Electrosurgical transurethral resection of the prostate and transurethral incision of the prostate (monopolar techniques)

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TAYLOR BL, JAFFE WI. Electrosurgical transurethral resection of the prostate and transurethral incision of the prostate (monopolar techniques). *Can J Urol* 2015; 22(Suppl 1):24-29.

Introduction: *We summarize the current guidelines, techniques, efficacy and complications associated with monopolar transurethral resection of the prostate (TURP) and transurethral incision of the prostate (TUIP) for benign prostatic hyperplasia (BPH). Patients who elect to have endoscopic surgical bladder outlet reduction are faced with an abundance of evolving treatment options. As new technology comes and goes, TURP and TUIP remain the gold standard for which new treatments are compared.*
Materials and methods: *A review of past and contemporary data including American and European guidelines was performed. Techniques, efficacy, durability, short term and long term complications of TURP and TUIP are summarized.*
Results: *Small prostate sizes < 30 mL without a median lobe can be effectively treated with TUIP with decreased perioperative complications and sexual side effects compared to TURP. Monopolar TURP demonstrates significant improvements in IPSS, peak flow rate (Qmax), and quality of life (QoL) with durable (8 year-22 year) outcomes. Secondary intervention increases by 1%-2% annually. Thirty-day mortality rate is low (0.1%) as well as incidence of TUR syndrome (< 1.1%). Short term and long term complications include bleeding requiring transfusion, clot retention, acute urinary retention (AUR), and urinary tract infections as well as incontinence, bladder neck contracture, urethral stricture, and sexual dysfunction.*
Conclusions: *Monopolar TURP and TUIP are effective endoscopic treatments for BPH with durable long term results. While the short term and long term complication rates are acceptable, new technologies aim to increase tolerability of bladder outlet reduction by decreasing treatment related morbidity.*

Key Words: benign prostatic hyperplasia (BPH), lower urinary tract symptoms (LUTS), transurethral resection of the prostate (TURP), monopolar technique, transurethral incision of the prostate (TUIP), efficacy, complications

Introduction

Transurethral resection of the prostate (TURP) has been the gold standard endoscopic surgical treatment for benign prostatic hyperplasia (BPH) for over 30 years. It is an appropriate option in men with moderate to severe lower urinary tract symptoms (LUTS) with or without significant bother from these symptoms.[1] Similarly, transurethral incision of the prostate (TUIP) is an equivalent alternative to TURP for patients with a prostate volume less than 30 mL that do not have a median lobe. The European guidelines also recommend monopolar TURP as the surgical standard procedure for men with prostate sizes of 30 mL-80 mL and bothersome moderate-to-severe LUTS secondary

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to benign prostatic obstruction.[2] Based on panel expert opinion, 80 mL is often suggested as the upper limit for TURP as complication rates increase with size.[2] Since TURP has been well studied for many years, there is extensive data in regards to its efficacy and safety, which also makes it the ideal comparison for new and alternative treatments for BPH.

Technique

Multiple techniques have been described for TURP originating with Nesbit in 1943.[3] A four step approach was then characterized and later modified by May and Hartung.[4,5] This technique begins with resection at the proximal portion of the middle lobe at the 6 o'clock position. With the resectoscope placed just proximal to the verumontanum, long cuts are made towards the verumontanum controlling the end of each cut. Care is taken to avoid damaging the external sphincter, which may occur if the lower part of the cut extends deep or distal to the verumontanum. If there is an intravesical median lobe, this should be resected first with short swipes taking care to not cut down into the trigone or injure the ureteral orifices. In order to achieve a smooth surface, each cut should be next to the previous cut down to the level of the prostatic capsule, which is identified as a fibrous structure compared to the granular appearance of a prostatic adenoma, Figure 1. Next, the resection is carried along the lateral lobes. If the lateral lobes are very large, each lobe can be cleaved at 9 o'clock and 3 o'clock to expedite subsequent resection and control hemostasis. Near completion, incision of the internal sphincter can be made at the 5 o'clock and 7 o'clock positions of the bladder neck to decease the incidence of developing a bladder neck contracture.[6]

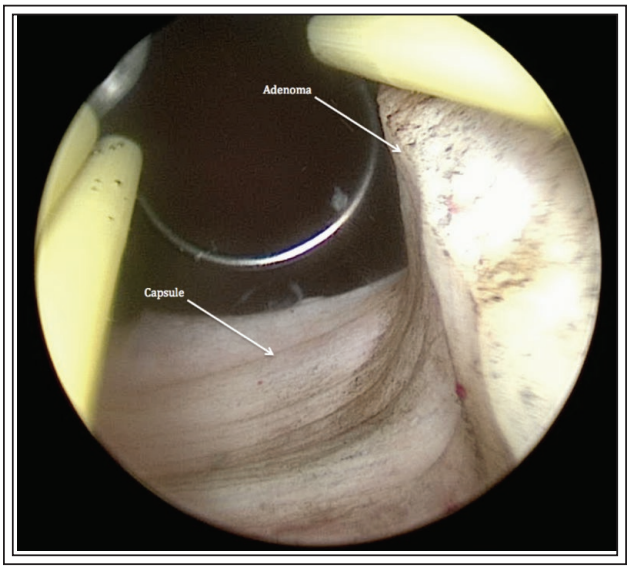

Figure 1. Intraoperative appearance of prostate adenoma versus capsule.

An alternate technique involves resecting the prostate in quadrants starting at the 12 o'clock position. The prostate tissue is resected to 9 o'clock, and then from 12 o'clock to 3 o'clock. Next the midportion of the gland is resected from 9 o'clock to 6 o'clock followed by resection from 3 o'clock to 6 o'clock. The residual apical tissue is resected next to the verumontanum.[7]

Transurethral incision of the prostate utilizes an electrical knife to make incision(s) from the inside of the bladder neck down to the verumontanum. The depth of the incisions should be down to the prostate capsule. Once fat is present, the surgeon has reached the correct depth. Either bilateral incisions can be performed at the 5 o'clock and 7 o'clock positions or consider a single incision at 6 o'clock to decrease retrograde ejaculation.

Efficacy of TUIP

When measuring IPSS reduction and peak flow (Qmax), TUIP has equivalent early outcomes as TURP in patients with prostate volumes less than 30 mL without a large median lobe.[8] Tkocz and Prajsner compared 100 men randomized to TURP or TUIP with prostate volumes ≤ 30 mL and 2 years of follow up and found that both groups improved in all parameters including nocturnal voiding frequency, IPSS, quality of life (QoL), and Qmax. Although TURP showed a significantly higher percentage change in QoL than TUIP, there were no statistically significant differences in outcomes between groups.[9] A meta-analysis of 10 randomized controlled trials (RCT) found similar results in symptomatic improvements between TUIP and TURP, although TUIP was associated with an insignificant, but decreased improvement in Qmax.[10] Among the eight studies that included an upper limit of prostate size on inclusion criteria, three had volumes < 60 mL while the rest had volumes < 30 mL.

Efficacy of TURP

A contemporary meta-analysis comparing 20 RCTs demonstrated that TURP results in a significant reduction in IPSS (-70%), Qmax improvement (+162%), QoL score (-69%), and post void residual (PVR) reduction (-77%).[11] Hoekstra et al showed with 1 year follow up a reduction of IPSS by 10, improvement in QoL by 4, increase in Qmax by 10 mL/s, decrease in PSA by 2.4 ng/mL, and decrease in prostate volume of 13 mL.[12] This is comparable with the 12-month results

from the recently published European multicenter GOLIATH study comparing 291 patients randomized to GreenLight XPS laser vaporization and TURP. There was comparable efficacy and adverse events between the two treatment arms. After TURP, there was a mean reduction in IPSS of 16, improvement in QoL by 3.3 points, increase in Qmax by 14.8 mL/s, decrease in PVR by 76.1 mL, decrease in PSA by 1.5 ng/mL, and decrease in prostate volume of 25.2 mL.[13]

Durability

Long term data comparing alternate treatments to TURP is lacking. TURP has shown durable outcomes with 8-22 years of follow up.[14] Thomas et al followed 217 men after TURP for a mean follow up of 13 years and demonstrated sustained decrease in most symptoms with improvements of urodynamic parameters.[15] The authors highlight the importance of pressure flow studies prior to repeat TURP as most long term failures were associated with detrusor underactivity.

The incidence of secondary intervention after TURP is reported to increase by 1%-2% annually.[16] A repeat procedure after TUIP is more common than after TURP (18.4% versus 7.2%).[10] In a review of 29 RCTs, the mean rate of secondary intervention after TURP was 2.6% with a mean follow up of 16 months.[17] A nation-wide analysis of 23,123 patients followed for 8 years revealed that a secondary TURP at 1, 5 and 8 years was 2.9%, 5.8% and 7.4%, respectively. The incidence of a secondary procedure (TURP, urethrotomy, bladder neck incision) within 8 years of TURP was 14.7%.[18]

Morbidity and mortality

Reich et al demonstrated in a contemporary large scale multicenter evaluation of 10,654 men a 30-day mortality rate of 0.1% and immediate morbidity of 11.1%.[19] No perioperative deaths were recorded in a review of 29 RCTs.[17] Madersbacher et al examined short term and long term incidence of reoperation, myocardial infarction, and mortality among 20,671 and 2452 patients who underwent TURP and open prostatectomy, respectively. The mortality rates for TURP at 90-days, 1 year, 5 years, and 8 years were 0.7%, 2.8%, 12.7%, and 20%, respectively, which were identical for open prostatectomy. The 8-year incidence of myocardial infarction was 4.8%.[18]

Transurethral resection syndrome (TUR syndrome)

In contemporary series, the risk of TUR syndrome after TURP has decreased to < 1.1%.[20] No cases have been reported for TUIP. TUR syndrome is characterized as a dilutional hyponatremia (serum sodium < 125 mEq/l), which can lead to mental confusion, nausea, vomiting, hypertension, bradycardia, and visual disturbances. This occurs with early perforation of capsular veins or sinuses with continued influx of hypotonic irrigating fluid. An advantage of spinal anesthesia is the ability to monitor signs of TUR syndrome such as unrest, cerebral disturbance, or shivering. This can ultimately lead to bronchial or cerebral edema. Depending on severity, treatments can include aborting the

TABLE 1. **Perioperative complications and management**

Perioperative complication	Incidence (%)	Management
Bleeding/transfusion	2	May compress bleeding with resectoscope; adjust angle of scope for visualization; coagulate large vessels circumferentially; decrease irrigation to identify small arterial bleeders; venous bleeding controlled with balloon catheter
TUR syndrome	1	Stop procedure, 20 mg furosemide IV, free water restrict, hypertonic NaCl if severe
Extravasation (bladder neck divided, capsular injury)	4	Extraperitoneal: forced diuresis Intraperitoneal: percutaneous drainage versus open - Consider suprapubic tube
Injury of orifices (hydronephrosis)	< 0.3	If severe, place double J stent for 2-3 weeks; otherwise follow up ultrasound sufficient
Injury of external sphincter	< 0.5	Identify external sphincter and veru, especially during apical resection; may use rectal palpation; minimize traction of balloon catheter

procedure, free water restriction, administration of 20 mg furosemide, and hypertonic saline. This syndrome is unique to monopolar TURP due to the need to use a hypotonic solution to conduct current (1.5% glycine or mannitol). Concerns for TUR syndrome have lead to the introduction of bipolar TURP as an alternative.

Short term complications (bleeding, transfusions, clot retention, AUR, UTI)

Bleeding requiring transfusion occurred in 2.9% of 10,654 TURPs.[19] A contemporary meta-analysis by Ahyai et al including 23 different RCTs with 954 patients who underwent TURP showed bleeding requiring transfusion in 2% (0%-9%), acute urinary retention in 4.5% (0%-13.3%), clot retention in 4.9% (0%-39%), and urinary tract infection in 4.1% (0%-22%),[11] Table 1.

Neoadjuvant 5 alpha-reductase inhibitors

Multiple randomized, placebo-controlled studies have assessed the role of 5 alpha-reductase inhibitors in reducing perioperative bleeding by starting the medication 2-6 weeks prior to TURP. Two randomized trials and a non randomized trial showed a reduction in blood loss with pretreatment.[21-23] Another study showed only a difference for resection weights greater than 18 grams, suggesting that finasteride may help reduce blood loss for larger prostates.[24] However, other RCTs found no difference in blood loss when comparing the placebo and treatment groups.[25,26]

Long term complications (incontinence, bladder neck contracture, urethral stricture, retrograde ejaculation, and erectile dysfunction)

Long term complications from TURP and TUIP include urinary incontinence (TURP: 2.2% versus TUIP: 1.8%), bladder neck contracture (TURP: 4.7%), urethral stricture (TURP: 3.8% versus TUIP: 4.1%), retrograde ejaculation (TURP: 65.4% versus TUIP: 18.2%), and erectile dysfunction (TURP 6.5%),[17] Table 2.

The VA Cooperative Study comparing transurethral surgery with watchful waiting found an equivalent 1% risk of urinary incontinence between the two groups.[27] Early incontinence after surgery is most likely due to urgency from a healing fossa and associated UTI or detrusor overactivity, which can be managed with anti-cholinergic or anti-inflammatory medications.[28] Reports of bladder neck contracture occur more commonly after treatment of smaller glands < 30 mL with incidence in the literature ranging from 0.14%

TABLE 2. **Postoperative complications and management**

Postoperative complication	Incidence (%)	Management
Clot retention	5	Evacuate obstructing clots; reinflate catheter in fossa or in bladder with 30 cc-50 cc in balloon on tension; if unresolved, needs reintervention paying attention to bladder neck bleeding
Urinary tract infection/ epdidiymitis	4	Increased risk if patient has preoperative bacteriuria or prolonged procedure > 70 minutes
Urosepsis	2	Broad spectrum antibiotics
Acute urinary retention	4-5	Mainly due to detrusor failure rather than incomplete resection; perform pressure-flow studies after 4-6 weeks if persistent retention
Incontinence	2	Early incontinence is usually due to detrusor overactivity and is treated with anticholinergics and anti-inflammatories Late incontinence (> 6 weeks) should be evaluated with cystoscopy and pressure-flow studies
Retrograde ejaculation	65	Irreversible side effect; will need advanced reproductive techniques if desire fertility
Bladder neck contracture (BNC)	4-5	TURP for smaller glands has increased risk of BNC for which TUIP should be considered as alternative; treat with electrical or laser incision of bladder neck
Stricture	4	Meatal: dilation or internal urethrotomy Bulbar: dilation, internal urethrotomy, or urethroplasty

to 20%.[29,30] TURP with transurethral incision of the bladder neck has a lower rate of bladder neck contracture than TURP alone, and this is even more prominent for resected adenomas > 30 mL.[31]

It is important to counsel patients considering TURP of the potential for sexual dysfunction, especially if they are younger or are considering having children. The risk of retrograde ejaculation is high after TURP (53%-75%), and this is thought to be secondary to resecting apical tissue near the verumontanum. It has been described that a potential way to decrease this risk is to spare the tissue around the verumontanum during resection.[20] There used to be a concern for developing erectile dysfunction after TURP, however the landmark study by the VA Cooperative Study Group compared TURP with watchful waiting, and after a mean follow up of 2.8 years, there was a similar deterioration of sexual performance in both study groups (19% in TURP group and 21% in watchful waiting group).[27]

TUIP versus TURP

While the reintervention rate is lower for TURP, this must be balanced against the decreased morbidity associated with TUIP. The risk of blood transfusions and retrograde ejaculation are significantly less with TUIP when compared with TURP. A systematic review showed that the incidence of blood transfusions was 0.4% versus 8.6% and retrograde ejaculation was 18.2% versus 65.4% for TUIP versus TURP, respectively.[14]

Conclusion

TURP continues to be the gold-standard endoscopic procedure for LUTS due to BPH. TUIP is equivalent for prostate glands that are less than 30 mL without a median lobe. The drive to create new alternative minimally invasive technologies stems from the desire to decrease perioperative, short term, and long term complications associated with monopolar TURP. While new technologies such as bipolar TURP and photovaporization of the prostate have more favorable perioperative outcomes after short term follow up compared to monopolar TURP, long term comparative data is lacking.[32] Monopolar TURP has provided durable results over 20 years, and will continue to play a pivotal role in the current armamentarium of treatments.

Disclosure

Dr. Benjamin L. Taylor and Dr. William I. Jaffe have no disclosures. □

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