by culture) 2.3% [3] including epididymitis.
Late Complications

- Urethral stricture 3.8% [4]. With 24-Fr resectoscope, incidence is less than 2%. It is unnecessary to do a preliminary Otis urethrotomy before TURP.
- Bladder neck stenosis 4% [4] (treatment: endoscopic incision at 5, 7 and 12 o’clock position).
- Stress incontinence 2.2% [4].
- Sexual dysfunction (retrograde ejaculation 65%–70% [4] and erectile dysfunction 6% [4]).

New Developments

Transurethral resection in saline. A new class of resectoscopes combined with special high-frequency generators makes resection in saline possible. In contrast to conventional TUR, the new resectoscopes integrate both electrodes within the instrument, making the earth plate unnecessary. Since the high-frequency current is delivered via the resection loop to the sheath of the resectoscope, there is no uncontrolled flow of current through the patient’s body. Due to the use of saline as irrigation medium, the risk of TUR syndrome is reduced significantly.

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References

4. European Association of Urology: guidelines for BPH, 2004
**Fig. 9.1.** 3D diagram of anatomical landmarks for TURP. Endoscopic views of lateral lobe adenoma at the bladder neck *(right top)* and lateral lobe adenoma at the level of the verumontanum *(right bottom)*

**Fig. 9.2.** Step 1: Trench resection from the bladder neck to the verumontanum starting at 6 o’clock position
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