REVIEW ARTICLE

Surgery for Benign Prostatic Hyperplasia

Part 3 in a Series on Benign Prostatic Hyperplasia

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SUMMARY

Introduction: The last ten years have seen significant developments in the treatment of benign prostatic hyperplasia (BPH), in the form of new drugs and minimally invasive endoscopic procedures. In Germany 60 000 men are operated on anually for BPH. The most frequently used surgical procedure is transurethral resection of prostate (TURP). Methods: The review is based on guidelines of the German Urologists as well as of the American Urological Association. Results: Improvement of symptoms, quality of life, and voiding parameters following TURP for the therapy of lower urinary tract symptoms suggestive of BPH exceed those for any other available treatment modality. Furthermore, TURP provides the best long term outcome. Over the years TURP specific complications have been reduced consistently by technical improvements. Discussion: TURP remains the standard procedure, thanks to improvements in equipments and operative techniques. Any alternative treatment must be measured against TURP as a „gold standard".

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Key words: benign prostatic hyperplasia, clinical BPH, transurethral resection of prostate, complication

Transurethral resection of the prostate (TURP) was performed for the first time in 1932, using a resectoscope. Up to the early 1990s, the treatment of benign prostatic hyperplasia (BPH) was limited to phytotherapeutics, endoscopic transurethral resection of the prostate, or open surgery as transvesical or retropubic enucleation. Since then, urology has experienced a boom of new drug treatments and alternative, minimally invasive therapies as alternatives to surgery, which always carries a risk of potential complications and permanent damage. By administering alpha blockers and 5-alpha reductase inhibitors, urologists, family doctors, and specialists for internal medicine were able to offer drug treatment options that were better validated and more effective. Many irritations and discussions arose because some urologists swore by TURP as the gold standard, whereas others denounced it as a bloody procedure and the cause of impotence and incontinence. Those in favor of surgical treatment had to adopt a defensive position, as evidenced by the numbers of operations over a 10 year period *(diagram 1)*. Since the new therapies have been available for more than a decade, indications for surgery have become more precise and the numbers of operations have stabilized. Currently, about 60 000 surgical procedures for BPH are performed in Germany, and in spite of increasingly established alternative treatment methods, TURP is the most commonly used surgical treatment, at about 90% (1, 2). Faced with the pressure from other approaches, TURP has changed, its effectiveness has increased, and the associated complications have been reduced to a minimum. Increasing improvements of the instruments and standardized surgical techniques confirm the position of TURP as a standard procedure, and other methods have to measure up against it (3).

Methods

The data analysis and evaluations presented in this review – except for the new technical developments of TURP – are based on the German Urological Association Guidelines for

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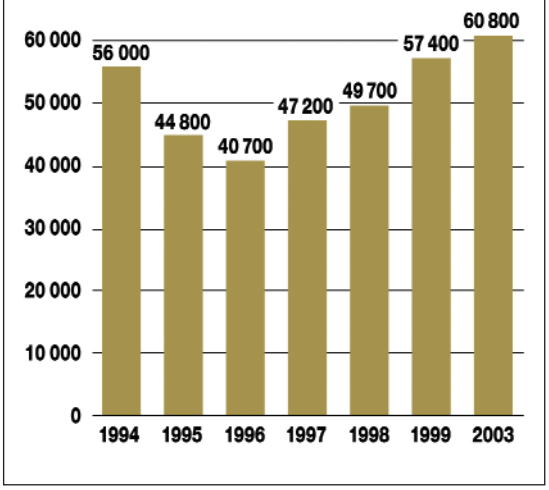
DIAGRAM 1



Number of operations for BPH in Germany (× 1000), modified from Federal Statistical Office and Federal Office for Quality Assurance (Statistisches Bundesamt und Bundesgeschäftsstelle Qualitätssicherung)

the Diagnosis and Therapy of Benign Prostatic Hyperplasia (3, 4). The guidelines were mainly developed by the working group BPH of the German Association of Urology (Professor Höfner is chairman, Professor Tunn and Professor Reich are members of the working group). They are based on a computer supported literature search of the years 1986 through May 2002, and the findings were supplemented by hand searches of review articles and published guidelines. The second data source – which was used primarily to compare of different therapeutic options with TURP *(diagram 2)* – were the BPH guidelines of the American Urological Association (AUA) from 2003 (5). A systematic meta-analysis was performed that included data from prospective, blinded, randomized studies with more than 100 patients. In the included studies, drugs were tested versus placebo, and instrumental therapies versus sham treatment or TURP. All therapies are individually listed in the original literature according to their respective control group, with regard to significant differences.

Indication for surgery

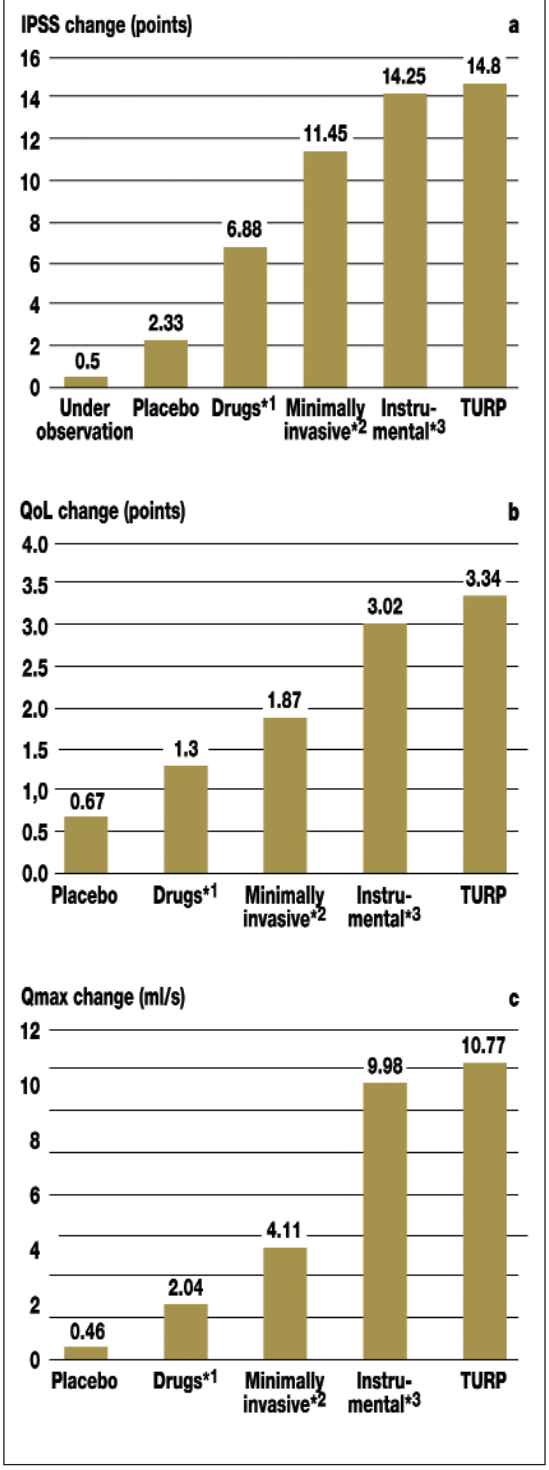
Today, the indication for surgery is clearly defined, and absolute and relative indications have to be distinguished *(box)*. The basis for the indication is a diagnosis of the subjective and objective criteria of the illness in accordance with the recommended basic and optional diagnostic tests (4). The subjective criteria include medical history, quantification of symptoms, degree of suffering, and quality of life. The objective criteria include a physical (including a digitorectal) examination, laboratory testing of blood and urine, uroflowmetry, determination of postvoid residual urine, and sonographic measurement of the prostate, if possible by means of transrectal ultrasonography.

Pre-inpatient management and preparation of the patient

Since not many treatment options are available, the decision in favor of surgery has to be explained to patients while providing detailed reasons. Explanations should be individually adapted (with regard to the course of the surgery, postoperative healing, short term or long term complications, and possible individual risks) and should certainly emphasize the urgency of the procedure and the lack of realistic alternatives. Again and again, doctors will encounter patients who – in spite of an existing absolute indication for surgery – seek alternatives to surgery, prompted by fear and a lack of understanding of the necessity of the procedure, and thus change their doctor frequently. These patients may have complications such as chronic urinary tract infections, substantial amounts of residual urine, bladder calculi, or chronic urinary retention with overflow incontinence and chronic renal failure.

A pre-inpatient check of drugs that patients will have to stop taking before surgery, and that will have to be replaced by alternative drugs, is obligatory. This includes mainly

DIAGRAM 2



Improvement of a) symptoms (international prostate symptom score, IPSS), b) quality of life (QoL), and c) urinary flow rate (Qmax), 12 months after treatment (TURP compared with drug treatment, minimally invasive and instrumental therapeutic options); meta-analysis of randomized controlled studies with a number of patients in excess of 100; modified from (5); *1 alfuzosin, doxazosin, tamsulosin, terazosin; *2 transurethral microwave therapy (Prostatron 2.0 and 2.5, Targis) and transurethral needle ablation; *3 laser coagulation and laser vaporization, prostate incision, electrovaporization.

BOX 1

Indications for surgery

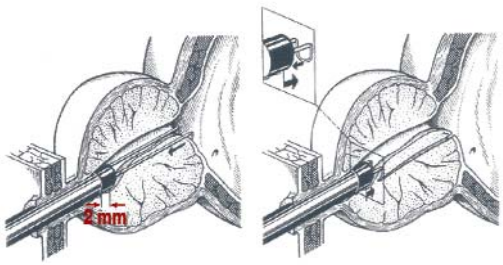
Absolute

- Recurrent urinary retention
- Recurrent urinary tract infections
- Recurrent macrohematuria that cannot be controlled conservatively
- Bladder calculi
- Dilatation of upper urinary tract/renal failure owing to BPH-related bladder outlet obstruction

Relative

- Relevant, BPH-related bladder outlet obstruction
- Bladder diverticles
- No success with conservative or alternative therapies (for example, in unchanged or increasing symptoms or obstruction)
- Allergies or contraindications for conservative therapies
- Postvoid residual urine >100 ml

DIAGRAM 3



Graphic representation of surgical technique, adapted from: Matuschek E, Urologisch endoskopische Operationen. Stuttgart: Schattenhauer 1987; 80. With permission from Schattauer GmbH, Stuttgart.

thrombocyte aggregation inhibitors such as acetylsalicylic acid, which should not be taken less than 4 days before the operation. All vitamin K antagonists have to be stopped 2 weeks before the operation, and patients can start taking these again 2 weeks after the procedure, at the earliest. Only when an INR <1.2 is measured is surgery possible, because of the increased risk of hemorrhage. If, and in what dosage, heparin preparations can be used has to be discussed with the general practitioner or internal specialist treating the patient. Certain diabetes drugs, such as metformin, should be stopped at least 48 hours before the procedure; these are contraindicated because of the necessary anesthesia. In general, in case of significant comorbidity, the surgeon will have to cooperate with the treating specialists and the anesthesiologist to decide whether a patient is fit for surgery and anesthesia.

An existing urinary tract infection should be excluded at the outpatient stage or should be treated with a view to resistance. Perioperative preventive treatment with antibiotics is recommended in bladder outlet obstruction (BOO) because of the increased exposure to germs. In case of an increased risk of infection, antibiotic prophylaxis is obligatory – for example, if the patient is catheterized, his general condition is reduced, he has a metabolic disorder such as diabetes, he is immunocompromised, he is having a reoperation, or he is at risk of endocarditis. For prostate surgery, cotrimoxazole or fluoroquinolones are recommended (6).

TABLE

Complications arising from transurethral resection*

Complication	Frequency (%)
TUR syndrome	1.09
Bleed (transfusion)	3.63
Operative revision/postoperative coagulation	5.38
Urinary tract infection	3.67
Mortality	0.24
Mortality associated with TURP	0.09

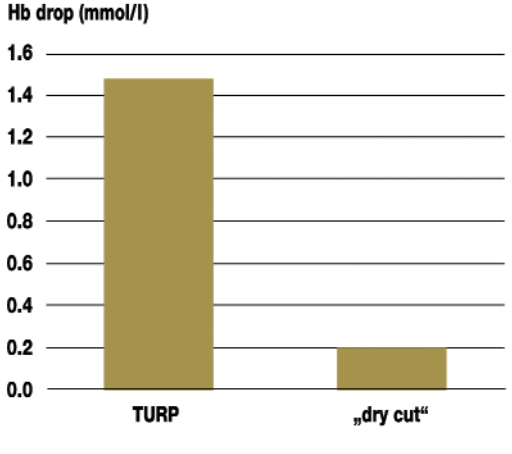
* Quality report Federal Office for Quality Assurance 2002
TURP, transurethral resection of the prostate; TUR, transurethral resection

Operative technique

The hyperplastic prostatic tissue is resected endoscopically through the urethra (transurethral), using special resectoscopes measuring 24 to 27 on the Charrière scale, which enable a "shaving off" of prostate "slices" via a cutting loop. The loop is a U shaped wire, which the surgeon pulls through the tissue in a proximal to distal direction *(diagram 3)*. Electroresection uses a modern high frequency surgical device and a current that is adapted to the tissue's firmness. By automatically adapting the required current, the high frequencies introduced into the body can be reduced.

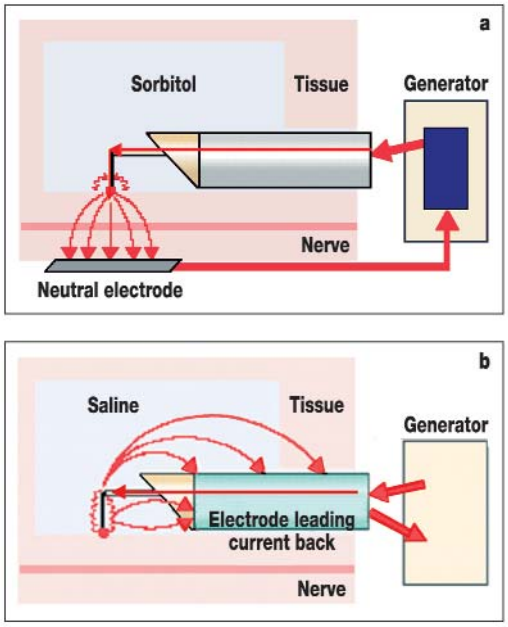
In the same way as in electrosurgery, in the endoscopic procedure the cutting of the prostatic tissue and the coagulation of blood vessels are guided by an adaptable current. Resection can be done under conditions of high and low pressure, i.e. with a backflow resectoscope or by inserting a suprapubic bladder catheter. The surgeon performs this procedure via direct visual control through an endoscope or by having the image transmitted to a monitor via video camera, as a video resection. From the patient's preoperative diagnosis by transrectal ultrasonography, the total volume of the prostate is known, as is the volume to be removed in the area of the central and transitional zones. The aim of the operation is not the removal of the entire prostate but the resection of the urodynamically effective obstruction on the bladder outlet and prostatic apex. Resection of the prostate to the peripheral zone is usually feasible in 1 hour, depending on the size of the prostate. An experienced surgeon can remove at least 1 g of weight per minute. The duration of the

DIAGRAM 4



Significantly different postoperative hemoglobin drop ($p < 0.01$) after classic resection technique (TURP) and dry-cut resection (n=119) in the first author's patient cohort

DIAGRAM 5



Resection mechanism in a) classic (monopolar) resection. The resistance of the sorbitol is greater than that of the tissue. b) In bipolar resection, no current flows into the tissue because the tissue's resistance is greater than that of the saline.

resection is limited to 60 to 90 minutes, owing to the risk of ingress of irrigation fluid into the vascular circulation via open veins, depending on whether a high pressure or low pressure procedure is used, so that depending on the surgeon's ability, adenomas measuring >80 to 100 cm^3 are better removed by using transvesical adenoma enucleation. After the resection has been completed and bleeding has been brought under control, a catheter is inserted for 1 to 2 days, which is connected to a permanent postoperative irrigation device.

Treatment results

In view of the new conservative and minimally invasive therapeutic options it is necessary to define the current position of modern TURP. In the context of different re-examinations, the success rate of TURP exceeds 80% with regard to all evaluated variables. According to the currently most reliable data source – the BPH guidelines of the American Urological Association (AUA) – TURP therefore has the highest effectiveness with regard to improvement of symptoms, quality of life, and urinary stream, compared with all other therapeutic options *(diagram 2)*. The presented data in the different bars in *diagram 2* correspond to a subsumed meta-analysis of the American guideline. The significance between the groups is reported in the individual studies versus placebo or sham treatment or TURP in the guidelines or the original literature. There is no randomized study of TURP versus drugs.

In patients whose complaints and pathological findings are more serious, the postoperative treatment results are better. The operative success in patients with larger adenomas is higher than in patients whose resected mass weighs less. Further advantages compared with other procedures are an operative result that is obvious at an early stage, effective reduction of BOO, tissue harvesting for histology, and the lowest rate for repeated interventions at long term follow-up (7).

Intraoperative and postoperative complications in transurethral resection

The improvement of subjective and objective illness criteria by using transurethral resection of the prostate have to be balanced against perioperative morbidity and mortality. The most common complications after TURP are arterial or venous hemorrhages, urinary tract infections or even urosepsis, and the so-called TUR syndrome, in which ingress of irrigation

fluid results in electrolyte imbalance. The study analysis in the current guideline of the American Urological Association showed a rate of significant hematuria of 6% and a transfusion rate of 8% (5). Patients whose preoperative hemoglobin (Hb) value was normal and whose resected mass weighed less than 30 g do not usually need a transfusion (8). Among the postoperative infections, distinction can be made between urinary tract infections or epididymitides. The American guideline reported an overall infection rate of 6% (5).

Long term complications are urethral stricture, retrograde ejaculation, and urinary incontinence. In assessing the frequency of postoperative complications, cases of incontinence have to be considered that statistically might have occurred even without the intervention (9). Wasson et al. found in a randomized comparison that TURP did not result in a raised rate of urinary incontinence or impotence compared with controlled waiting after 3 years (10). The American guidelines report rates of 3% for incontinence, 7% for urethral stricture, and 10% for erectile dysfunction (5).

The most reliable data sources for Germany are the quality reports from the for 2002 and 2003 (1, 2). For 2002, the BQS analyzed data from 374 hospitals (77% of all expected hospitals) and for 2003 from 481 hospitals (102% of expected). In 2002, a total of 31 771 TURPs were evaluated (90.84% of operations for BPH) and 51 558 TURPs in 2003 (84.8% of BPH operations). In 2002, at least one complication was documented in 11.41% of patients after TURP *(table)*. The overall complication rate for 2003 was 11.8%. The exact rates can be expected to be similar to those of 2002.

Technical innovations

According to Germany's BQS statistic, bleeding complications – that is, transfusions or necessary postoperative coagulation – are most common, and in the past few years, much effort has gone into seeking out and developing newer procedures of TURP that minimize the risk of bleeds. Three approaches exist: a modification of high frequency generators as "coagulant intermittent cutting" (CIC) (11, 12) or dry-cut resection (13), a modification of the electrodes as vaporesection with a band loop (14), and the replacement of the monopolar resection technique with the bipolar technique.

Comparative studies between conventional TURP and newer procedures have shown better results with regard to the risk of bleeds, experimentally (15) as well as clinically (16–18) for CIC (11) and vaporesection and dry-cut resection (level of evidence 2b [19]). A retrospective comparison of traditional TURP with dry-cut resection in 214 patients in the first author's patient cohort showed an almost unchanged hemoglobin level after dry-cut resection (– 0.19 mmol/l), whereas the hemoglobin value fell significantly after the traditional resection technique had been used (– 1.47 mmol/l, $p = 0.024$) *(diagram 4)* (13).

The bipolar resection technique is one of the most recent technical innovations for transurethral resection. In the classic monopolar technique, the current flows through the tissue because the resistance in the body is lower than in the sorbitol containing irrigation fluid. The result: increased tissue heating and resection as an effect of the tissue's denaturing owing to the high frequency current *(diagram 5)*. In the bipolar technique, after activation of the high frequency current, the physiological saline around the loop is heated to boiling point. The resulting bubbles create an environment with high electrical resistance; the voltage between electrode and saline solution spikes, forming an arc. The tissue is heated indirectly by the heat from the ignition of the arc; this enables the resection *(diagram 5)*. According to studies, this new technique has shown advantages over TURP experimentally (20) as well as clinically (21–24).

Conflict of Interest Statement
The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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