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Typical Complications Following Surgery for Benign Prostatic Hyperplasia

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Abstract: The article presents a comparative analysis of various surgical techniques used in the treatment of patients with prostate adenoma. It evaluates the standardization of transurethral resection of the prostate (TURP) as the "gold standard" in relation to transvesical extraurethral adenomectomy. According to both domestic and international sources, as well as the authors' own data, postoperative complications occur in 28.7% to 100% of cases following TURP due to incomplete removal of hyperplastic tissue, whereas after radical extraurethral adenomectomy, complications are observed in only 5.6% of cases. Therefore, open transvesical or retropubic extraurethral adenomectomy demonstrates significantly better short- and long-term outcomes compared to the "closed" transurethral resection of the prostate.

Key words: transurethral resection, extraurethral adenomectomy, prostate adenoma, retropubic adenomectomy

Standardization represents a system of regulatory documents that establish unified norms, rules, and requirements authorized by competent governing bodies [1]. Within surgical urology, standardization pertains to the establishment of model approaches to operative interventions, particularly for benign prostatic hyperplasia (BPH). These standards are formulated on the basis of clinical and pathological investigations conducted according to a defined methodological framework. The principal objective of surgical standardization is to ensure uniform requirements for operative techniques, thereby enhancing the quality of surgical performance and improving postoperative outcomes. The standardized technique of transurethral resection of the prostate **(**TURP) for benign prostatic hyperplasia includes several procedural modifications: 1.Pseudo-TUR involves the excision of only a limited portion of hyperplastic tissue, typically at the bladder neck or middle prostatic lobes, resulting in the formation of a "urinary channel." 2.Portional TUR entails the removal of approximately 30–80% of hyperplastic tissue, creating a cone-shaped channel between the bladder and prostate. This approach may be categorized as either palliative or subtotal. 3.Total TUR (transurethral adenomectomy**)** is characterized by the resection of up to 100% of hyperplastic tissue, which some authors [2,3] equate with open adenomectomy. 4.Radical (subradical) TUR involves the excision of the entire prostatic parenchyma together with its capsule [4].

Complete removal of BPH tissue along with the fibrous capsule via resectoscope loop, however, is technically unfeasible due to the presence of an intracapsular venous network. Injury to this network is frequently accompanied by significant intraoperative bleeding. Moreover, full excision of the prostate by this method carries the risk of damaging the paraprostatic venous plexus.

The primary clinical indication for TURP in BPH is the relief of lower urinary tract symptoms. The likelihood of symptomatic improvement reaches up to 88%, according to data from the ANSRK (1994). In 1996, the World Health Organization (WHO) formulated and recommended standardized indications for TURP in BPH for clinical validation, including: Prostate volume less than 60 cm^3;Presence of obesity or severe cardiovascular comorbidities; Previous surgical interventions on the bladder, prostate, anterior abdominal wall, or intestines; Unsatisfactory outcomes following previous non-surgical or minimally invasive treatments (e.g., hyperthermia, thermotherapy, laser therapy); True or false recurrences of the disease; Long-term failure of conservative management, including pharmacotherapy; Coexistence of adenoma with chronic prostatitis or prostatic calculi.

A considerable number of urologists emphasize that the success of TURP largely depends on the technical proficiency and experience of the operating surgeon, as this procedure remains among the most complex and technically demanding within the domain of transurethral endosurgery [5]. The extent of tissue resection is determined by the surgeon's expertise; however, the operative duration should not exceed one hour, as prolongation is directly associated with an increased risk of intraoperative bleeding and other postoperative complications [3,5,6].

According to **A. Z. Vinarov et al. [5],** the effectiveness of transurethral resection of the prostate (TURP) for benign prostatic hyperplasia (BPH) is **not determined by the volume** of hyperplastic tissue, provided that the **operation duration does not exceed 90 minutes**.

When performing TURP, the **seminal colliculus (verumontanum)** serves as the **distal landmark** of resection, while the **bladder neck** and **interureteric ridge** define the **proximal boundary** of the operative field. Disregard for these anatomical landmarks may lead to **injury of the ureteric orifices or perforation of the bladder wall.** Resection distal to the seminal colliculus is contraindicated**, as** it poses a high risk of **damage to the external urethral sphincter**, which lies in close proximity. The seminal colliculus forms an integral component of the voluntary urethral sphincter complex. The **choice of surgical technique** for adenomectomy is guided by the degree of invasiveness, radicality of resection, and anticipated complication profile. Additional factors influencing the decision include procedural accessibility, cost-effectiveness, and the expected impact on patients' quality of life. A key indicator of the **disability potential** associated with any surgical procedure is the **extent and nature of tissue injury** during intervention. The surgical approach must adequately correspond to the radical stage of the operation [7,8]. In this regard, **open adenomectomy** remains a leading method both in terms of **radicality** and **operative trauma** [8].

In contrast, during **TURP**, the actual degree and distribution of tissue damage to the prostate, prostatic urethra, and bladder remain **concealed**, reflecting the "hidden" nature of invasiveness inherent to endoscopic techniques. The procedure involves staged resection of the **prostatic urethra, bladder neck,** and **interadenomatous BPH tissue.**

Excision of prostatic parenchyma along with adenomatous tissue leads to **structural disruption** and **functional impairment** of the gland. During TURP, the **excretory ducts** of the main prostatic glands are transected, resulting in loss of anatomical continuity and disturbance of acinar secretory function. Consequently, in the residual prostatic parenchyma, **inflammatory changes** tend to intensify, with certain studies reporting this occurrence **in up to 100% of cases** [9].

Following TURP, an **internal postoperative cavity** is formed within the adenomatous bed, bordered by the **surgical capsule** on one side and a **defect in the inferior bladder wall** on the other. This cavity remains lined by **thermally altered tissue**, a byproduct of electrosurgical resection

During the **healing phase** of the postoperative wound surface, **necrotic and thermally damaged tissue** is gradually rejected in the form of a scab. In certain cases, this process is accompanied by **episodes of intravesical bleeding**, typically occurring on the **7th–8th, 13th–14th, and 21st postoperative days** [10]. As regeneration progresses, the wound surface becomes covered with **granulation tissue**, which is subsequently replaced by **urothelial epithelium** proliferating from the mucosal margins of the bladder and urethra.

Epithelialization and wound cleansing are protracted processes, usually requiring **6 to 18 months** for completion. Over this period, the postoperative cavity transforms into a **"pre-bladder"**—a permanent residual chamber located between the bladder lumen and the resected proximal urethral end. Within this pre-bladder cavity, **urinary calculi** may form, while **chronic inflammation** and **persistent dysuria** are commonly observed. Thus, instead of a transient surgical incision in the anterior abdominal wall, the patient is left with a **permanent internal wound cavity**, paradoxically associated with the so-called **"gold standard"** technique of TURP for benign prostatic hyperplasia.

By contrast, in **open (transvesical) adenomectomy**, the postoperative wound of the anterior abdominal wall and the bladder wall incision typically **heal within 2–3 weeks**, coinciding with the

restoration of spontaneous micturition. Consequently, the **functional and recovery outcomes** following open adenomectomy are often superior to those achieved after TURP.

At present, however, **transvesical extraurethral adenomectomy** remains **insufficiently mastered** by many urologists and surgeons worldwide. In numerous institutions, this technique is only beginning to gain recognition, whereas **TURP is regarded as a "prestigious" procedure**. Nonetheless, before performing such technically demanding endoscopic surgery, it is imperative that urologists first acquire proficiency in **open adenomectomy**, as intraoperative complications during TURP frequently necessitate conversion to a transvesical approach to achieve **adequate hemostasis**. The feasibility of **TURP for BPH** is further constrained by anatomical and technical factors. The **urethral lumen** must be sufficiently patent to accommodate the **resectoscope sheath**, whose external diameter must be **smaller than the urethral caliber**. In clinical practice, **cystoresectoscopes of size No. 24 or 27** are most commonly used; however, their introduction often requires **preliminary urethral bougienage**, as the urethral diameter in many patients is naturally smaller. **Forced insertion** of an oversized resectoscope can result in **mucosal desquamation** or even **urethral wall perforation**, which subsequently predisposes the patient to **cicatricial urethral stricture formation** [9]. TURP for BPH is considered technically feasible only when the **functional bladder capacity exceeds 100 mL** and is **contraindicated** in the presence of **vesicoureteral reflux, bilateral or unilateral ureteropyeloectasia**, or when **bladder tumors** and **diverticula** are present within the resection zone. Additionally, TURP is contraindicated in patients exhibiting **varicose dilatation of the bladder neck and urethral veins**, owing to the heightened risk of **intraoperative hemorrhage**.

During **transurethral vaporization** of benign prostatic hyperplasia (BPH), the **electric current intensity** is typically **25–50% higher** than that used in standard transurethral resection (TURP). As a result, the **depth of coagulation necrosis** is approximately **tenfold greater** than that observed during conventional TURP, which significantly reduces intraoperative bleeding. However, due to the extensive zone of thermal injury, the **rejection of necrotic tissue** during postoperative reparative processes occurs **considerably more slowly** than after standard resection.

Despite this, **intravesical bleeding** may also accompany the postoperative period following vaporization. Nevertheless, endourologists frequently emphasize the **relative intraoperative advantages** of vaporization compared with traditional TURP, particularly the **markedly reduced bleeding intensity** during the procedure [6]. Yet, despite these limitations, this method continues to be regarded as part of the so-called **"gold standard"** in the surgical management of BPH.

The **primary cause of intraoperative bleeding** during TURP is injury to **large arterial branches** supplying the hyperplastic prostatic tissue. Additional bleeding may arise from **dilated venous sinuses** or **varicose veins** within the vesicourethral segment, as well as from **capsular perforation** involving the sub- and intracapsular venous plexuses. The **base of the adenomatous complex** is closely adherent to the **bladder neck**, and during resection of the vesicourethral segment, the **fibrous capsule** of the prostate is easily breached. Injury to a **neighboring venous sinus** can result in **massive hemorrhage** and **bladder tamponade**. These venous sinuses can occasionally exceed the **diameter of the resectoscope**, posing a significant technical hazard [9]. When such bleeding occurs, transurethral resection must be **immediately discontinued, as electrocoagulation** is often ineffective for large venous trunks. In cases where **bleeding persists beyond 24 hours** despite conservative management, **open surgical intervention** becomes necessary to **remove residual adenomatous tissue** and achieve **definitive hemostasis**. Surgical correction of the vesicourethral segment following TURP is technically far more challenging than during **extraurethral adenomectomy**. Overall, **postoperative complications** occur in **28.7–100% of TURP cases**, compared to only **5.6%** following **extraurethral adenomectomy** [4,9,11,13]. One of the most serious complications is **water intoxication (TUR syndrome)**, which necessitates urgent correction of water–electrolyte imbalance, hemodynamic stabilization, and sometimes **extracorporeal hemodialysis. Acute inflammatory complications** after TURP occur in approximately **13% of cases**, often manifesting as severe **purulent-destructive infections** of the scrotal organs or bladder, requiring emergency surgical intervention (e.g., **orchiepididymectomy, percutaneous or open epicystostomy**).

In the **late postoperative period**, patients may develop **urethral strictures** and **fibrotic changes of the bladder neck**, occurring in up to **18%** of cases, while **bladder neck sclerosis** develops in approximately **15%**. The **incidence of retrograde ejaculation** following TURP remains notably high, ranging from **75% to 93%** [11]. Considering the wide spectrum of **TURP-related complications** including **iatrogenic injury** to the bladder, urethra, and prostatic capsule; **perforation** of the fibrous capsule; **disruption** of the proximal urethral sphincter; **loss of the bladder's contractile apparatus**; and the formation of a **persistent pre-bladder cavity** due to incomplete removal of adenomatous tissue it becomes difficult to characterize this method as a genuine **"gold standard."** By contrast, the **immediate and long-term outcomes** of **endourethral adenomectomy** (as described by **Fedorov Freyer**) are largely comparable to those of TURP.

However, the Fedorov Freyer procedure allows for **radical excision of adenomatous tissue** while preserving the **surgical capsule**, whereas TURP invariably results in **residual adenomatous fragments** remaining within the prostate. Analysis of the outcomes of **over 300 performed adenomectomies** demonstrates that the **extraurethral adenomectomy** represents the most effective method of **open surgical management of benign prostatic hyperplasia.** This approach exhibits **distinct clinical and functional advantages** over other surgical techniques including **transurethral resection of the prostate (TURP)** as consistently reported in both **domestic and international medical literature.**

Conclusion. Thus, open transvesical extraurethral adenomectomy demonstrates clear superiority over closed transurethral resection of the prostate (TURP**)** in virtually all key clinical parameters including the radically of adenomatous tissue removal, preservation of anatomical and functional structures, incidence of postoperative complications, duration of the rehabilitation period, and the restoration of spontaneous, complete urination. Consequently, defining TURP as the so-called "gold standard" of surgical management for benign prostatic hyperplasia does not correspond to the fundamental principles of standardization and least of all to the notion of a truly "gold" standard. In patients presenting with adenomatous enlargement confined to the lateral lobes of the prostate, classical retropubic adenomectomy, performed with preservation of the prostatic urethra and the integrity of the urethral and dorsal vascular plexuses, is typically carried out without intraoperative difficulties or notable complications. In such cases, urination is restored immediately following the removal of the urethral catheter. An incision of the soft tissues of the anterior abdominal wall and the anterior surface of the prostatic capsule provides optimal access for the least traumatic and most radical excision of adenomatous tissue, offering a safe and well-tolerated surgical option for patients with BPH, irrespective of age. One may therefore reasonably question: for whom, in fact, is TURP the "gold standard"? Perhaps only for the operating surgeon, who "tours" the patient intraoperatively and then discharges them within 24 hours for outpatient follow-up while the patient's ordeal only begins thereafter. Many such patients subsequently face persistent dysuria, incomplete urination, or a spectrum of postoperative complications, including gross hematuria, intravesical bleeding, post-TURP prostatitis, cystitis, orchiepididymitis, acute or chronic pyelonephritis, urinary incontinence, urethral stricture, and bladder neck sclerosis, among others.

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