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REVIEW ARTICLE

RECENT UPDATES IN SURGICAL TREATMENT OF BENIGN PROSTATIC HYPERPLASIA: A REVIEW ARTICLE

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ABSTRACT

Introduction: *Benign prostatic hyperplasia refers to the non-malignant growth or enlargement of the prostate gland and is a general cause of lower urinary tract symptoms in men which rises with growing age. There is a wide range of management options available from watchful waiting, and medicinal therapy to various surgical intervention methods. Though medicinal therapy is the preliminary treatment for benign prostatic hyperplasia, some patients lack the desire to keep on with the extended duration, and on occasion, they must break either due to treatment failure or side effects. Lately, numerous innovative surgical methodologies have been established to provide patients with efficient therapy on a day-care basis, without the risk of general anaesthesia and with rapid recovery, marginal morbidity, and safeguarding the reproductive function. Existing treatment alternatives for benign prostatic hyperplasia differ in the extent of intrusiveness, efficiency, complications, and cost-effectiveness. Various treatment modalities are available these days that are less invasive and have lesser complications as compared to conventional transurethral resection of the prostate. It helps curtail expenses, preserve time for recovery, curb untoward general and reproductive side effects. Laser, endoscopic, robotic, water vapor utilization, and various other minimally invasive methods have demonstrated their effectiveness in the treatment of benign prostatic hyperplasia in various studies.*

Keywords: *Cost benefit analysis; Lower urinary tract symptoms; Morbidity; Prostatic hyperplasia; Transurethral resection of prostate.*

INTRODUCTION

Prevalence of Benign Prostatic Hyperplasia (BPH) in histology during autopsy varies from 50% to 60% for males aged 60 to 70yrs, which increases to the range of 80% to 90% over 70 years of age.[1] Lower Urinary Tract Syndrome (LUTS) can be categorized into voiding symptoms (weak urine stream, straining, hesitancy and incomplete bladder emptying), storage symptoms (frequency, urgency, urge incontinence and nocturia), and post-void dribbling of urine.[2] Transurethral Resection Of Prostate (TURP) had been regarded as the gold standard surgical procedure for BPH.[3] Though symptoms relief, enhancement in flow rate and decrease of post-void residual volume have been reported, the apprehensions have been testified in safe consequences like Trans Urethral Resection (TUR) syndrome, intracapsular perforation, haemorrhage with a higher transfusion requirement. Devices that use laser, water vapour, and lesser invasive modalities like endoscopic, laparoscopic, and robotic have been increasingly used as an alternative to traditional TURP for BPH.[4,5]

ETIOPATHOLOGY

The pathogenesis of BPH is still mostly unknown, but there are numerous proposed theories:

a) Androgen Pathway: - With the reduction in testosterone, there is a decline in the ratio of

testosterone to oestrogen in the serum, which may be critical in the pathogenesis of BPH. The sensitivity of the testosterone to the prostate may be distorted.[6]

b) Age-Related Tissue Remodelling: - Prostate enlargement results from remodelling in the transition zone.

c) Inflammation: - Various studies have determined the presence of diverse bacterial and viral strains in BPH cases that may induce pro-inflammatory cytokines and chemokines by stromal cells of BPH, ultimately leading to prostatic growth.[7]

d) Metabolic Factors: - A group of numerous metabolic aberrations, including central obesity, hypertension, insulin resistance with compensatory hyper-insulinemia, dyslipidaemia and glucose intolerance.[8]

e) Genetic predisposition to BPH has been determined in cohort studies, first-degree relatives show a four-fold rise in the probability of BPH compared to control.[1]

DIAGNOSIS

Initial assessments for LUTS indicative of BPH are centred on the patient's medical history, and physical examination, including digital rectal examination, urinalysis, urine diary, and International Prostate Symptom Score (IPSS).[9] For years, the major surgical management alternatives for BPH were trans-urethral resection of the prostate (TURP) and open prostatectomy (OP).[10] Evaluated with medical therapy, the surgical approach is the traditional and most efficient treatment for patients with apparent LUTS or complications. Monopolar transurethral resection of the prostate (M-TURP) has been identified as the first-line surgical technique for LUTS secondary to BPH in normal volume.[11]

Medicinal therapy is frequently used as a preliminary and active method to improve LUTS.[12] The unsatisfactory symptom control and side effects related to medication causing BPH-related undesirable events, for instance, bladder stones, frequent infection, and haematuria often favour surgical treatment alternatives. These patients opting surgical treatments like transurethral resection of the prostate (TURP), laser enucleation of the prostate (HoLEP), simple prostatectomy, water ablation etc.[13] Nonetheless, these methods carry a non-negligible possibility of complications and substantially affect the patient's sexual function.[14] Six pharmacological classes (alpha-blockers, 5-alpha reductase inhibitors, Phyto therapeutics, anti-muscarinic, beta-3 agonists and phosphodiesterase type 5 inhibitors) are presently accessible alone or in combination for the treatment of LUTS/BPH.[15] Although transurethral resection of the prostate (TURP) using electric current is still considered the benchmark for the treatment of benign prostatic hyperplasia (BPH) of patients non-retorting to or inappropriate for pharmacologic treatment, the emphasis of the research is sheering towards 'new' surgical methods. These include endoscopic enucleation of the prostate (EEP), prostate vaporization (PV), and vaporesection of the prostate (VRP).[16] The standard for therapy for BPH according to the 2003 American Urological Association (AUA) Guideline remains the transurethral resection of the prostate (TURP), it facilitates a superior success rate in symptom scores, postvoid residual volume, urinary flow, and minimal retreatment rate on long-term follow-up.[17] Apart from established oral medication, efforts have been made to insert drugs straight into the prostate. This has been spurred on by the increased use and efficacy of botulinum toxin treatment in the bladder.[18] In recent years, the prostatic urethral lift (PUL) procedure has emerged as a promising alternative for men seeking treatment for annoying LUTS, with fewer side effects.[19]

SURGICAL TREATMENT

The European Association of Urology (EAU) has outlined the following indications of surgery: refractory urinary retention, recurrent urinary infections, haematuria refractory to medical treatment (other causes excluded), renal insufficiency, bladder stones, increased post-void residual, high-pressure chronic retention (absolute indication).[20]

Transurethral Resection of the Prostate (TURP): This procedure has been in use for many years and is still the surgical yardstick for bladder outlet obstruction (BOO) due to BPH, with some minimal changes. Transurethral resection of the prostate (TURP) is a method where the prostate is resected from an endoscopic approach.[10]

Bipolar techniques were very popular at the beginning because of the short learning curve.[2] In bipolar resection, the energy is cramped between the resection loop and the tip of the resectoscope. Though the abstraction of prostatic tissue is like M-TURP, Bipolar- Transurethral Resection of Prostate (B-TURP) consumes lesser energy/ voltage.[4] A recent large meta-analysis with overall 69 RCTs (8517 enrolled patients), in a 12-month period assessing bipolar devices, revealed no significant difference between B-TURP and M-TURP on IPSS, Quality of Life (QoL) score, prostate volume, and Post Void Residual (PVR).[16] Regardless of the build-up of evidence comparing M-TURP and B-TURP over the last decade, there has been continuing uncertainty regarding the differences between these two surgical approaches in terms of surgical outcomes.[17]

Simple Prostatectomy (SP): The open prostatectomy has evolved to be integrated into many robotic prostatectomy procedures, although its overall complication rate and hospital stay are still much higher than those of many transurethral procedures .[21] Laser enucleation has been associated with an extended learning curve, higher incidence of post-surgical urethral stricture, and transient stress urinary incontinence while the laparoscopic prostatectomy has restricted availability which makes Robotic Associated Simple Prostatectomy (RASP) an optimal minimally invasive alternative, particularly in the treatment of bulky glands.[22] RASP can be securely and efficiently accomplished in centres with adequate expertise as demonstrated in various studies. RASP has certain advantages over open technique such as lower perioperative morbidity and eventually swifter patient recovery. RASP seems to be attractive when compared with open simple prostatectomy as it can offer less blood loss and shorter hospital stays.[23] Xia et al. in their meta-analysis with a total of 406 related articles indicated that RASP is a viable and effective alternative to Open SP.[22]

Laparoscopic Adenomectomy (LA) in a short time has developed into a well–recognized preference for the surgical treatment of BPH.[24] It is consistent, reproducible, and delivers outstanding operational results. It has a marginal complication rate but has other advantages of minimally invasive surgery. RASP on the other hand offers briefer hospitalization, quicker recovery, and an earlier return to work than LA. Moreover, robotic surgery extends several advantages involving stereoscopic vision and 6 degrees of freedom.[25]

Transurethral Incision of the Prostate (TUIP): TUIP lessens lower urinary tract symptoms (LUTS) resulting from bladder outlet obstruction (BOO) by ripping open the bladder outlet without removing any tissue. Backed by the benign prostatic hyperplasia (BPH) guidelines of the European Association of Urology, American Urological Association, and the Canadian Urological Association, this procedure is deemed the choice of surgery for men with tiny prostates <30 cm^3 and absent middle lobes.[26] TUIP remains underutilized in urology, perhaps because of the concerns of the prostate size constraints, shortage of transrectal ultrasonography to estimate prostate volume earlier to BOO surgery, and the issue of enduring success. Holmium TUIP (Ho-TUIP) has been earlier depicted and used securely and successfully for small-sized prostates.[27,28]

Transurethral Vaporization of the Prostate (TUVP): For a long time, monopolar TURP has been considered a gold standard, and it has been an efficient technique for the treatment of BPH.[29] Nevertheless, M-TURP is always accompanied by several hurdles, such as transurethral resection syndrome, haemorrhage, retention of clots, and retrograde ejaculation. To enhance productivity and lessen these barriers, different transurethral techniques have been created, such as transurethral electro vaporization of the prostate (TUVP), bipolar TURP, and various other lasers.[30] B-TUVP appears to be effective and safe for treating moderate-to-severe lower urinary tract symptoms and urinary retention in patients with large BPH.[31]

Photo selective Vaporization of the Prostate (PVP): Laser vaporization is a safe and effective option for treating LUTS secondary to BPH. A patient-cantered approach considering patient preference and preoperative parameters should be employed to determine the ideal treatment option for each individual patient.[27]

Prostatic Urethral Lift (PUL): The most encouraging new technique has been the prostatic urethral lift. This

is a novel mechanical implant placed into the prostate that pulls the encroaching lobes of the prostate out of the way to improve men's flow.[12] This device has been shown to cause minimal interference to ejaculation when compared with the customary transurethral resection of the prostate (TURP). In a recent trial, comparable outcomes were found including patient satisfaction with minimal complications.[32] The evidence supports the PUL device as a clinically effective device for the treatment of BPH, giving IPSS score improvements from baseline.[33]

Transurethral Microwave Therapy (TUMT): Transurethral microwave thermotherapy (TUMT) uses microwave-induced heat to ablate prostatic tissue and is designed to have fewer major complications than TURP. TUMT is done under an outpatient setting in local anesthesia.[34] Though it used to be a widely done minimally invasive surgical therapy, its use has waned over the last decade.[35] Franco JV et al. concluded in their study that TUMT delivers a comparable decline in urinary symptoms to the TURP, with fewer unfavourable events and a small number of cases with ejaculatory dysfunction shortly. However, TUMT probably results in a large increase in retreatment rates.[34] Similarly, in a study done for treatment of BPH by Zietek RJ et al., they inferred TUMT to be a significant choice, particularly fitting for patients who assume better urinary symptoms not including waning erectile function.[36]

Water Vapor Thermal Therapy (WVTT): Convective radiofrequency water vapor thermal therapy is a new technology that uses targeted, manipulated water vapor energy (steam) to produce necrotic tissue in the prostate.[37] Considered a safe procedure for clinically substantial BPH, this minimally invasive surgical treatment has a significant record as effective, and efficient. WVTT currently is used during the treatment course for ablation of lateral and median lobes of the prostate. As an outpatient or office-based setting without general anaesthesia, it offers lasting relief from LUTS.38 For moderate-to-severe LUTS associated with BPH, Mcvary KT et al. concluded in their study that WVTT was the treatment approach of choice when compared to PUL in terms of cost and effectiveness, due to its lesser technical and retreatment expenses.[39]

Transurethral Needle Ablation (TUNA): Transurethral needle ablation (TUNA) is a minimally invasive procedure for the treatment of symptomatic benign prostatic hyperplasia (BPH).[40] It employs subordinate radiofrequency energy to trigger discerning necrosis of the hyperplastic prostatic tissue while conserving the urethra and neighbouring structures. Compared to transurethral resection of the prostate (TURP), office-based TUNA is an appealing alternative as it is minimally invasive and avoids general anesthesia.[40] The current study demonstrated both significant subjective and objective improvements over 10 and 8 years of follow-up, respectively. Haroun H et. al. concluded in their study that TUNA is a suitable preference for those who favour surgical methods with the maintenance of their sexual function and potency.[41]

Laser Enucleation: The well-known laser-assisted enucleation of the prostate, holmium laser enucleation of the prostate (HoLEP), is one of the most well-studied procedures, demonstrating efficacy and safety superior to those of traditional open prostatectomy and TURP. However, its high learning curve has limited its widespread acceptance and utility.[23,42] One of the surgical alternative treatments to TURP, or open prostatectomy for BPH, HoLEP according to EAU Guidelines, has the major advantage of reducing haemorrhage both intraoperatively and postoperatively which decreases transfusion rate, curtails hospital stay and need of catheterization.[43] An upgrade to conventional HoLEP, VB-HoLEP determines quicker operative time and results in a reduced amount of haemoglobin decrease, as it enhances coagulation, otherwise no variances in regard to time of catheterization, volume for irrigation, hospitalization, PVR, QOLS, maximum flow rate (Q_{max}) and IPSS at 3 and 6 months. Thulium laser enucleation of the prostate (ThuLEP) is superior to HoLEP in terms of the efficacy, safety and overall outcomes.[44]

Laser enucleation of the prostate (LEP) is now a regular and pervasive option, minimally invasive method to TURP and OP for BPH. Holmium: YAG, Greenlight and Diode, potassium-titanyl-phosphate (KTP), lithium triborate (LBO) laser, Thulium are the laser types now used in surgically curing symptomatic BPH.[45] Hou CP et al. in their research study found that these three surgical methods

(B-TUEP, ThuLEP, and RASP) were efficient and reliable for enlarged prostates bigger than 80 cm^3. Precisely, B-TUEP had least operative time, while ThuLEP technique had less pain on initial postoperative days. Lastly, patients who underwent RASP achieved the maximum progress in voiding function, especially in Q_{max} and IPSS voiding score.[46] In one study, for IPSS and Q_{max}, diode laser vaporization of prostate was the first choice. For PVR, HoLEP was the best choice. Compared with other transurethral procedures, thulium, holmium, and diode lasers were associated with better efficacy outcomes and fewer complications.[30,47]

Aquablation: Prostatic hydro ablation (Aquablation) is a new technique which requires high velocity water jets used in non-thermal ablation of the impeding prostatic tissue robotically delivered by a transurethral cystoscopic handpiece and guided by real time transrectal ultrasound imaging. Recent trials have shown that aquablation is safe and effective in the treatment of symptomatic BPH while maintaining sexual preservation.[48] Aquablation has demonstrated exceptional safety and success in men with smaller (30–80 cm^3) and larger size (80–150 cm^3) prostates. In contrast to TURP, the aquablation technique has a reduced rate of postsurgical ejaculatory dysfunction for both small (30–80 cc) and bigger size (80–150 cc) prostate glands. Being a robotically accomplished surgical alternative, aquablation technique is a safe and efficient as well for the treatment of BPH in men with large prostate glands. It has shown sturdy outcomes at 3 years tied with shortened operative times, decreased hospital stays, and minimal retreatment rates.[49]

Prostate Artery Embolization (PAE): Amongst most of the minimally invasive surgical approaches, super selective embolization of the prostate arteries (PAE) is the most remarkable for treating BPH. It can be implemented both under local anaesthesia and for elderly patients with severe comorbidities are the benefits it has over other procedures.[50,51] Prostatic artery embolization (PAE) extends certain noticeable advantages, like incorporating procedure under local anaesthesia, no need of holding anticoagulant drugs, and a speedy resume of normal activities. Abt et al. in their study concluded that a distinct improvement of LUTS can be observed 2 years after PAE, and the technique is combined with less unfavourable outcomes than TURP.[50]

CONCLUSION

PUL and WVTT are promising minimally invasive surgical therapies as preferrable choices to conventional treatment modalities for men with moderate-to-severe BPH. Evaluating M-TURP and B-TURP, there is indecision considering the distinctions between these two surgical methods in terms of overall outcome. RASP is a feasible and efficient minimally invasive option compared to open SP for bulky glands. It also has lesser perioperative morbidity, and ultimately speedier recovery. TUIP is the choice of surgery for men with small prostates <30 cm^3 and absent middle lobes. TUVP is a useful and reliable treating methodology for moderate-to-severe lower urinary tract symptoms and urinary retention in patients with large BPH. PUL causes minimal interference to ejaculation with comparable outcome compared to TURP. TUMT is done under outpatient setting in local anaesthesia, with equivalent decline in urinary symptoms as TURP, but with less adverse events and lesser ejaculatory dysfunction in long term follow up. WVTT is an outpatient or office-based setting without general anaesthesia, it offers lasting relief of LUTS.

TUNA is also an office-based appealing alternative which is both minimally invasive and avoids general anaesthesia, which also maintains sexual function and potency. Laser Enucleation when contrasted with other transurethral procedures, were linked with improved outcomes and less complications and more efficient and reliable for enlarged prostates bigger than 80 cm^3.

Aquablation has advantage of brief operative times, reduced hospitalization, and minimum retreatment rates for both small (30–80 cm^3) and bigger size (80–150 cm^3) prostate glands. Lastly, PAE is preferable for elderly patients with severe comorbidities are the benefits it has over other procedures, less unfavourable outcomes than TURP.

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