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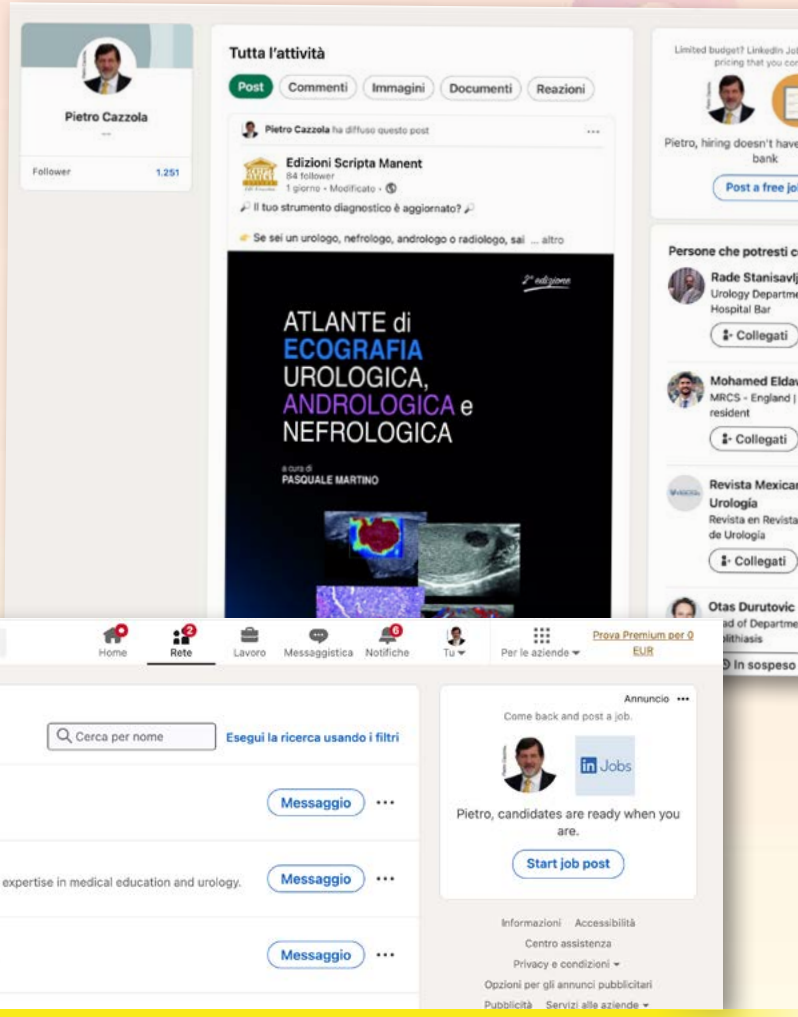

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ADVANCES IN UROLOGICAL DIAGNOSIS AND IMAGING

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Current role of prostate artery embolization in the treatment of benign prostatic hyperplasia related lower urinary tract symptoms. An updated review

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SUMMARY

Introduction: *Benign prostatic hyperplasia (BPH) related lower urinary tract symptoms significantly impact patients' quality of life. Available treatments include medication, surgery, and minimally invasive methods. Prostate artery embolization (PAE) is the less invasive non-pharmaceutical treatment. In the present article, we present current BPH treatment options and we compare them with PAE to investigate the role of PAE in the treatment of BPH related LUTS.*

Materials and methods: *A search was performed in MEDLINE, NCBI, Pubmed, Cochrane Library, and other electronic libraries based on the terms: "benign prostatic hyperplasia", and "prostate artery embolization. The selected articles were checked for the relevancy of their content to the discussed subject. The bibliographic information in the selected articles was checked for relevant publications not included in the original search.*

Results: *As a relatively new procedure, few data exist to determine the exact mechanism(s) by which PAE achieves the above results. Moreover, it is not yet known which of the BPH patients may ideally benefit from this kind of treatment.*

Conclusion: *PAE offer symptom relief to men with BPH. Currently is considered a viable method that tends to be used as an alternative to surgical treatments. So far, the ideal target group for PAE treatment among BPH patients remains unknown. It seems that patients with large prostate volumes and suboptimal results from pharmacotherapy unsuitable for surgery are the best candidates for PAE.*

Key words: *enlarged prostate, lower urinary tract symptoms, artery embolization.*

Abbreviations: *Benign prostatic hyperplasia (BPH), lower urinary tract symptoms (LUTS), prostate artery embolization (PAE), phosphodiesterase type 5 inhibitors (PDE5 inhibitors), 5α-reductase inhibitors (5ARIs), dihydrotestosterone (DHT), nitric oxide (NO), transurethral microwave therapy (TUMT), transurethral needle ablation (TUNA), laser resection/ablation (LRA), transurethral ethanol ablation (TEAP), high intensity frequency ultrasound (HIFU), holmium laser enucleation of the Prostate (HoLEP), open prostatectomy (OP).*

Introduction

Benign prostatic hyperplasia (BPH) is the most common benign neoplasm in men. Its incidence increases with aging: it is present in 20% of men at age 40, 50% at age 50, and 70% at age 60. Actually BPH is a histologic diagnosis characterized by proliferation of the cellular elements of the prostate (1). This involves both stromal and epithelial cells, and results in formatting large, fairly discrete nodules in the transition zone of the prostate. The aetiology remains somewhat unclear, however, is probably a normal part of the aging process in men, caused by changes in intra-prostatic hormone balance. Interactions between growth factors and steroid hormones may ultimately alter the balance of cell proliferation versus cell death to produce BPH. Alongside the age-related hormonal alterations, evidence suggests that failure in the spermatic venous drainage system in BPH patients results in increased hydrostatic pressure and local testosterone levels elevation (more than 100-fold above serum levels). BPH may also be developed following fibrosis and weakening of the muscular tissue in the prostate secondary to aging (1).

Given that BPH represents an increase in the number of cells rather than a growth in the size of individual cells, only

50% of individuals with histologic findings have clinical enlargement of the prostate. No correlation between histology and symptoms exists since only 50% of BPH patients with an enlarged prostate have lower urinary tract symptoms (LUTS). Both obstructive (delay in onset, decreased urinary stream, intermittency, and sensation of incomplete emptying) and irritative urinary symptoms (hesitancy, frequency, urgency, urge incontinence, bladder pain, and nocturia) are associated with BPH. Of note, LUTS are also present in other diseases such as infection and cancer of the prostate, urethral stricture, interstitial cystitis, overactive or hyperactive cyst, dysfunction or contraction of the bladder neck, dyssynergia of bladder neck, bladder diverticula, etc. Although bladder irritation is bothersome, chronic bladder outlet obstruction may lead to serious complications such as renal insufficiency, recurrent urinary tract infections, gross hematuria, and bladder calculi formation as well (1). Symptoms burden varies. Mild symptoms usually do not require treatment however, moderate and severe symptoms could be treated with either medical therapy or surgery. Currently, prostatic arterial embolization (PAE) has emerged as a feasible procedure to treat lower urinary tract symptoms associated with BPH. However, as a relatively new procedure, few data exist to determine the exact mechanism(s) by which PAE achieves the above results, and it is not known which of the BPH patients may ideally benefit from this kind of treatment.

Aim

This article aims to present current BPH treatment options and compare them with PAE to investigate the role of PAE in the treatment of BPH-related LUTS.

Materials and Methods

A search was performed in MEDLINE, NCBI, Pubmed, Cochrane Library and other electronic libraries using the following terms: "benign prostatic hyperplasia", "lower urinary tract symptoms", "prostate enlargement", "prostate", "steroid hormones", "symptom remission", "prostatic volume" in combination with the keywords: "prostate artery embolization", "prostate pharmaceutical treatment", "prostate surgery". The selected articles were checked for their content's relevancy to the discussed subject. The bibliographic information in the selected articles was checked for relevant publications not included in the original search.

Results

Medical treatment includes α1-adrenoceptor antagonists (α1-blockers/α1-AR inhibitors), inhibitors of 5α-reductase (5ARIs), the combination of the above, phosphodiesterase type 5 inhibitors (PDE5 inhibitors), a combination of α1-blocker with PDE5 inhibitor and combination of α1-blocker with an anticholinergic agent. The mechanism of action of the abovementioned four factors varies: α1-AR inhibitors cause urethral dilation and prostatic smooth muscle relaxation by blocking the binding of norepinephrine to the smooth muscle receptors (2). The common side effects reported are dizziness, headache, asthenia, postural hypotension, rhinitis, and sexual dysfunction (3). On the other hand, 5ARIs are compounds that block the conversion of testosterone to dihydrotestosterone (DHT). DHT initiates transcription and translation promoting thus cellular growth and BPH development. Since 5a-reductase inhibition leads to a 60%-95% decrease in circulating DHT, it shifts the imbalance between growth and apoptosis in favor of cellular death and subsequently induces a decrease in prostatic volume. The most common side effects include decreased libido, erectile dysfunction, a decrease in ejaculate volume, and gynecomastia (4,5).

Anticholinergic medications inhibit the stimulation of the smooth muscle of the bladder by the action of acetylcholine on muscarinic receptors, and reduce the BPH related irritative urinary symptoms. Side effects may include: dry mouth, blurry vision, constipation, drowsiness, sedation, hallucinations, memory impairment, difficulty urinating, confusion, decreased sweating, decreased saliva (5). Finally, PDE5 inhibitors increase the levels of nitric oxide (NO) and repair the BPH induced decrease in NO-mediated relaxation of prostate smooth muscle (6). Common adverse effects include headache, flushing, runny nose, stomach pain, back pain, and indigestion. PDE5 inhibitors may cause dizziness or a sudden drop in blood pressure. Some men (<2%) experience prolonged and/or painful erections. Visual problems (increased sensitivity to light, bluish haze, or temporary difficulty distinguishing between blue and green) may occur.

Surgery (transurethral resection or open prostatectomy) is the appropriate treatment option for patients with moderate to severe symptoms of prostatic hyperplasia, which cannot be alleviated with medication, refractory urinary retention, recurrent or persistent urinary tract infections; recurrent gross hematuria, documented significant residual urine after voiding with or without overflow incontinence, pathophysiological changes of the kidneys, ureters, or bladder, abnormally low urinary flow rate; renal insufficiency secondary to bladder outlet obstruction, bladder calculi and/or large bladder diverticula (7). As with all types of surgery, both transurethral resection and open prostatectomy are associated with potential risks. The most common side effect of both procedures is retrograde ejaculation. In fact, 25% to 99% of men experience retrograde ejaculation after undergoing prostatic surgery. Another side effect is erectile dysfunction, which occurs in approximately 3% to 35% of men. Up to 30% of men present prolonged hesitancy while 5.8 and 5.6% of patients receiving TUR-P fail to void and need surgical revision respectively. Urethral stricture is estimated to develop in up to 4% of cases. Other relevant complications are significant urinary tract infection (3.6%), bleeding requiring transfusions (2.9%) and transurethral resection syndrome (1.4%) (8). Temporary urinary incontinence

is a less common complication, occurring in as many as 2% of cases. About 10% of men need a repeat TURP within 10 years (9). In addition, wound infections occur in fewer than 5% of patients after suprapubic and retropubic prostatectomies while urinary fistulas, rectal injury and osteitis pubis have been reported also (10).

Minimally Invasive Surgical Techniques include transurethral microwave therapy (TUMT), transurethral needle ablation (TUNA), laser resection/ablation (LRA), transurethral ethanol ablation (TEAP), and high intensity frequency ultrasound (HIFU) (11). LRA with Holmium provides comparable results to TURP (in IPSS and flow rates), while having lower complication rates. Randomized, comparative trials between TUMT and TUNA versus TURP show symptom scores to be comparable, though flow rates were clearly superior for TURP. Patients did not report incontinence or retrograde ejaculation as a result of the treatment. The main complication of TUMP is the inability to urinate for more than a week. TEAP shows promising results, though several severe morbidities have been reported. HIFU remains mostly experimental (11).

It is less than two decades since PAE was systematically used for the treatment of BPH induced LUTS. Initial experience showed promising results in terms of reduction of the prostatic volume, symptom remission and improvements in quality of life. PAE is the less invasive non-pharmaceutical treatment and it is safe: adverse events related to prostatic artery embolization are generally rare. Post-embolization syndrome, which consists of symptoms of pain, mild fever, malaise, nausea, vomiting and night sweats, is a commonly recorded post procedural complication. Other minor complications including hematospermia, diarrhea, and UTI have been rarely reported. Bladder ischemia represents a rare complication of PAE, and less than 5 events have been reported so far (12). Ischemic rectitis has been also reported in a single case (13).

Data concerning the role of PAE in the treatment of BPH induced LUTS has been criticized for different reasons: There is a relatively small number of published studies while the number of research groups is limited worldwide. Moreover, quality of several studies available was referred to be poor due to cohort, unclear patient selections and dropouts as well as statistical limitations and missing long-term results (14). Of note, embolization material (large vs small sized particles and non-spherical vs micro-spherical particles) and embolization technique (distant vs proximal vs combined embolization) varies among studies. Accumulated evidence showed that the PErFecTED (Proximal Embolization First, Then Embolize Distal) technique has produced greater prostate ischemia and infarction than previously described methods with clinical improvement of lower urinary symptoms and lower recurrence rates (15,16). Similarly, small sized particles (50 μm and 100 μm) have been proven as more effective than larger non-spherical particles (200-500 μm) (17). Compared to non-spherical particles microspheres showed greater improvement in IPSS, QoL, prostatic volume, and Qmax. However, significant difference was noted only for prostatic volume reduction (18). Interestingly, a comparative study using 100-300 μm versus 300-500 μm found not significant differences in functional and imaging outcomes following use of the two embolic sizes. Nevertheless, the incidence of adverse events was greater with 100-300 μm embolic materials (19). Other researchers suggest smaller sized particles (50-100 μm) to be the appropriate embolic agents for PAE to treat LUTS-related to BPH (20). Taking into account the small diameter of the intraprostatic arterial branches, small sized particles (5 -100 μm) seems to achieve a more complete filling of the vascular bed of the prostate. On the other hand, it remains unclear whether the small-sized microspheres can actually play any role in the reported ischemic complications.

No generally accepted definition for technical and clinical success exists, and the variety in outcome measures in the published studies renders any qualitative evaluation difficult. Some authors define technical success as selective prostatic arterial catheterization and embolization achievement on at least one pelvic side, while others consider bilateral embolization as procedure technical success (21,22). In fact, bilateral PAE seems to lead to better clinical results while up to 50% of patients after unilateral PAE have a good clinical outcome (23). Although many of the existing studies confirm this finding, a recent one revealed the possibility to reach contralateral prostatic territory from the ipsilateral prostatic artery and embolize it via peri/intra-prostatic anastomoses. In such a case the use of small sized particles (50-100 μm) is of outmost importance in order to reassure the embolization of intra-prostatic anastomoses. In fact, in this study, all cases had significant clinical success after a short follow-up period of 3.3 months (24).

Regarding clinical success, principal outcome assessment varies among studies and could be either objective or subjective, laboratory, clinical or both. For example, regaining the ability to urinate after PAE is a measurable size whereas questionnaire-based self-reported improvement of both urination and sexual function and QoL as well is not. Moreover, as long as the exact mechanism by which PAE affects BPH induced LUTS remains unclear, reduction in prostate volume and serum PSA may not be adequate. In fact, clinical success is not necessarily analogous to prostate volume reduction. Moreover, the reduction on prostate volume occurs progressively and stabilized within six months of the procedure. Yet, up to 20% of patients undergoing PAE show no prostate volume reduction 3 months after the procedure (25). A small MRI study showed that volume reduction of the prostate after embolization was significant only in patients with infarcts (26). In this study infarcts were seen in only 70.6% of the subjects, exclusively in the central gland. Other studies confirmed the association between infarction after PAE and larger decreases in volume. A retrospective study also showed that volume decrease occurs in both central and peripheral zones (27). For these reasons prostatic ischaemia/ infarction observed on early post-embolisation MRI may be the best predictor of clinical success after PAE in patients with AUR secondary to BPH (28).

A significantly high PSA elevation occurs in the 24 hours after PAE. During follow-up, mean PSA decreases to a level significantly lower than at baseline. This is suspected to result from prostate inflammation and ischemia resulting from the embolization and suggests prostate cellular apoptosis after PAE (29). However, no statistically significant correlation was detected between PSA level 24 hours after PAE and prostate volume reduction at 3 months of follow-up (30). In contrast, a statistically significant negative correlation between PSA level elevation 24 hours after PAE and IPSS decrease at 3 months of follow-up exists (31). PSA elevation after PAE may have utility as a prognostic factor for predicting patient response to PAE (31).

Uncertainty regarding the role of pre-treatment prostatic volume in the successfulness of PAE exists. Bagla et al. performed an analysis on 78 consecutive patients undergoing PAE, comparing prostate volume groups (group 1 < 50cm3; group 2, 50-80cm3; group 3 >80 cm3) at baseline and follow-up to assess for differences in outcomes of American Urological Association (AUA) symptom index, quality of life (QOL)-related symptoms, and International Index of Erectile Function (IIEF). According to their result, no statistically significant differences in the above parameters was found between groups (31). Other authors suggest that patients with a smaller prostate (i.e., volume <30 cm3) should be excluded because PAE is believed to work based on prostate volume reduction, which will be more limited in patients with almost normal sized prostates (32). Interestingly, Little et al., found a statistically significant reduction in prostate volume following embolization with a median reduction of 34% (34) in the group of patients with adenomatous-dominant BPH (AdBPH), compared to a mean volume reduction of 22% in the non-AdBPH group. The International Prostate Symptom Score (IPSS) and the quality of life (QOL) score significantly improved in the AdBPH group while there was no deterioration in sexual function in either group post-PAE (33). This finding may indicate a greater impact of PAE induced ischaemia in the adenomatous than in the stromal element of the prostate gland.

Clinical success is often related to the characteristics of the study populations: for patients with moderate to severe LUTS refractory to medical treatment, clinical success is usually defined as improving symptoms (IPSS or AUA symptom score) and quality of life (QoL) (34). In some studies of cohorts with similar characteristics, clinical success was also defined as significant improvements in sexual function, urinary flow rate, QOL, and reduction in prostate volume and serum PSA (35). Additionally, in patients with acute urinary retention (AUR) due to BPH and failed trial without catheter, outcomes are defined as based on successful weaning of catheter in 2 weeks after PAE, procedure-related complications, and percent non-perfused prostate volume and prostate volume reduction on MRI at 2 weeks after PAE (36).

Age may play a role in PSA and erectile function after PAE. Li et al., performed PAE in 24 patients (65-85 years, mean 74.5 years) with severe LUTS refractory to medical therapy. Despite clinical success PSA and IIEF improvements after PAE did not differ from pre-PAE significantly (22). Studies with a lower mean age found significant IIEF improvements after PAE.

Discussion

Prostate volume reduction is considered the basic mechanism by which 5ARIs treat BPH-induced LUTS, even though reduction does not correlate with the degree of symptoms relief (37,38). In both treatments, reduction in prostate volume occurs progressively and stabilized between three to six months. Both treatments are more effective in patients with larger prostate volumes (39). Both treatments improve IPSS, PVR and, Qmax. Dutasteride, the most powerful 5ARI, increases Qmax by 0.6 ml/s at 2 yr, which can be further improved to 1.9 ml/s at 4 yr (40). PAE may achieve far greater improvements in Qmax, (mean increase in Qmax from 8.0 to 14 mL/s at 12 months and to 18 mL/s at 24 months after PAE) (41). Although 5-ARIs reduce also the long-term risks of AUR and the need for invasive BPH therapy. On the other hand, PAE offers definite treatment as an alternative to invasive BPH therapy (42). According to the literature, a dutasteride treatment for 4 years reduces serum PSA levels by 57% from the baseline. Most of this reduction occurs within 1 year of treatment (43). One concern with reducing PSA levels is the potential masking of prostate cancer detection. Similarly, after PAE, PSA levels typically decrease significantly. Studies have shown that PSA values can drop by around 42% one year after the procedure (44,45). This reduction is due to the shrinkage of the prostate gland, which is achieved by cutting off its blood supply, and does not mask prostate cancer detection. The major advance of PAE over Dutasteride is the limited number and degree of side effects. The side effects of the 5 ARI treatments -among others- include persistent erectile dysfunction, sexual dysfunction, high Gleason grade prostate cancer, and depression. Sexual function related adverse events are bothersome and led to discontinuation of patients from the drug (46,47). Published evidence indicates absence of similar adverse effects on PAE outcomes. Moreover, 30% of patients treated with PAE report improved sexual function (48).

A recent study reported that PAE provided long-term effectiveness, with significant sustained relief up to six years (48). Success rates vary among studies; nevertheless, between one-fourth and one-third of patients fail to have adequate symptom improvement and choose some other form of treatment by 12 months (49). The facts above support the superiority of PAE over 5-ARIs as a first-line treatment of BPH-related LUTS. Currently, the specific indications remain unspecified (50).

A-blockade became established as a therapy for BPH based on its effects on symptoms and flow rates. The benefits of a-blocker therapy appear shortly after starting therapy due to the alteration in dynamic smooth muscle tension within the prostate and bladder neck (51). The main a-blockers

provide a comparable increase in Qmax with that of PAE (52). Some side effects of a-blockers (orthostatic hypotension, dizziness, and tiredness) are the most commonly cited reasons for drug discontinuation (52). These side effects may seriously affect some elderly BPH patients under antihypertension treatments. In fact, a-blockers can increase the effects of other medications such as beta-blockers, calcium channel blockers, or medicines for erectile dysfunction. Moreover, some research has found that long-term use of some alpha-blockers can increase the risk of heart failure (53,54). Since none of the abovementioned adverse events has been associated with PAE, the last appears as a safe alternative option for this group of BPH patients. For the remaining patients, the choice between these options depends on factors like symptom severity, prostate size, patient preference, and overall health.

A recent study evaluated the effectiveness and safety of PAE compared to dutasteride and tamsulosin as the first alternative treatment for benign prostatic hyperplasia (BPH) in patients who had not received previous treatment (50). The study found that both interventions improve voiding and bladder outflow obstruction from baseline, with more patients unobstructed after PAE (63%) than medication (28%), more patients in group 1 experienced changes in ejaculation and reduced sexual desire. The most common side effects in group 2 were temporary increased urine frequency and pain during urination, which resolved within 1 month. PAE patients had significantly more significant reductions in prostate size, incomplete emptying, total IPSS, quality of life, and Qmax. Since a-blockers provide a comparable increase in Qmax with that of PAE (52), it is expected that the combination 5-ARIs and a-blocker would be more efficient than PAE as a first-line treatment of BPH-related LUTS. Given the small number of participants and considering that PAE is especially effective in patients with very large prostates, more research is needed to demonstrate the potential superiority of PAE over the 5-ARI/α-blocker combination.

Currently, it remains unclear whether storage symptoms (also known as irritative LUTS) are caused by bladder outlet obstruction because the symptoms may remain in up to 33% of the patients after surgical removal of the obstruction (55). Evidence suggests that muscarinic receptors of the bladder are involved in the pathogenesis of irritative LUTS, therefore, the role of PAE in treating these symptoms is questionable. Literature provides confounding findings: Two studies found storage and voiding symptoms to be improved similarly after PAE (56,57), two other studies showed statistically significant more remarkable improvement in the voiding symptoms subscore of IPSS (58,59) and a single study found the mean voiding symptoms subscore of IPSS to be lower than mean IPSS-s component score one month after PAE. This result remained at 36 months follow up (60).

So far, no study exists comparing the effectiveness of PAE to that of anticholinergic/α-blocker combination in treating BPH-related storage symptoms.

Recent trials have examined the effectiveness of sildenafil (61), tadalafil (7), and vardenafil (62) in men with LUTS and BPH. All of the studies consistently demonstrated that this class of drugs improves mainly storage LUTS although no significant improvements in objective indices of outlet obstruction (e.g. uroflowmetric parameters or postvoid residual volume) were recorded. Possible effects of PDE5-Is on LUTS may involve either relaxation of bladder smooth muscle, bladder compliance changes, improvement in bladder wall perfusion or activities at the central nervous system level (63). Data regarding the long-term efficacy of PDE5 inhibitors or PDE5 inhibitors/α-blocker combination is scarce, rendering any comparison between them and PAE difficult.

As with PAE, minimally invasive surgical techniques (MIST) offer lower morbidity, reduced hospitalization, and increased convenience. Both PAE and MIST may be an appropriate choice for certain patients, such as younger men, debilitated elderly patients, and patients with severe medical conditions. A recent meta-analysis of studies comparing PAE with MIST found more significant improvement in symptoms (IPSS), quality of life, higher maximum flow of urine, and greater reduction in prostate volume in patients who received PAE compared to the control groups (64). Similar to PAE, the least invasive techniques are done without anaesthesia and have significantly lower rates of side effects but lag behind effectiveness. None of them to date have proven superior to TURP. Over 5 - 10 years of follow-up, a relatively high percentage of patients receiving these less invasive procedures need surgery again. Specifically, the office-based procedures of TUMT and TUNA, have the highest rates of reoperations, higher IPSS, and lower Qmax (12). Comparison of efficacy and safety of prostatic urethral lift vs prostatic artery embolization for benign prostatic hyperplasia showed that the two procedures are equally safe and that PAE has a better ranking concerning improvement of most clinical and functional outcomes (65). Comparison among Aquablation, PAE and Rezum found no consistently significant outcome differences (66).

Limited experience and the absence of large-scale randomised studies do not allow for a comprehensive comparison between minimally invasive surgical techniques and PAE. Of note, a small number of patients who failed prior different urological interventions and underwent PAE showed a subsequent improvement in symptoms (67). This positive response may suggest that embolization can be an effective treatment alternative in this subset of patients.

TURP is considered the 'gold standard' surgical procedure for the treatment of symptomatic BPH. It is the most effective surgical procedure, though the most invasive. It has the highest risk for serious complications, including blood loss, erectile dysfunction, and urinary incontinence. However, TURP remains the procedure of choice because it is believed to be more effective than minimally invasive surgical techniques. Three trials did not reveal a significant difference between PAE and TURP in IPSS score reduction (68-71), nevertheless, other studies observed a greater decrease of IPSS in the TURP group at long-term follow-up (72-74).

According to meta-analyses, TURP is associated with better urodynamic results, which get even better as time passes (75-77). Prostate-specific antigen levels, quality of life, and post-void residual volume improvements show no significant difference between treatments (75,76). Evidence suggests that TURP results in significantly smaller prostate volume than either original or PErFecTED PAE (68,78). However, PAE is mainly performed in large prostates, and its impact on prostatic volume gradually increases. Of note, in contrast to TURP alone, PAE + TURP provides better postoperative outcomes despite no significant difference in the severity grade distribution of postoperative complications (79). Generally, both TURP and PAE show low adverse events rates (mainly retrograde ejaculation and postembolization syndrome, respectively) and comparable sexual function outcomes post-treatment. However, while TURP requires spinal anesthesia and hospitalization; PAE is performed on an outpatient basis. For this reason, PAE may be an appropriate choice for certain patients, such as younger men, debilitated elderly patients, and patients with severe medical conditions.

The role of TURP in treating patients with enormous glands (prostate volumes >100 mL) is limited. Current treatment options include holmium laser enucleation of the Prostate (HoLEP) and open prostatectomy. HoLEP is a very efficacious endoscopic alternative to open prostatectomy and has proven long-term results over more than a decade. It also has fewer and less severe complications when compared to open prostatectomy. Even though the clinical benefits of HoLEP are well proven, it is costly and narrowly available. A recent meta-analysis showed that HoLEP is superior to PAE at 3 months for Qmax improvement. There was no significant difference in IPSS, QoL, postvoid residual (PVR), and Qmax improvement at 1 year between PAE and HoLEP. PAE was also associated with lesser SAE compared to HoLEP (80). Studies on the long-term outcome of PAE are needed to establish the durability of early outcomes after PAE.

Open prostatectomy (OP) remains the most effective and durable treatment for patients with enormous glands. Nevertheless, a recent study showed that OP is associated with a relative morbidity rate, blood loss, prolonged recovery time, and moderate to heavy patient burden. On the other hand, higher value of postoperative hemoglobin level (mg/dL) and shorter hospitalization (days) and catheterization (days) was recorded for PAE group (81). When compared with OP, PAE showed inferior 1-year surgical and functional results. More precisely, patients of OP group had lower IPSS, PVR, prostate-specific antigen (PSA), QoL, International Index of Erectile Function-5 and greater peak flow (PF). Another comparative analysis between PAE and OSP showed similar initial IPSS readings for both treatments. However OP demonstrated a significantly greater reduction at both 6 months and 12 months, signaling better symptom relief in this cohort. Quality of life also favored OP with a notable improvement at 12 months, despite comparable baseline values. Nevertheless, PAE patients maintained better erectile function over time, with significant differences seen at 6 months and 12 months. OP patients experienced a superior peak urinary flow rate with higher measurements at both 6 months and 12 months (74).

Conclusion

Although surgery is the most effective treatment of LUTS associated with BPH, most patients who eventually undergo surgery have had a course of medical therapy first. Some men may choose minimally invasive procedures and very few choose TURP as their initial treatment. Actually, the primary consideration when deciding whether therapy for BPH is symptoms severity however, some factors such as patient age, comorbidity, quality of life, sexual health, risk of disease progression, patient preference, economics and treatment availability may also interfere. According to the existing evidence PAE appears to provide comparable if not better results than pharmacotherapy. Current literature suggests that PAE provide inferior improvements in prostate volume and Qmax than surgery but it is capable to restore the ability to urinate after catheterization due to medication refractory urinary retention. For this reason, several authors proposed PAE as definite treatment for frail elderly patients with multiple comorbidities (57). Other researchers proposed PAE to be a stop-gap measure, especially for young men, until they need surgery (58), however, supporting evidence is poor and more research is needed in order to confirm or reject this use.

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Urolithiasis and the Microbiome: How Lifestyle Factors Play a Role

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Urolithiasis is one of the most common urological diseases, with a globally increasing incidence. Preventive measures are a well-established strategy to reduce the morbidity associated with urolithiasis, primarily relying on lifestyle modifications and pharmacological treatments. In addition, emerging research areas—such as studies on the microbiome—are showing promising potential.

The Authors of this review (1) examined the most recent findings on lifestyle-based prevention strategies and microbiome changes in patients with urolithiasis. Most lifestyle recommendations are already included in existing urological guidelines, but additional interventions, like vitamin D supplementation, may offer further benefits. Microbiome studies have identified specific microbial profiles and metabolic pathways that either promote or inhibit stone formation.

Despite these efforts, current preventive approaches have not yielded fully satisfactory outcomes, suggesting that lifestyle interventions alone may be insufficient. Furthermore, microbiome research faces challenges due to the strong influence of various clinical factors on microbial composition and the lack of standardized analytical procedures. Therefore, standardizing methodologies and pooling data from large-scale clinical and microbiome registries are critical steps toward enhancing current prevention strategies through targeted microbiome-based interventions.

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EAU25 Press release: High resolution ultrasound could enable faster prostate cancer diagnosis

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Biopsies guided by high-resolution ultrasound are as effective as those using MRI in diagnosing prostate cancer, an international clinical trial has shown. The technology, called micro-ultrasound, is cheaper and easier to use than MRI. It could significantly speed up diagnosis, reduce the need for multiple hospital visits and free up MRI for other uses, researchers say.

The results of the OPTIMUM trial are presented today [Sunday 23 March 2025] at the European Association of Urology Congress in Madrid and published in JAMA.

OPTIMUM is the first randomised trial to compare micro-ultrasound (microUS) guided biopsy with MRI-guided biopsy for prostate cancer. It involves 677 men who underwent biopsy at 19 hospitals across Canada, the USA and Europe. Of these, half underwent MRI-guided biopsy, a third received microUS-guided biopsy followed by MRI-guided biopsy and the remainder received microUS-guided biopsy alone.

MicroUS was able to identify prostate cancer as effectively as MRI-guided biopsy, with very similar rates of detection across all three arms of the trial. There was little difference even in the group who received both types of biopsies, with the microUS detecting the majority of significant cancers.

Around a million prostate cancer biopsies are carried out each year in Europe, a similar number in the USA and around 100,000 in Canada. The majority of biopsies are conducted using MRI images fused onto conventional ultrasound, as this enables urologists to target potential tumours directly, leading to more effective diagnosis. MRI-guided biopsy requires a two-step process (the MRI scan, followed by the ultrasound-guided biopsy), requiring multiple hospital visits and specialist radiological expertise to interpret the MRI images and fuse them onto the ultrasound.

Micro-ultrasound has higher frequency than conventional ultrasound, resulting in three times greater resolution images that can capture similar detail to MRI scans for targeted biopsies. Clinicians such as urologists and oncologists can be easily trained to use the technique and interpret the images, especially if they have experience in conventional ultrasound. MicroUS is cheaper to buy and run compared to MRI, and could enable imaging and biopsy to be carried out during one appointment, even outside a hospital setting.

The results of the OPTIMUM trial could have a similar impact to the first introduction of MRI, according to lead researcher on the trial, Laurence Klotz, Professor of Surgery at the University of Toronto's Temerty Faculty of Medicine and the Sunnybrook Chair of Prostate Cancer Research.

"When MRI first emerged and you could image prostate cancer accurately for the first time to do targeted biopsies, that was a game-changer," he recalls. "But MRI isn't perfect. It's expensive. It can be challenging to get access to it quickly. It requires a lot of experience to interpret properly. And it uses gadolinium which has some toxicity. Not all patients can have MRI, if they have replacement hips or pacemakers for example.

"But we now know that microUS can give as good a diagnostic accuracy as MRI and that is also game-changing. It means you can offer a one-stop shop, where patients are scanned, then biopsied immediately if required. There's no toxicity. There are no exclusions. It's much cheaper and more accessible. And it frees up MRIs for hips and knees and all the other things they're needed for."

Professor Jochen Walz, from the Institut Paoli-Calmettes Cancer Center, Marseille/France, is a leading expert in the field of urological imaging and a member of the EAU Scientific Congress Office. He said: "This is a well-conducted

and exciting study which adds a very important tool to the diagnosis of prostate cancer. Using micro-ultrasound is a more straightforward and simpler process. This also makes it safer, by avoiding the potential errors that can creep in during the transfer of MRI to ultrasound for a fusion biopsy.
"It does require training to spot the patterns and interpret micro-ultrasound images correctly. But once that's been mastered, then it could enable prostate cancer diagnosis and biopsy to happen at the same appointment. It could also make targeted biopsies more available in less developed healthcare systems where MRI is a very precious resource.

"The ease and cost of micro-ultrasound means it could be an important tool for screening programmes as well, but further research would be needed to understand its potential role in that setting."
The trial was sponsored by Canadian company Exact Imaging, which has developed the microUS technology.

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1. *https://eaucongress.uroweb.org/eau25-press-release-high-resolution-ultrasound-could-enable-faster-prostate-cancer-diagnosis/*


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