Check for updates

*Journal of Medical Imaging and Radiation Oncology*

Journal of Medical Imaging and Radiation Oncology

INTERVENTIONAL RADIOLOGY—GUIDELINES OPEN ACCESS

# Interventional Radiology Society of Australasia Quality Care Guidelines for Prostate Artery Embolisation for Men With Symptomatic Benign Prostatic Hyperplasia in Australia and New Zealand

William E. L. Ormiston[1,2] | Glen Schlaphoff[3] | Andrew Owen[4] | Brendan Buckley[5] | Dinesh Ranatunga[4,6] | Christopher Rogan[7,8] | Nicholas I. Brown[9,10]

[1]Sir Charles Gairdner Hospital, Perth, Australia | [2]Hollywood Private Hospital, Perth, Australia | [3]Liverpool Hospital, Sydney, Australia | [4]Austin Health, Melbourne, Australia | [5]Auckland City Hospital, Auckland, New Zealand | [6]University of Melbourne, Melbourne, Australia | [7]Chris O'Brien Lifehouse, Sydney, Australia | [8]Sydney Adventist Hospital, Sydney, Australia | [9]The Wesley Hospital, Brisbane, Australia | [10]The University of Queensland, St Lucia, Australia

**Correspondence:** Nicholas I. Brown (nicholas.brown@uq.edu.au)

**Received:** 21 May 2026 | **Revised:** 29 August 2026 | **Accepted:** 1 September 2026

**Keywords:** benign prostatic hyperplasia | embolisation | lower urinary tract symptoms | prostate artery embolisation

## ABSTRACT

**Objective:** This guideline defines recommendations for the provision of quality care for prostate artery embolisation (PAE) treatment for symptomatic benign prostatic hyperplasia (BPH). It has been developed using the AGREE-II framework and aligns with current evidence, sourced from Randomised Controlled Trials, meta-analyses and expert consensus. Recommendations are graded according to the level of evidence supporting them.

**Target Audience:** Men with symptomatic BPH considering their treatment options and referring clinicians including general practitioners, urologists and interventional radiologists.

**Formulation of Recommendations:** This guideline was developed using a modified Delphi approach among a panel of expert interventional radiologists, with a structured review of current literature including randomised controlled trials, meta-analyses and high-quality cohort studies.

**Target Users:** This guideline is intended for use by medical practitioners involved in the assessment and management of men with symptomatic BPH, including general practitioners, urologists and interventional radiologists. It may also inform policy-makers, hospital administrators and quality assurance bodies regarding the standard of care for PAE.

**Updating Procedure:** This guideline will be reviewed 5 years after publication, or earlier if significant new evidence emerges. Updates will follow the AGREE CheckUp process and will be published in relevant peer-reviewed outlets and society guidelines.

## 1 | Introduction

Benign prostatic hyperplasia (BPH) is a prevalent condition in ageing men, with histological evidence of glandular and stromal proliferation found in up to 80% of men by the age of 80 [1]. BPH is characterised by enlargement of the transitional zone of the prostate, which encroaches on the urethral lumen and contributes to bladder outlet obstruction and a range of lower urinary tract symptoms (LUTS) [2]. These may include urinary frequency, urgency, nocturia, weak stream, hesitancy, intermittency and the sensation of incomplete voiding. Although this constellation of symptoms can be exacerbated by a complex

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2026 The Author(s). *Journal of Medical Imaging and Radiation Oncology* published by John Wiley & Sons Australia, Ltd on behalf of Royal Australian and New Zealand College of Radiologists.

range of factors, an enlarged prostate is the most common cause of LUTS. The cumulative effect of these symptoms can cause substantial deterioration in quality of life, with further complications including urinary retention, recurrent urinary tract infections and renal impairment.

First-line management of BPH typically includes lifestyle modification and pharmacologic therapy, such as alpha-adrenergic antagonists and 5-alpha-reductase inhibitors [3–5]. However, medication is often insufficient, with up to 30%–50% of men discontinuing treatment due to inadequate symptom control or adverse effects [4, 5]. There are a wide range of invasive and minimally-invasive surgical options, including Urolift, Rezum, transurethral resection of the prostate (TURP), laser enucleation (HoLEP) and open prostatectomy. The more invasive surgical interventions are effective but can be associated with irreversible morbidity. TURP remains the surgical gold standard, but can be linked with ejaculatory dysfunction, erectile changes, incontinence, bleeding and prolonged catheterisation [6].

Prostate artery embolisation (PAE) emerged as a non-surgical, image-guided treatment alternative for BPH 25 years ago [7, 8]. Performed by interventional radiologists, PAE involves embolising the prostatic arteries using microparticles or liquid adhesive, resulting in targeted ischaemia and progressive reduction in gland volume. Embolisation of prostate arteries by experienced operators is endorsed as an acceptable treatment for appropriately selected patients within international guidelines from both interventional radiology [9, 10] and urological societies (EAU, AUA) [11] as well as the NICE guidelines in the UK [12].

### 1.1 | PAE Indications

*PAE is a safe and effective non-surgical treatment for men with obstructive BPH causing moderate to severe LUTS.*

*Treatment should be offered to men with BPH and moderate to severe LUTS who have failed, are intolerant to, or have declined medical therapy in the absence of contraindications.*

Numerous high-quality studies—including systematic reviews, meta-analyses and randomised controlled trials—have concluded that PAE provides significant improvements in International Prostate Symptom Score (IPSS), peak urinary flow (Qmax), post-void residual (PVR) and quality of life (QoL), with sustained long-term benefit [13–18] for patients who were refractory to medical therapy. Comparative studies, including the UK-ROPE registry study [19], prospective trials, large cohort studies and a series of randomised controlled trials [20–25], have compared PAE to both surgical interventions and sham in patients with BPH who did not respond to or tolerate medical therapy and found that embolisation is both safe and effective.

While no RCT has demonstrated superiority of PAE over TURP in IPSS outcomes, PAE has been consistently found to be associated with fewer adverse events, reduced complication rates and shorter procedural times [26]. Some subjective QoL outcomes favour PAE [24]. With a shorter length of stay and reduced impact on erectile function alongside comparable improvement in LUTS [16].

Embolisation of the prostate can also be performed on patients with catheter-dependent urinary retention [27]. With the aim of restoring independent urination and removal of the indwelling urinary catheter in situ. Catheter-free urination is typically achieved in >75% of patients with indwelling catheters, up to 97% in some cohort studies [28–31].

Men with prostate volumes >40 mL are eligible for embolisation; however, PAE is particularly suited to patients who.

- Have larger prostate volumes >60 mL
- Wish to preserve sexual function and/or avoid risk of incontinence
- Are poor surgical candidates due to age or comorbidities
- Have acute or chronic catheter-dependent urinary retention

**Recommendation: A**

*PAE is a safe and effective treatment for intractable prostatic bleeding.*

PAE was developed in the 1970s as a treatment for managing lower urinary tract bleeding [32, 33]. Although this led to the development of PAE as a treatment for BPH, embolisation remains a viable method of resolving intractable prostatic haemorrhage, whether spontaneous or post-operative. PAE has also developed an important role in the palliative management of haemorrhage arising from prostate malignancy [34, 35]. Investigations, including cystoscopy, should be performed to confirm prostatic haemorrhage and to exclude other potential bleeding sources such as bladder lesions or undiagnosed prostate malignancy.

**Recommendation: B**

*All men considering treatment for symptomatic benign prostatic hyperplasia (BPH) should be counselled on the full range of available treatment options, including PAE.*

PAE is one of many treatment options for managing obstructive BPH. LUTS can be multifactorial and whilst BPH is a common cause, there are often multiple factors that can contribute to progressive symptoms. Management of obstructive BPH may therefore require a multifaceted approach, requiring input from urologists and interventional radiologists to optimise treatment across the range of factors thought to be responsible for LUTS.

**Recommendation: A**

*PAE has a role in early BPH management and may be considered as an alternative to medical therapy.*

PAE has an emerging role as an effective alternative to medical therapy in the first-line management of benign prostatic hyperplasia (BPH). Two recent randomised controlled trials provide high-level evidence supporting this approach. The P-EASY



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

**Recommendations**

Evidence grading for each Recommendation Level follows standard classification:

- *Level A*: High-level evidence includes RCTs, systematic reviews and meta-analyses.
- *Level B*: Moderate-level evidence such as cohort or case–control studies.
- *Level C*: Expert opinion or consensus in the absence of higher-level data.

Background and Indications.

- PAE is a safe and effective non-surgical treatment for men with obstructive BPH causing lower urinary tract symptoms (LUTS). *Recommendation: A*
- Treatment should be offered to men with BPH and moderate to severe LUTS who have failed, are intolerant to, or have declined medical therapy, in the absence of contraindications. *Recommendation: A*
- PAE is a safe and effective treatment for intractable prostatic bleeding. *Recommendation: B*
- All men considering treatment for BPH should be informed of the full range of treatment options, including PAE. *Recommendation: A*
- PAE has a role in early BPH management and may be considered as an alternative to medical therapy. *Recommendation: A*
- PAE can be safely performed before or after TURP. *Recommendation: A*
- PAE may be used to downsize prostate volume or reduce the risk of future bleeding prior to surgery or other treatments. *Recommendation: B*
- PAE can be repeated safely if lower urinary tract symptoms recur, although repeat procedures are associated with reduced efficacy. *Recommendation: A*

Patient Selection, Pre- and Post-Procedural Care

- Men referred for PAE should be evaluated by an interventional radiologist in an appropriate clinical setting, with multidisciplinary input and shared decision-making. *Recommendation: C**
- Expert analysis of work-up imaging and careful procedural planning are essential. *Recommendation: C*
- Men currently under surveillance for low-grade or low-volume prostate malignancy and who require treatment for symptomatic BPH may still be suitable for PAE. *Recommendation: B*
- Men undergoing PAE should have a prostate cancer risk assessment prior to the procedure, including appropriate history, clinical examination and PSA level, followed by an MRI if there is an elevated clinical suspicion for prostate cancer in accordance with USANZ guidelines on prostate cancer screening. *Recommendation: C*
- Post-procedural follow-up should be conducted by the interventional radiologist or service who performed the PAE and who should be accessible to the patient, GP, or urologist as needed. *Recommendation: C**

Procedural Considerations.

- The use of cone-beam CT during PAE can improve procedural accuracy but is not mandatory. *Recommendation: B*
- Both radial and femoral access are valid options for PAE. *Recommendation: B*
- PAE requires the use of a permanent embolic agent to achieve sustained, distal prostatic ischaemia and infarction. *Recommendation B*
- There is no consensus on the type of permanent embolic agent to be used for PAE. *Recommendation B*
- The PeRFECTED technique is effective but optional. *Recommendation B*

Outcomes and Safety.

- PAE can provide long-term symptom relief, with durable improvements lasting many years in the majority of men. *Recommendation: A*
- PAE is associated with faster recovery, shorter hospitalisation, fewer side-effects and fewer major complications compared to surgical options such as TURP. *Recommendation: A*
- The risk of sexual dysfunction following PAE is low, with lower rates of ejaculatory dysfunction compared to TURP. *Recommendation: A*
- Sexual function may improve after PAE. *Recommendation: B*
- Clinically significant non-target Embolisation is rare. *Recommendation: A*
- Radiation exposure during PAE should be minimised (as low as reasonably achievable, ALARA). *Recommendation: C*
- Radiation doses during PAE are typically low and doses are comparable to other similar angiographic and diagnostic procedures. *Recommendation: B*
- PAE should only be performed by appropriately trained interventional radiologists. *Recommendation: C*.*



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

ADVANCE trial [36] assessed treatment-naive men randomised to PAE or combination medical therapy (dutasteride and tamsulosin) and demonstrated superior symptomatic relief and improved urodynamic outcomes in the PAE group. Similarly, the PARTEM trial [37] evaluated men previously treated with alpha-blockers and found PAE to be significantly more effective than ongoing medical therapy. These findings support the use of PAE as a potential alternative to medical therapy as a first-line or early treatment option for select patients with early or moderate LUTS secondary to BPH.

**Recommendation: A**

*PAE can be safely performed before or after TURP.*

PAE can be safely performed either before or after transurethral resection of the prostate (TURP). As a procedure that reduces prostatic blood flow, PAE may be considered in cases where prior surgical intervention has occurred or in patients who experience suboptimal outcomes after surgery. The literature supports the safety and feasibility of PAE in both pre- and post-TURP settings [38–40], offering flexibility in treatment planning for men with symptomatic BPH and a viable alternative in cases of recurrent symptoms post-TURP.

**Recommendation: A**

*PAE may be used to downsize prostate volume, or reduce* the *risk of future bleeding, prior to prostatectomy or other surgical treatments.*

PAE can be used effectively to downstage prostate volume prior to surgical intervention, particularly in patients with very large glands where conventional surgery may be high risk or technically challenging. By reducing vascularity and prostate size, PAE can facilitate subsequent procedures such as prostatectomy or TURP, potentially improving operative conditions and reducing intraoperative bleeding. Several case series and cohort studies have reported successful use of PAE in this context [41, 42]. With significant reductions in prostate volume consistently demonstrated in meta-analyses [13–18]. This strategy may be particularly valuable for patients with high surgical risk or those requiring staged treatment approaches.

**Recommendation: B**

*PAE can be repeated safely if lower urinary tract symptoms recur, although repeat procedures are associated with reduced efficacy.*

PAE can be safely repeated in patients with recurrent lower urinary tract symptoms (LUTS), although the efficacy of repeat procedures is typically reduced, particularly in those who did not initially respond after a technically successful bilateral embolisation [20, 43]. Recurrent LUTS is often due to revascularisation of the hyperplastic transitional zone [44], either through recanalisation of previously embolised arteries or recruitment of collateral vessels [20].

Evidence suggests re-PAE is most effective in patients who initially improved after PAE but later relapsed [43]. These patients experience significantly better symptom and quality of life improvements with higher cumulative success rates compared to those who showed no response to their first PAE. A repeat PAE may require longer procedural time due to altered pelvic vascular anatomy and potential technical challenges. The decision to repeat a PAE procedure should be made after discussion between the patient and interventional radiologist regarding the potential for added benefit compared to alternative treatment options.

Overall, repeat PAE remains a viable and safe option for selected patients with recurrence, particularly where initial PAE had clear clinical benefit.

**Recommendation: A**

## 1.2 | Patient Selection, Pre- And Post-Procedural Care

*Men referred for PAE should be evaluated by an interventional radiologist in an appropriate clinical setting, with multidisciplinary input and shared decision-making.*

PAE requires careful pre-procedural planning, including expert review of imaging, assessment of baseline characteristics and thorough case preparation. Men referred for PAE should undergo evaluation by an interventional radiologist in a dedicated clinic setting that allows for detailed clinical history, physical examination and imaging review, including measurement of symptomatic burden, for example using IPSS and QoL scores. Any additional imaging required to confirm appropriate patient selection and complete procedural planning should be undertaken. Pre- and post-operative assessment of voiding function is recommended. Patients must be informed of the relative risks and benefits of PAE versus medical and surgical alternatives. This assessment should occur as part of a multidisciplinary approach, that should include urology review, ensuring a comprehensive evaluation and discussion of treatment options. International guidelines, including those from RANZCR, SIR, CIRSE and NICE [9, 10, 12, 45], emphasise the importance of appropriate infrastructure, imaging and operator expertise to ensure safety and optimise outcomes.

**Recommendation: C**

Expert analysis of work-up imaging and careful procedural planning are essential.

Given the anatomical variability of prostatic arterial supply and the need to avoid non-target embolisation, high-level interpretation of CT angiography or any other required work-up imaging is essential, eg ultrasound of the renal tracts. This aids appropriate patient selection and successful procedural planning, ultimately reducing unexpected complications and shortening procedural times.

**Recommendation: C**

*Men currently under surveillance for low-grade or low-volume prostate malignancy and who require treatment for symptomatic BPH may still be suitable for PAE.*



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Men who are currently under surveillance for low-grade or low-volume prostate malignancy, such as ISUP 1 and who require treatment for symptomatic BPH may still be suitable for PAE [45]. PSA levels typically nadir after PAE and a new baseline level should be established 6 months after treatment, with surveillance PSA levels thereafter [46]. Ongoing prostate cancer surveillance should be guided by a urologist and follow a plan established prior to the PAE.

**Recommendation: C**

*Men undergoing PAE should have a prostate cancer risk assessment prior to the procedure.*

Men undergoing PAE should receive a prostate cancer risk assessment, including appropriate history, clinical examination and PSA level, followed by an MRI if there is an elevated clinical suspicion for prostate cancer in accordance with USANZ guidelines on prostate cancer screening. This is because men at risk for benign prostatic hyperplasia (BPH) are also at risk for prostate cancer [47]. PAE can cause a short-term, transient rise in PSA levels [18], followed by a sustained reduction in PSA. Embolisation may also alter prostate anatomy [48], potentially distorting subsequent MRI interpretation. Therefore, prostate cancer evaluation is ideally completed prior to embolisation to avoid diagnostic uncertainty and ensure appropriate management.

**Recommendation: C**

*Post-procedural follow-up should be conducted by the interventional radiologist or service who performed the PAE and who should be accessible to the patient, GP, or urologist as needed.*

Post-procedural follow-up should be managed by the interventional radiologist, or interventional radiology service, who performed the PAE, alongside any other potential GP or urologist follow-up. Post-embolic symptoms following PAE are commonly reported and should be expected and may include transient increased urinary frequency, urgency, dysuria, perineal pain or discomfort, haematuria or constipation. These symptoms should be proactively managed. The performing interventional radiologist or service should remain accessible to the patient, the referring GP and/or the referring urologist during the post-procedure period, to ensure continuity of care and timely management of any concerns. Routine clinical follow-up comprising the same subjective and objective measures used in the pre-procedure work-up is recommended, such as IPSS, QoL and ultrasound scanning. Additional cross-sectional imaging may be required for certain cases.

**Recommendation: C**

## 1.3 | Procedural Considerations

*The use of cone-beam CT during PAE can improve procedural accuracy but is not mandatory.*

The use of intra-procedural cone-beam CT (CBCT) during PAE is optional and may be employed to improve procedural accuracy. While early PAE techniques did not incorporate CBCT [7, 8], it is now frequently used to identify the prostatic arteries, detect non-target embolisation and assess embolisation coverage [49–51]. CBCT offers advantages over digital subtraction angiography (DSA) alone, especially in visualising complex vascular anatomy where non-target sites may mimic prostatic branches [49]. However, its use is associated with increased radiation exposure and procedure time [51, 52]. Pre-procedural CT angiography may assist with planning and while it can add to contrast and radiation burden, it can be used based on clinical assessment by the Interventional Radiologist.

**Recommendation: B**

*Both radial and femoral access are valid options for PAE.*

Both radial and femoral access are valid options for PAE. Limited evidence demonstrates no significant difference between either approach in terms of safety and efficacy [53, 54]. The choice depends on operator preference, experience and anatomical considerations. Radial access may offer patient comfort advantages and earlier ambulation, but can be technically more demanding due to vessel tortuosity and the requirement of specialised equipment. Femoral access remains widely used and provides a more direct approach to the internal iliac system.

**Recommendation: B**

*PAE requires the use of a permanent embolic agent to achieve sustained, distal prostatic ischaemia and infarction.*

PAE requires the use of a permanent embolic agent to achieve the necessary extent of prostatic ischaemia and infarction to reduce prostate volumes and relieve urinary obstruction. This may include particles (e.g., PVA or calibrated microspheres) or liquid embolics (e.g., NBCA, histacryl) [49–58]. Particle embolisation remains the most widely accepted approach, as it is the embolic of choice in all the major trials due to its reproducibility and safety profile. There is currently no strong evidence to support a specific particulate embolic agent, particle size, or particle type (e.g., PVA vs. microspheres). Selection should be guided by institutional preference and operator experience. Most studies have used particles in the range of 100–500 μm [59]. While liquid agents can be effective, their use may reduce the feasibility of repeat embolisation if symptoms recur [55–58]. Prospective comparative trials are lacking and procedural outcomes have not been shown to be significantly affected by embolic variation in current literature.

**Recommendation: B**

*The PeRFECTED technique is effective but optional.*

The PeRFECTED (Proximal Embolisation First, Then Embolise Distal) technique aims to achieve more complete devascularisation of the prostate by sequential embolisation of both proximal and distal prostatic branches [22, 60]. Although the technique has been associated with improved clinical outcomes in some studies, it is not essential to achieving a therapeutic effect. Its use depends on operator experience and anatomical feasibility.



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

In cases where PeRFECTED cannot be safely performed, standard super-selective embolisation remains acceptable.

**Recommendation: B**

### 1.4 | Outcomes and Safety

*PAE can provide long-term symptom relief, with durable improvements lasting many years in the majority of men.*

While PAE is not a curative treatment, durable symptom relief is achieved in the majority of patients, with sustained improvements in IPSS and QoL documented up to 5–10 years in large cohorts [61, 62]. Reintervention rates range from approximately 20% at 5 years to 30%–60% at 10 years, typically involving repeat PAE or delayed prostatectomy [62]. Compared to medical therapy, which fails or is not tolerated in most patients, PAE offers greater long-term symptom control with fewer systemic side-effects. Although retreatment rates following PAE are likely higher than those reported for other minimally invasive surgical therapies (MISTs) such as Rezūm and UroLift [63, 64] embolisation remains a compelling alternative for appropriately selected patients, particularly those seeking a non-surgical option that preserves ejaculatory function and avoids general anaesthesia. Repeat PAE is safe and effective, allowing many patients to avoid definitive surgery even in the long term [61, 62].

**Recommendation: B**

*PAE is associated with faster recovery, shorter hospitalisation, fewer side-effects and fewer major complications compared to surgical options such as TURP.*

As a minimally-invasive, imaging-guided procedure, PAE has a number of advantages over surgical interventions. PAE has a low rate of major complications (0.3%–0.65%) [44, 61], improves quality of life, can be performed without requiring an indwelling urinary catheter, does not adversely affect erectile function and in some cases may improve IIEF scores. While PAE is slightly less effective than TURP in improving voiding parameters, it offers advantages in safety, sexual function preservation and reduced hospital stay. Comparative studies suggest PAE offers clear advantages in safety: lower rates of retrograde ejaculation, reduced perioperative complications, shorter hospital stays and faster return to normal activities [16, 19, 65]. PAE can safely be performed as a day-procedure with outpatient recovery, which leads to lower treatment costs and reduced societal burden [66–68].

These findings support PAE as a low-risk, minimally-invasive treatment alternative to inpatient surgery, which is likely to be especially appealing to patients wishing to avoid the risks of medical therapy or operative intervention.

**Recommendation: A**

*Erectile function may improve after PAE.*

Although not a primary treatment for erectile dysfunction, some cohort studies and meta-analyses have shown that PAE can result in modest improvements in erectile function scores [17, 69], while others report no significant change [15, 69–74]. Several reports suggest that discontinuation of BPH medications, reduction in prostate mass, relief of urinary symptoms (e.g., nocturia) and removal of long-term catheters after PAE may lead to improvements in erectile function, as reflected by increased International Index of Erectile Function (IIEF) scores [72, 73]. Although there is a theoretical risk of non-target embolisation to the penile vasculature during PAE [75], multiple studies and meta-analyses have not demonstrated an association between PAE and worsening erectile function [15, 70, 71]. Overall, the procedure should be considered to have a neutral or occasionally beneficial effect on erectile function, especially when compared with surgical alternatives.

**Recommendation: B**

*The risk of sexual dysfunction following PAE is low, with lower rates of ejaculatory dysfunction compared to TURP.*

Ejaculatory dysfunction (EjD), including anejaculation, can occur following prostate artery embolisation [70, 73], although it is significantly less common than after transurethral resection of the prostate (TURP). The prostate contributes to the production of ejaculatory fluid and embolisation may reduce ejaculate volume or impact function, particularly if non-target embolisation of the seminal vesicles has occurred.

Transient hematospermia, or blood in the semen, occurs in up to 16% of patients following PAE [76]. This is typically self-limiting and resolves without intervention. The presence of blood reflects minor post-procedural effects on adjacent structures and does not indicate long-term complications. Multiple studies, including the UK-ROPE study and other comparative trials [25, 60, 77], have shown consistently lower rates of EjD with PAE compared to surgical alternatives, supporting its use in men for whom preservation of ejaculatory function is a priority.

**Recommendation: A**

*Clinically significant non-target embolisation is rare.*

The risk of significant non-target embolisation during PAE—to adjacent organs such as the penis, bladder, or rectum—is low, estimated at approximately 0.5%–1%. Multiple studies and meta-analyses, including randomised controlled trials, have demonstrated that with appropriate technique and imaging guidance, the likelihood of clinically significant off-target embolisation is minimal and usually self-limiting. This safety profile supports the routine use of PAE in appropriately selected patients [19, 21, 22, 25, 75, 78].

**Recommendation: A**

*Radiation doses during PAE are typically low and doses are comparable to other similar angiographic and diagnostic procedures.*

PAE involves the use of ionising radiation; however, radiation doses are typically well within safe levels. A recent study demonstrated a mean total dose–area product (DAP) of 450.7 Gy·cm$^2$ (range, 248.3–791.73 Gy·cm$^2$) per procedure [79],



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

with the effective dose to the interventional radiologist of 17 microsieverts. Another study demonstrated the ionising radiation dose area product per procedure is around 17,400 μGy/m$^2$ or an effective dose of approximately 47 mSv. The associated increase in lifetime cancer risk is therefore low, estimated at an additional lifetime cancer risk of 0.1%–0.2% (baseline risk for men is 44.9%) in a patient population with an average age of 65 [80]. These levels are comparable to other interventional radiology procedures such as TIPS, gastrointestinal embolisation and TACE [81] and are associated with a very low risk of short-term or long-term adverse outcomes.

**Recommendation: B**

*Radiation exposure during PAE should be minimised (as low as reasonably achievable, ALARA).*

As with all procedures that utilise ionising radiation, interventional radiologists should minimise the radiation required to successfully complete the procedure in as short a time as possible. Ionising radiation doses during PAE are low and typically well within safe levels, however reducing radiation doses to as low as reasonably achievable will limit the exposures of patients as well as procedural, nursing and technical staff. Many factors will influence the overall radiation dose required to complete a PAE and the subsequent risks, including patient size, anatomy and age. Appropriate personal protective equipment should be mandatory and appropriate radiation shielding should be available in accordance with the RANZCR Interventional Radiology and Interventional Neuroradiology Standards of Practice and Code of Practice Radiation Protection in the Medical Applications of Ionising Radiation [82, 83].

**Recommendation: C**

*PAE should only be performed by appropriately trained interventional radiologists.*

Interventional radiologists (IRs) are the appropriately trained medical specialists to perform PAE in Australia and New Zealand and have typically undertaken additional specialty training. The procedure requires expertise in pelvic vascular anatomy, advanced microcatheter techniques and image-guided embolisation—skills integral to specialised IR practice. All published randomised controlled trials, large case series and meta-analyses [13–15, 17, 18, 69, 74, 84–86] have reported PAEs performed by IRs. This is supported by international guidelines from the Society of Interventional Radiology (SIR) and the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) [9, 10]. Which recommend that only IRs with adequate training and institutional support should perform PAE.

**Recommendation: C**

---

### Author Contributions

**William E. L. Ormiston:** conceptualization, writing – original draft, writing – review and editing, investigation, methodology, formal analysis, validation, supervision. **Glen Schlaphoff:** investigation, methodology, writing – review and editing, validation, formal analysis. **Andrew Owen:** investigation, methodology, validation, writing – review and editing, formal analysis. **Brendan Buckley:** investigation, methodology, validation, writing – review and editing, formal analysis. **Dinesh Ranatunga:** investigation, validation, writing – review and editing, formal analysis, methodology. **Christopher Rogan:** investigation, methodology, validation, formal analysis, writing – review and editing. **Nicholas I. Brown:** conceptualization, investigation, writing – original draft, methodology, validation, writing – review and editing, formal analysis, supervision, project administration.


### Acknowledgements

The authors acknowledge the contributions of multidisciplinary colleagues and professional bodies in the preparation of this guideline, including the Interventional Radiology Society of Australasia (IRSA) and the Royal Australian and New Zealand College of Radiologists (RANZCR). Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australasian University Librarians.


### Conflicts of Interest

The authors declare no conflicts of interest. Nicholas Brown serves as an editorial board member for JMIRO. To exclude bias, he was removed from all decision making relating to consideration of this manuscript.

### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### References


1. A. F. Awedew, H. Han, B. Abbasi, et al., "The Global, Regional and National Burden of Benign Prostatic Hyperplasia in 204 Countries and Territories From 2000 to 2019: A Systematic Analysis for the Global Burden of Disease Study 2019," *Lancet Healthy Longevity* 3, no. 11 (2022): e754–e776.

2. K. L. Lee and D. M. Peehl, "Molecular and Cellular Pathogenesis of Benign Prostatic Hyperplasia," *Journal of Urology* 172, no. 5 (2004): 1784–1791.

3. A. Morton, M. Williams, M. Perera, et al., "Management of Benign Prostatic Hyperplasia in the 21st Century: Temporal Trends in Australian Population-Based Data," *BJU International* 126, no. S1 (2020): 18–26.

4. J. S. Sandhu, B. R. Bixler, P. Dahm, et al., "Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia (BPH): AUA Guideline Amendment 2023," *Journal of Urology* 211, no. 1 (2024): 11–19.

5. S. Gravas, M. Gacci, C. Gratzke, et al., "Summary Paper on the 2023 European Association of Urology Guidelines on the Management of Non-Neurogenic Male Lower Urinary Tract Symptoms," *European Urology* 84, no. 2 (2023): 207–222.

6. J. V. A. Franco, P. Tesolin, and J. H. Jung, "Update on the Management of Benign Prostatic Hyperplasia and the Role of Minimally Invasive Procedures," *Prostate International* 11, no. 1 (2023): 1–7.

7. F. C. Carnevale, A. A. Antunes, J. M. Da Motta Leal Filho, et al., "Prostatic Artery Embolisation as a Primary Treatment for Benign Prostatic Hyperplasia: Preliminary Results in Two Patients," *Cardiovascular and Interventional Radiology* 33, no. 2 (2010): 355–361.

8. J. S. DeMeritt, F. F. Elmasri, M. P. Esposito, and G. S. Rosenberg, "Relief of Benign Prostatic Hyperplasia-Related Bladder Outlet Obstruction After Transarterial Polyvinyl Alcohol Prostate Embolisation," *Journal of Vascular and Interventional Radiology* 11, no. 6 (2000): 767–770.





17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

9. F. H. Cornelis, T. Bilhim, N. Hacking, M. Sapoval, C. R. Tapping, and F. C. Carnevale, "CIRSE Standards of Practice on Prostatic Artery Embolisation," *Cardiovascular and Interventional Radiology* 43, no. 2 (2020): 176–185.

10. J. P. McWilliams, T. A. Bilhim, F. C. Carnevale, et al., "Society of Interventional Radiology Multisociety Consensus Position Statement on Prostatic Artery Embolisation for Treatment of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia: From the Society of Interventional Radiology, the Cardiovascular and Interventional Radiological Society of Europe, Société Française de Radiologie and the British Society of Interventional Radiology," *Journal of Vascular and Interventional Radiology* 30, no. 5 (2019): 627–637.e1.

11. J. N. Cornu, M. Gacci, H. Hashim, et al., "EAU Guidelines on Non-Neurogenic Male Lower Urinary Tract Symptoms (LUTS)," (2024) EAU Guidelines 2024 – Full PDF.

12. NICE Guidance – Prostate artery embolisation for lower urinary tract symptoms caused by benign prostatic hyperplasia: NICE, "Prostate Artery Embolisation for Lower Urinary Tract Symptoms Caused by Benign Prostatic Hyperplasia," *BJU International* 122, no. 1 (2018): 11–12.

13. Z. Xu, Z. Zhou, Y. Mu, T. Cai, Z. Gao, and L. Liu, "An Updated Meta-Analysis of the Efficacy and Safety of Prostatic Artery Embolisation vs," *Transurethral Resection of the Prostate in the Treatment of Benign Prostatic Hyperplasia. Front Surg* 8 (2021): 779571.

14. P. Xiang, D. Guan, Z. Du, et al., "Efficacy and Safety of Prostatic Artery Embolisation for Benign Prostatic Hyperplasia: A Systematic Review and Meta-Analysis of Randomised Controlled Trials," *European Radiology* 31, no. 7 (2021): 4929–4946.

15. G. M. Knight, A. Talwar, R. Salem, and S. Mouli, "Systematic Review and Meta-Analysis Comparing Prostatic Artery Embolisation to Gold-Standard Transurethral Resection of the Prostate for Benign Prostatic Hyperplasia," *Cardiovascular and Interventional Radiology* 44, no. 2 (2021): 183–193.

16. V. Zumstein, P. Betschart, M. W. Vetterlein, et al., "Prostatic Artery Embolisation Versus Standard Surgical Treatment for Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia: A Systematic Review and Meta-Analysis," *European Urology Focus* 5, no. 6 (2019): 1091–1100.

17. B. Malling, M. A. Røder, K. Brasso, J. Forman, M. Taudorf, and L. Lönn, "Prostate Artery Embolisation for Benign Prostatic Hyperplasia: A Systematic Review and Meta-Analysis," *European Radiology* 29, no. 1 (2019): 287–298.

18. S. R. Shim, K. J. K. Kanhai, Y. M. Ko, and J. H. Kim, "Efficacy and Safety of Prostatic Arterial Embolisation: Systematic Review With Meta-Analysis and Meta-Regression," *Journal of Urology* 197, no. 2 (2017): 465–479.

19. A. F. Ray, J. Powell, M. J. Speakman, et al., "Efficacy and Safety of Prostate Artery Embolisation for Benign Prostatic Hyperplasia: An Observational Study and Propensity-Matched Comparison With Transurethral Resection of the Prostate (The UK-ROPE Study)," *BJU International* 122, no. 2 (2018): 270–282.

20. J. M. Pisco, T. Bilhim, L. C. Pinheiro, et al., "Medium- and Long-Term Outcome of Prostate Artery Embolisation for Patients With Benign Prostatic Hyperplasia: Results in 630 Patients," *Journal of Vascular and Interventional Radiology* 27, no. 8 (2016): 1115–1122.

21. Y. a. Gao, Y. Huang, R. Zhang, et al., "Benign Prostatic Hyperplasia: Prostatic Arterial Embolisation Versus Transurethral Resection of the Prostate—A Prospective, Randomised and Controlled Clinical Trial," *Radiology* 270, no. 3 (2014): 920–928.

22. F. C. Carnevale, A. Iscaife, E. M. Yoshinaga, et al., "Transurethral Resection of the Prostate (TURP) Versus Original and PErFecTED Prostate Artery Embolisation (PAE) due to Benign Prostatic Hyperplasia (BPH): Preliminary Results of a Single Center, Prospective, Urodynamic-Controlled Analysis," *Cardiovascular and Interventional Radiology* 39 (2016): 44–52.

23. A. Radwan, A. Farouk, A. Higazy, Y. R. Samir, A. M. Tawfeek, and M. A. Gamal, "Prostatic Artery Embolisation Versus Transurethral Resection of the Prostate in Management of Benign Prostatic Hyperplasia," *Prostate International* 8, no. 3 (2020): 130–133.

24. I. Insausti, A. Sáez De Ocáriz, A. Galbete, et al., "Randomised Comparison of Prostatic Artery Embolisation Versus Transurethral Resection of the Prostate for Treatment of Benign Prostatic Hyperplasia," *Journal of Vascular and Interventional Radiology* 31, no. 6 (2020): 882–890.

25. D. Abt, L. Hechelhammer, G. Müllhaupt, et al., "Comparison of Prostatic Artery Embolisation (PAE) Versus Transurethral Resection of the Prostate (TURP) for Benign Prostatic Hyperplasia: Randomised, Open Label, Non-Inferiority Trial," *BMJ* 19 (2018): k2338.

26. R. Altman, R. Ferreira, C. Barragan, et al., "Comparing Prostatic Artery Embolization to Surgical and Minimally Invasive Procedures for the Treatment of Benign Prostatic Hyperplasia: A Systematic Review and Meta-Analysis," *BMC Urology* 24 (2024): 22.

27. M. F. Ozervarli, K. C. Oba, M. Yilmaz, et al., "Minimally Invasive Treatments for Benign Prostatic Hyperplasia in Patients Over 75: A Systematic Review," *World Journal of Urology* 43 (2025): 703.

28. J. Frandon, A. Belaouni, O. Pellerin, et al., "Efficacy and Safety of Prostate Artery Embolization for Patients With Lower Urinary Tract Symptoms and Indwelling Urinary Catheter: A Retrospective Multicenter Study," *Diagnostic and Interventional Imaging* 103, no. 12 (2022): 601–606.

29. G. Molineros, E. Atias, I. Tamir, et al., "Prostate Artery Embolisation for Weaning of Indwelling Urinary Catheter," *Harefuah* 164, no. 8 (2025): 488–491.

30. A. G. Kenny, O. Pellerin, G. Amouyal, et al., "Prostate Artery Embolisation in Patients With Acute Urinary Retention," *American Journal of Medicine* 132, no. 11 (2019): e786–e790.

31. F. C. Carnevale, J. M. da Motta-Leal-Filho, A. A. Antunes, et al., "Quality of Life and Clinical Symptom Improvement Support Prostatic Artery Embolization for Patients With Acute Urinary Retention Caused by Benign Prostatic Hyperplasia," *Journal of Vascular and Interventional Radiology* 24, no. 4 (2013): 535–542.

32. W. Bischoff and U. Goerttler, "Successful Intra-Arterial Embolization of Bleeding Carcinoma of the Prostate," *Der Urologe. Ausgabe A* 16, no. 2 (1977): 99–102.

33. M. E. Mitchell, A. C. Waltman, C. A. Athanasoulis, W. S. Kerr, and S. P. Dretler, "Control of Massive Prostatic Bleeding With Angiographic Techniques," *Journal of Urology* 115, no. 6 (1976): 692–695.

34. L. Moramarco, A. M. Grande, M. Vertemati, and P. Aseni, "Prostate Artery Embolisation in the Treatment of Massive Intractable Bleeding From Prostatic Neoplasms: A Case Report and Systematic Review," *Journal of Clinical Medicine* 13, no. 1 (2024): 65.

35. S. Dehvari, I. Razipour, R. Bemana, et al., "Prostatic Artery Embolization for Palliative Control of Hematuria in Locally Advanced or Metastatic Prostate Cancer: A Systematic Review," *Abdominal Radiology* 51 (2025): 2583–2595, https://doi.org/10.1007/s00261-025-05250-x.

36. N. Brown, A. Kiosoglous, S. Castree, et al., "The 'Prostate Embolisation AS First-Line therapY compAred to meDication in Treatment naïVe Men With prostAte eNlargement, a Randomised ControllEd Trial' (P- EASY ADVANCE): A Randomised Controlled Trial of Prostate Embolisation vs Medication for BPH," *BJU International* 134, no. S2 (2024): 38–46.

37. M. Sapoval, N. Thiounn, A. Descazeaud, et al., "Prostatic Artery Embolisation Versus Medical Treatment in Patients With Benign Prostatic Hyperplasia (PARTEM): A Randomised, Multicentre, Open-Label,



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Phase 3, Superiority Trial," *Lancet Regional Health - Europe* 31 (2023): 100672.

38. A. Y. M. Lee, S. H. Neo, B. A. Brodie, et al., "Preoperative Prostatic Artery Embolisation Before Transurethral Resection of the Prostate for Prostate Glands Larger Than 80 mL: The First Randomised Controlled Trial," *Prostate International* 13, no. 1 (2025): 22–27.

39. Z. W. Xu, W. Tian, C. G. Zhou, B. Leng, H. B. Shi, and S. Liu, "Prostatic Artery Embolisation for the Treatment of Recurrent Lower Urinary Tract Symptoms Following Transurethral Resection of the Prostate," *Journal of Vascular and Interventional Radiology* 32, no. 2 (2021): 242–246.

40. P. Goyal, R. Salem, and S. K. Mouli, "Controversies in Prostate Artery Embolisation: Future Best Practice," *Semin Intervent Radiol* 39, no. 6 (2022): 562–570.

41. M. Parmar, J. E. Katz, R. Blachman-Braun, et al., "Safety and Efficacy of Holmium Laser Enucleation of Prostate as Salvage Procedure for Persistent or Recurrent Lower Urinary Tract Symptoms Secondary to Bladder Outlet Obstruction After Prior Prostate Artery Embolisation: A Match Analysis," *World Journal of Urology* 39, no. 11 (2021): 4199–4206.

42. P. Li, C. Wang, Q. Cao, J. Zhang, H. Shi, and X. Meng, "Prostatic Arterial Embolisation Followed by Holmium Laser Enucleation of the Prostate as a Planned Combined Approach for Extremely Enlarged Benign Prostate Hyperplasia," *Urologia Internationalis* 99, no. 4 (2017): 422–428.

43. N. V. Costa, D. Torres, J. Pisco, et al., "Repeat Prostatic Artery Embolisation for Patients With Benign Prostatic Hyperplasia," *Journal of Vascular and Interventional Radiology* 31, no. 8 (2020): 1272–1280.

44. V. Lucas-Cava, F. M. Sánchez-Margallo, L. Dávila-Gómez, J. R. Lima-Rodríguez, and F. Sun, "Prostatic Artery Occlusion Versus Prostatic Artery Embolisation for the Management of Benign Prostatic Hyperplasia: Early Results in a Canine Model," *British Journal of Radiology* 95, no. 1136 (2022): 20220243.

45. N. Parikh, K. Yamoah, P. Johnstone, et al., "Prostate Artery Embolisation in the Setting of Prostate Cancer: Review and Opinion," *Cancer Control* 32 (2025): 10732748251317691.

46. S. Mouli, R. Salem, and T. D. McClure, "Prostate Artery Embolisation for Benign Prostatic Hyperplasia," *Journal of Urology* 212, no. 1 (2024): 216–219.

47. Australian Institute of Health and Welfare, "Cancer data in Australia," (2024) Australian Institute of Health and Welfare – Cancer data in Australia.

48. N. E. Frenk, R. H. Baroni, F. C. Carnevale, et al., "MRI Findings After Prostatic Artery Embolisation for Treatment of Benign Hyperplasia," *American Journal of Roentgenology* 203, no. 4 (2014): 813–821.

49. S. Bagla, K. S. Rholl, K. M. Sterling, et al., "Utility of Cone-Beam CT Imaging in Prostatic Artery Embolisation," *Journal of Vascular and Interventional Radiology* 24, no. 11 (2013): 1603–1607.

50. M. Q. Wang, F. Duan, K. Yuan, G. D. Zhang, J. Yan, and Y. Wang, "Benign Prostatic Hyperplasia: Cone-Beam CT in Conjunction With DSA for Identifying Prostatic Arterial Anatomy," *Radiology* 282, no. 1 (2017): 271–280.

51. N. Rostambeigi, D. Crawford, and J. Golzarian, "Benefits and Advances of Cone Beam CT Use in Prostatic Artery Embolization: Review of the Literature and Pictorial Essay," *Cardiovascular and Interventional Radiology Endovascular* 7, no. 1 (2024): 46.

52. F. Cadour, F. Tradi, P. Habert, et al., "Prostatic Artery Embolization Using Three-Dimensional Cone-Beam Computed Tomography," *Diagnostic and Interventional Imaging* 101, no. 11 (2020): 721–725.

53. A. J. Richardson, J. Kumar, K. Richardson, et al., "Safety of Prostatic Artery Embolisation via Transradial Access Versus Transfemoral Access," *Journal of Vascular and Interventional Radiology* 35, no. 4 (2024): 541–547.

54. S. Bhatia, S. H. Harward, V. K. Sinha, and G. Narayanan, "Prostate Artery Embolisation via Transradial or Transulnar Versus Transfemoral Arterial Access: Technical Results," *Journal of Vascular and Interventional Radiology* 28, no. 6 (2017): 898–905.

55. A. Vizzuso, S. Barbieri, E. Petrella, et al., "Prostatic Artery Embolisation Using N-Butyl Cyanoacrylate Glue in Patients With Indwelling Catheter," *Cardiovascular and Interventional Radiology* 46, no. 2 (2023): 295–298.

56. D. Bamshad, J. Sanghvi, N. Galla, et al., "Early Outcomes of Prostatic Artery Embolisation Using n-Butyl Cyanoacrylate Liquid Embolic Agent: A Safety and Feasibility Study," *Journal of Vascular and Interventional Radiology* 35, no. 12 (2024): 1855–1861.

57. R. Loffroy, A. Quirantes, K. Guillen, et al., "Prostate Artery Embolization Using n-Butyl Cyanoacrylate Glue for Symptomatic Benign Prostatic Hyperplasia: A Six-Month Outcome Analysis in 103 Patients," *Diagnostic and Interventional Imaging* 105, no. 4 (2024): 129–136.

58. R. Loffroy, K. Guillen, E. Salet, et al., "Prostate Artery Embolisation Using N-Butyl Cyanoacrylate Glue for Urinary Tract Symptoms due to Benign Prostatic Hyperplasia: A Valid Alternative to Microparticles?," *Journal of Clinical Medicine* 10, no. 14 (2021): 3161.

59. D. Torres, N. V. Costa, J. Pisco, L. C. Pinheiro, A. G. Oliveira, and T. Bilhim, "Prostatic Artery Embolisation for Benign Prostatic Hyperplasia: Prospective Randomized Trial of 100–300 μm Versus 300–500 μm Versus 100- to 300-μm + 300- to 500-μm Embospheres," *Journal of Vascular and Interventional Radiology* 30, no. 5 (2019): 638–644.

60. F. C. Carnevale, A. M. Moreira, and A. A. Antunes, "The "PErFecTED Technique": Proximal Embolisation First, Then Embolize Distal for Benign Prostatic Hyperplasia," *Cardiovascular and Interventional Radiology* 37, no. 6 (2014): 1602–1605.

61. S. Bhatia, A. Bhatia, A. J. Richardson, et al., "Prostatic Artery Embolisation: Mid- to Long-Term Outcomes in 1,075 Patients," *Journal of Vascular and Interventional Radiology* 36, no. 3 (2025): 456–466.

62. T. Bilhim, "Long-Term Outcome of Prostatic Artery Embolisation for Patients with Benign Prostatic Hyperplasia: Single-Centre Retrospective Study in 1072 Patients Over a 10-Year Period," 2022, https://doi.org/10.1007/s00270-022-03199-8.

63. K. T. McVary, T. Rogers, and C. G. Roehrborn, "Rezūm Water Vapor Thermal Therapy for Lower Urinary Tract Symptoms Associated With Benign Prostatic Hyperplasia: 4-Year Results From Randomised Controlled Study," *Urology* 126 (2019): 171–179.

64. C. Gratzke, N. Barber, M. J. Speakman, et al., "Prostatic Urethral Lift vs Transurethral Resection of the Prostate: 2-Year Results of the BPH 6 Prospective, Multicentre, Randomised Study," *BJU International* 119, no. 5 (2017): 767–775.

65. G. Müllhaupt, L. Hechelhammer, N. Graf, et al., "Prostatic Artery Embolisation Versus Transurethral Resection of the Prostate for Benign Prostatic Obstruction: 5-Year Outcomes of a Randomised, Open-Label, Noninferiority Trial," *European Urology Focus* 10, no. 5 (2024): 788–795.

66. S. Bagla, J. Smirniotopoulos, J. Orlando, and R. Piechowiak, "Cost Analysis of Prostate Artery Embolisation (PAE) and Transurethral Resection of the Prostate (TURP) in the Treatment of Benign Prostatic Hyperplasia," *Cardiovascular and Interventional Radiology* 40, no. 11 (2017): 1694–1697.

67. N. Patel, N. Yung, G. Vigneswaran, et al., "1-Year Cost-Utility Analysis of Prostate Artery Embolization (PAE) Versus Transurethral Resection of the Prostate (TURP) in Benign Prostatic Hyperplasia (BPH)," *BMJ Surg Interv Health Technol* 3, no. 1 (2021): e000071.

68. J. S. Rink, M. F. Froelich, J. P. McWilliams, et al., "Prostatic Artery Embolisation for Treatment of Lower Urinary Tract Symptoms:



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

A Markov Model-Based Cost-Effectiveness Analysis," *Journal of the American College of Radiology* 19, no. 6 (2022): 733–743.

69. J. S. Pyo and W. J. Cho, "Systematic Review and Meta-Analysis of Prostatic Artery Embolisation for Lower Urinary Tract Symptoms Related to Benign Prostatic Hyperplasia," *Clinical Radiology* 72, no. 1 (2017): 16–22.

70. A. Uflacker, Z. J. Haskal, T. Bilhim, J. Patrie, T. Huber, and J. M. Pisco, "Meta-Analysis of Prostatic Artery Embolisation for Benign Prostatic Hyperplasia," *Journal of Vascular and Interventional Radiology* 27, no. 11 (2016): 1686–1697.e8.

71. T. Wong, M. Tembelis, V. Acharya, and J. C. Hoffmann, "Prostatic Artery Embolisation and Sexual Function: Literature Review and Comparison to Other Urologic Interventions," *Techniques in Vascular and Interventional Radiology* 23, no. 3 (2020): 100693.

72. I. Voznesensky, E. Shaw, K. J. DeLay, et al., "Benign Prostatic Hyperplasia Treatment Options and Their Effects on Sexual Function," *Sexual Medicine Reviews* 5 (2017): 87–102.

73. N. Brown, D. Walker, R. McBean, et al., "Prostate Artery Embolisation Assessment of Safety and feasibilitY (P-EASY): A Potential Alternative to Long-Term Medical Therapy for Benign Prostate Hyperplasia," *BJU International* 122 (2018): 27–34.

74. S. Feng, Y. Tian, W. Liu, et al., "Prostatic Arterial Embolisation Treating Moderate-To-Severe Lower Urinary Tract Symptoms Related to Benign Prostate Hyperplasia: A Meta-Analysis," *Cardiovascular and Interventional Radiology* 40, no. 1 (2017): 22–32.

75. A. M. Moreira, A. M. De Assis, F. C. Carnevale, A. A. Antunes, M. Srougi, and G. G. Cerri, "A Review of Adverse Events Related to Prostatic Artery Embolisation for Treatment of Bladder Outlet Obstruction due to BPH," *Cardiovascular and Interventional Radiology* 40, no. 10 (2017): 1490–1500.

76. S. Bagla, C. P. Martin, A. van Breda, et al., "Early Results From a United States Trial of Prostatic Artery Embolization in the Treatment of Benign Prostatic Hyperplasia," *Journal of Vascular and Interventional Radiology* 25 (2014): 47–52.

77. A. F. Ray, J. Powell, M. J. Speakman, et al., "Efficacy and Safety of Prostate Artery Embolization for Benign Prostatic Hyperplasia: An Observational Study and Propensity-Matched Comparison With Transurethral Resection of the Prostate (The UK-ROPE Study)," *BJU International* 122, no. 2 (2018): 270–282.

78. J. M. Pisco, T. Bilhim, N. V. Costa, et al., "Randomised Clinical Trial of Prostatic Artery Embolisation Versus a Sham Procedure for Benign Prostatic Hyperplasia," *European Urology* 77, no. 3 (2020): 354–362.

79. G. Andrade, H. J. Khoury, W. J. Garzón, et al., "Radiation Exposure of Patients and Interventional Radiologists During Prostatic Artery Embolisation: A Prospective Single-Operator Study," *Journal of Vascular and Interventional Radiology* 28, no. 4 (2017): 517–521.

80. D. Maclean, B. Maher, S. Modi, et al., "Prostate Artery Embolization: A New, Minimally Invasive Treatment for Lower Urinary Tract Symptoms Secondary to Prostate Enlargement," *Therapeutic Advances in Urology* 9, no. 8 (2017): 209–216.

81. D. L. Miller, S. Balter, P. E. Cole, et al., "Radiation Doses in Interventional Radiology Procedures: The RAD-IR Study Part II: Skin Dose," *Journal of Vascular and Interventional Radiology* 14, no. 8 (2003): 977–990.

82. The Royal Australian and New Zealand College of Radiologists (RANZCR), "Standards of Practice for Interventional Radiology and Interventional Neuroradiology | RANZCR," (2022), https://www.ranzcr.com/college/document-library/standards-of-practice-for-interventional-radiology-and-interventional-neuroradiology.

83. ARPANSA, "Code of Practice Radiation Protection in the Medical Applications of Ionising Radiation," (2008), https://www.arpansa.gov.au/sites/default/files/legacy/pubs/rps/rps14.pdf.

84. F. Capdevila, I. Insausti, A. Galbete, E. Sanchez-Iriso, and M. Montesino, "Prostatic Artery Embolisation Versus Transurethral Resection of the Prostate: A Post Hoc Cost Analysis of a Randomized Controlled Clinical Trial," *Cardiovascular and Interventional Radiology* 44, no. 11 (2021): 1771–1777.

85. V. Lucas-Cava, F. M. Sánchez-Margallo, I. Insausti-Gorbea, and F. Sun, "Comparative Efficacy and Safety of Prostatic Urethral Lift vs Prostatic Artery Embolization for Benign Prostatic Hyperplasia: A Systematic Review and Network Meta-Analysis," *BJU International* 131, no. 2 (2023): 139–152.

86. E. S. Jung, J. H. Kim, E. L. Yoon, et al., "Comparison of the Methods for Tumor Response Assessment in Patients With Hepatocellular Carcinoma Undergoing Transarterial Chemo Embolisation," *Journal of Hepatology* 58, no. 6 (2013): 1181–1187.



17549485, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1754-9485.70179 by Warren Clements - Bayside Health (Alfred Health) , Wiley Online Library on [03/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License