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COMPARATIVE EVALUATION OF MONOPOLAR AND BIPOLAR TRANSURETHRAL RESECTION OF THE PROSTATE

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The article discusses the author's experience with monopolar (M-TURP) and bipolar (B-TURP) transurethral resection (TUR) of the prostate for benign prostatic hyperplasia (BPH) performed in a total of 49 patients, approximately the same number of patients in each group, in three private clinics. Information from modern urological literature on the technical characteristics of operations, indications and complications are given.

The main purpose of the article is to give recommendations to general practitioners and novice urologists for adequate preparation of patients with BPH for TUR of prostate surgery, optimization of the choice of endourological instruments and irrigation solutions, taking into account reduction of intraoperative complications.

It has been revealed that with a large prostate gland (> 70 g), bipolar resection of the prostate gland is a relatively safe method of resection compared with monopolar resection, taking into account the risk of TUR syndrome. It is confirmed that epidural anesthesia is preferable to spinal one, especially in simultaneous operations, taking into account the control of postoperative pain. Antibacterial treatment 24 hours before surgery reduces the risk of developing postoperative infection in patients with acute urinary retention and / or when handling the Foley catheter *in situ*. In this study, no significantly higher urethral stricture frequency has been found in the bipolar group. It has also been established that chronic urinary tract infections (chronic epididymitis, chronic prostatitis) in elderly men are not a contraindication for performing surgically "clean" operations in the inguinal-scrotal region.

Key words: *prostate gland, benign prostatic hyperplasia, monopolar transurethral resection, bipolar transurethral resection, transrectal ultrasound, elderly men, indications and contraindications for surgery, intraoperative complications.*

Benign prostatic hyperplasia (BPH) is the most common disease of the genitourinary system in older men, but may appear as early as the age of 40–50 years. The social significance and topicality of this problem are emphasized by demographic studies indicating a significant increase in the population of the planet over the age of 60, whose rates significantly outpace the growth of the population as a whole [2].

Until recently, and especially in the countries of the former CIS, the term "prostate adenoma" was most widely used. However, today the overwhelming majority of specialists in the world recognize the

definition of "benign prostatic hyperplasia," which most fully reflects the pathogenesis of the disease and its histological features. The change in terminology was the result of large-scale studies that confirmed the non-specificity of the symptoms and clinical manifestations observed in BPH [2, 8].

Preparing a patient with BPH for transurethral resection (TUR), inpatient treatment and postoperative rehabilitation is a multifaceted process that has a number of features related to age, moral and ethical, socio-economic, cultural and other factors [4]. It is necessary to remember the features of these diseases, such as diabetes mellitus, arterial hypertonia, coronary heart disease [1]. Despite the fact that digital rectal examination is the simplest, cheapest and safest method for diagnosing BPH and this technique has not been canceled, the correct interpretation of the results of digital rectal examination largely depends on the experience and classification of the doctor [3]. But in the conditions of modern medicine, general practitioners often refer patients for instrumental examinations for diagnosis, and sometimes for patient satisfaction, especially in private clinics. Ultrasound examination (ultrasound) of the pelvic organs is widespread because of the relative simplicity, safety, high information content and accessibility for the public [6]. Often, patients with BPH come to the urologist already with the results of ultrasound, only to learn an alternative opinion. The appearance and development in recent years of a huge variety of ultrasound machines have made this method in the diagnosis of BPH the leading. Although classical radiologists of ultrasound in most cases do not hinder the transfer of their methods to urologists, it is impossible to keep the progress and development of technology, especially in conditions of competition between private clinics and insurance medicine. An increasing number of practicing urologists master ultrasound diagnostic techniques, which are actively used in their work [3, 6].

In everyday practice in urology, two main methods of ultrasound are used: transabdominal and transrectal. During a transabdominal ultrasound scanning of the kidneys, bladder and prostate gland is performed, the state of the kidney parenchyma, the change of the renal pelvis system, the mobility of the kidneys, the state of the ureters are evaluated. The study allows to quickly and effectively visualize the bladder, to determine of residual urine volume. The disadvantage of the method is the low quality of visualization of the parenchyma of the prostate gland, a large error in determining its size and volume (especially if it is difficult for urine to accumulate in the bladder), the dependence of the obtained data on the qualifications and skills of a specialist. We must remember that an integral part of the ultrasound of the prostate is the determination of residual urine volume [3, 6].

The "gold standard" of instrumental examination of the prostate gland is transrectal ultrasound (TRUS). It is performed by a rectal sensor, which is injected into the patient's rectum, in the lying position on the left side, with the knees tucked into the stomach [3, 6, 8]. In the transrectal study, the ultrasound sensor is located in close proximity to the prostate gland, which can significantly improve the quality of visualization and give the most accurate definition of the size, volume and condition of the tissues (presence of tumors and destruction sites) of the prostate gland. TRUS is especially effective for patients who have undergone TUR surgeries, but still complain of difficulty urinating (Figure 1).

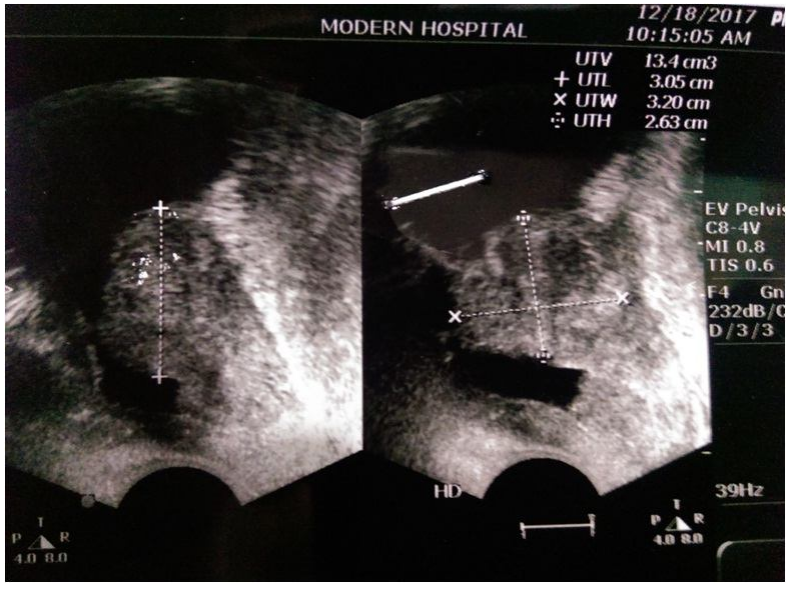

Figure 1. Transrectal ultrasound examination of the prostate after TUR surgery. The node of the lateral lobe of the prostate is not resected and causes obstruction of the posterior urethra

In a modern urological clinic, there are enough research methods for making a definitive diagnosis of BPH for a patient and the choice of surgical treatment tactics. Treatment tactics include:

- Definition of indications and contraindications (absolute and relative) for surgical treatment;
- Determination of the type of surgery and the specific methodology of the selected operation;
- Exclusion or delay of the operation and the appointment of conservative (or palliative) therapy [4, 10].

TUR of the prostate gland is the "gold standard" for treatment of BPH with a volume of the prostate gland (RV) of no more than 80–100 cm^3. TUR is a type of endoscopic electrosurgical operation, in which the removal of tissues (resection) and vascular coagulation are carried out by a high-frequency current with the help of a special instrument – a resectoscope, conducted along the urethra. The resectoscope consists of metal tubes, optics, an electrotome and a special resection loop. The operation consists in removing the prostate tissue with this loop, which is inserted into the prostatic urethra by a resectoscope [2, 8, 9].

Absolute indications for the implementation of TURP (according to the European Association of Urology – EAU Guidelines) are:

- refractory (refractory to treatment) urinary retention;
- recurrent (repeating) urinary retention;
- recurrent hematuria, which is not amenable to drug treatment with 5-alpha-reductase inhibitors;
- bladder stones;
- renal failure due to BPH[8].

Relative indication for TURP surgery is:

- morphological changes in the bladder or upper urinary tract, such as bladder diverticulum or hydronephrosis caused by prostate infrasive obstruction;
- chronic and recurrent urinary tract infection caused by intravesical obstruction;
- a constant and increasing residual urine volume more than 100 ml.

It is important to remember that urodynamic indicators and the size of the prostate gland are not an absolute indication for surgery. The final decision also depends on the patient's readiness for surgery, economic, social and other reasons [4, 8, 10].

There are also absolute and relative contraindications for the implementation of TUR of the prostate gland. Depending on the experience and qualifications of the urologist, the technical equipment of the endourological surgical unit, as well as the qualification level of the anesthesiology team and the medical staff of the operating unit, the ratio of absolute and relative contraindications changes [7, 11]. Contraindications include the following diseases and conditions of the patient:

- acute inflammatory diseases of the urinary and other organs and systems;
- uncorrected coagulopathy;
- ureteral stones and bladder more than 2 cm in diameter;
- coxarthrosis;
- lengthed (more than 1 cm) strictures of the urethra;
- narrow urethra (diameter of the urethra is smaller than the diameter of the resectoscope tube available);
- long urethra (the length of the urethra is longer than the length of the resectoscope tube available);
- varicose veins of the bladder neck;
- vesicoureteral reflux;
- large bladder diverticulum;
- bladder tumors;
- small bladder (less than 100 cm^3);
- patients of reproductive age and with preserved sexual activity, especially those who plan to start a family.

Adenoma size more than 50 ml is not for novice surgeons, more than 100 ml is only for experienced endoscopic surgeons, the alternative is open adenomectomy.

Monopolar TUR (M-TUR) is the earliest and most common configuration of transurethral resection. High-frequency current from the resection (coagulation) generator is fed to the resectoscope held by the urologist. The current density is high, and when this electrode touches the tissues of the body, a pronounced effect of local heating on the tip of the resection loop occurs. The tissue is removed by "shave off" the pieces

of the prostate. The current then spreads throughout the body and returns to the generator through the patient plate (often incorrectly referred to as the "ground plate"). This plate should be in good contact with the patient (often on the gluteal region) on an area of at least 70 cm^3. Improper use of the patient plate is the most common cause of failure of resection and coagulation, as well as accidental burns in the area of the plate [10]. In addition to the high-frequency current generator, the system for electrical resection also includes an illuminator, an optical fiber, a fluid supply system, and a foot-pedal control (Figure 2) [10].

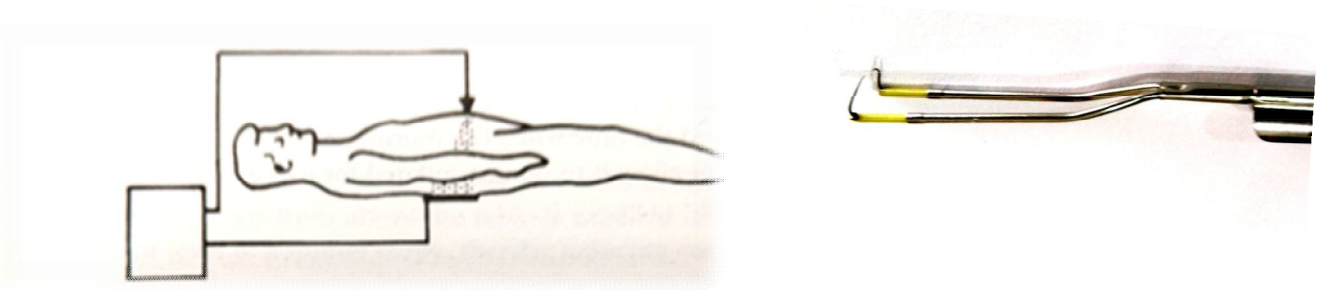

Figure 2. Diagram of current flow pattern for monopolar resection and cutting loop

M-TUR typically uses a 3.2 % Turusol solution per 3000 ml for irrigation of the bladder. The solution contains 2.7 % sorbitol, 0.54 % mannitol and water for injection, which does not contain electrolytes [5]. During M-TUR of the prostate, a certain amount of irrigation fluid enters the blood through intravascular absorption of the solution, which can lead to undesirable TUR syndrome – arterial hypotension, tachycardia, nausea, vomiting, and pulmonary edema due to hypo-osmolar overhydration.

Prevention of TUR syndrome should include: the hydrostatic pressure of the Trusol irrigation solution should not exceed 50 cm H_2O, the resection time should not exceed 60 minutes, it is desirable to operate the patient under regional (spinal or epidural) anesthesia to control consciousness and the early manifestations of TUR syndrome (restlessness, confusion, shortness of breath and weakness) [5, 10]. It should be noted that not only the volume and composition of the irrigation solution, but also the initial level of azotemia affects the half-life of the absorbed liquid. Therefore, renal tests (urea, creatinine, uric acid) must be included in laboratory tests in the preoperative preparation of a patient with TUR surgeries [1, 7].

Bipolar TUR (B-TUR) is identical to the traditional TUR method. The bipolar resectoscope is also connected to a high-frequency generator, and isotonic saline is used as a solution for irrigation (0.9 % NaCl to 3000 ml). Unlike the monopolar resectoscope, the current does not pass through the patient's entire body, but is limited by the distance between the electrodes (active and passive) of the resection loop inside the resectoscope. Bipolar resection also eliminates the need for a plate and uses significantly less energy. During irrigation, NaCl is not absorbed into the bloodstream by intravascular absorption and the likelihood of TUR syndrome decreases sharply [4, 8, 11, 12] (Figure 3).

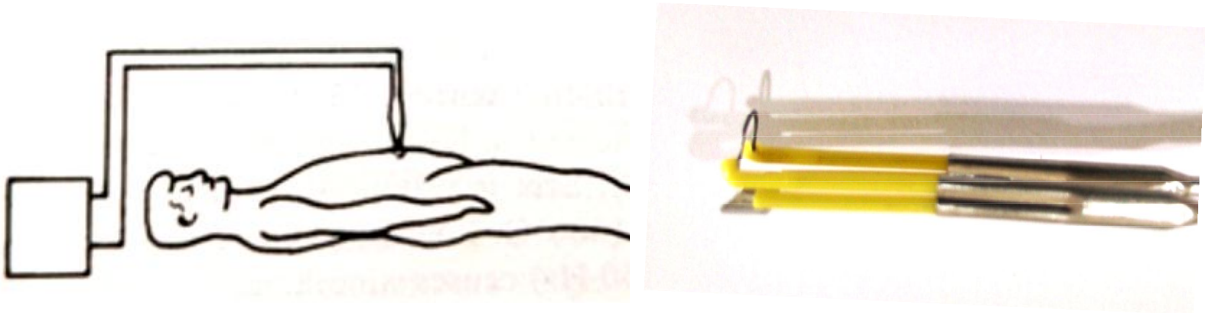

Figure 3. Diagram of current flow pattern for bipolar resection and cutting loop

However, it is necessary to fully realize that isotonic solutions cannot prevent severe heart and pulmonary insufficiency, in cases of absorption of a large volume of irrigant. Accordingly, B-TUR offers a theoretical advantage of allowing more time to perform the resection and control of hemostasis. Some authors believe that B-TURP may be associated with a higher frequency of urethral strictures. Despite its increasing use, B-TURP has not yet become a "new standard" [8, 9].

It should be noted that TUR-operations have intraoperative, early and late complications. For example, according to various literature, intraoperative bleeding is up to 3.3–7.2 %, acute inflammation of the urinary tract (including epididymitis) is 1.5–2.3 %, urethral stricture – 3.8–7.6 %, cervical perforation – 1.2 %, bladder neck sclerosis – 3.5–4.0 %, retrograde ejaculation – 65–70 %, erectile dysfunction – up to 6 % [8, 10, 11].

We have performed 49 operations, of which 24 (49 %) of the B-TUR, 25 (51 %) of the M-TUR surgeries. The age of patients ranged from 55 to 85 years (Table 1). The total volume of the prostate was from 45 to 80 g. Acute urinary retention, often caused by prostate infrasing obstruction, was observed in 10 patients with an average age of ~ 70 years. Simultaneous operations –TURP + hernioplasty by Liechtenstein, for BPH and inguinal hernia, were performed in a total of 17 patients. Of the 49 patients, 7 patients underwent simultaneous endoscopic surgery for urolithiasis – posterior urethral stricture (3), cystolithotripsy (2) and ureterolithotripsy (2). One patient (63 years old, B-TURP surgery) was diagnosed with prostate cancer during histopathological examination (TURP material). At the next stage, this patient was undergoing open radical prostatectomy in a planned manner.

Table 1

Distribution of patients by age groups, types of operations, concomitant surgical diseases, anesthesia and complications

Age groups	The number of patients	Frequency, %
55-60	7	14.2
60-65	15	30.6
65-70	11	22.4
70-75	8	16.3
>75	8	16.3
Transurethral resection of the prostate gland (TUR)		
Bipolar TUR	24	48.9
Monopolar TUR	25	51.0
Related surgical diseases		
Left-sided inguinal hernia	6	12.2
Right-sided inguinal hernia	8	16.3
Bilateral inguinal hernia	3	6.1
Stricture of the posterior urethra	3	6.1
Bladder stone	2	4.1
Ureteral stone	2	4.1
Anesthesia		
Spinal	37	75.5
Epidural	9	18.3
Combined – spinal with endotracheal	3	6.1
Complications		
Retrograde ejaculation	28	57.1
Erectile dysfunction	23	46.9
TUR syndrome	**0**	**0**
Acute inflammation of the urinary tract	2	4.1
Stricture of the posterior urethra	3	6.1

Conclusion: It has been revealed that with a large prostate gland (> 70 g), bipolar resection of the prostate gland is a relatively safe method of resection compared with monopolar resection, taking into account the risk of TUR syndrome. The same method costs less cheaply in private clinics, since isotonic solutions are used for irrigation solution. However, the success of a surgical operation largely depends on the skill and experience of the urologist and often on the technical support of the surgical unit, the availability of an experienced anesthesiologist and the intensive care team. It is confirmed that epidural anesthesia is preferable to spinal, especially in simultaneous operations, taking into account the control of postoperative pain [7, 11].

Antibacterial treatment 24 hours before surgery reduces the risk of developing postoperative infection in patients with acute urinary retention and / or when handling the Foley catheter *in situ*.

B-TURP was associated with a relatively higher incidence of urethral strictures. Of the 3 strictures, two were operated on using the bipolar method. In this study, no significantly higher urethral stricture frequency has been found in the bipolar group. Perhaps this is most related to the diameter of the shell of the resectoscope and postoperative catheter dwell time. It has also been established that chronic urinary tract infections (chronic epididymitis, chronic prostatitis) in elderly men are not a contraindication for performing surgically "clean" operations in the inguinal-scrotal region.

Thus, increasing the effectiveness of operative methods for treating diseases of the prostate gland by preventing the development of intraoperative complications in TUR of the prostate and in the postoperative period is one of the urgent problems of urology. A well-designed, multicenter, randomized control study with long-term observation and cost analysis is still needed.

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ЭФФЕКТИВНОСТЬ МОНОТЕРАПИИ И РАННЕЙ ПОЛИТЕРАПИИ ПРИ ФОКАЛЬНОЙ ЭПИЛЕПСИИ С ФЕНОМЕНОМ ВТОРИЧНОЙ БИЛАТЕРАЛЬНОЙ СИНХРОНИЗАЦИИ НА ЭЛЕКТРОЭНЦЕФАЛОГРАММЕ

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