

GUIDELINES: NEW SERVICE DEVELOPMENT

PROSTATE ARTERY EMBOLISATION (PAE)

FOR

BENIGN PROSTATIC HYPERPLASIA

Background:

Benign prostatic hyperplasia (BPH) is a common condition affecting men over 50 years of age. It is a non-cancerous enlargement of the prostate gland that can lead to compression of the prostatic urethra and elevation of the bladder base. BPH often presents with lower urinary tract symptoms (LUTS) which include hesitancy, poor flow, nocturia, frequency, incomplete voiding and retention. Mild symptoms are typically managed conservatively or with medical management using alpha blockers and 5-alpha-reductase inhibitors. If these measures fail then surgical options become available and include transurethral resection of the prostate (TURP), transurethral greenlight photoselective vaporisation, holmium enucleation of prostate (HoLEP), Urolift implants or open prostatectomy (see NICE guidance CG97 2015: lower urinary tract symptoms in men: Management).

Prostate artery embolisation (PAE) is a new interventional image guided surgical technique to treat BPH. The procedure was first described by Carnevale et al in 2001 and has been performed in a number of institutions around the world notably; the San Paulo group led by Carnevale and the Lisbon group led by Pisco. The principles involved mirror, to some degree, those related to the treatment of uterine fibroids, in that, nodules of BPH are hypervascular when compared to the background normal prostate tissue. Targeting this tissue leads to infarction and volume reduction thereby improving the patients LUTS. Even in the absence of confluent infarction loss of volume and improved symptoms occur and although the mechanism of action in non infarction cases is less well understood it is likely to be in part due to cellular apoptosis as well as sensory and hormonal changes within the prostate itself.

NICE Guidance & Governance:

PAE has recently gained NICE guidance (IPG611) where it confirms the current safety and efficacy of the procedure to treat BPH in an appropriately selected population of men. The guidance states that there is a requirement for a robust clinical governance, consent and audit structure to be in place and that the procedure requires the input of both an interested Urologist and an Interventional Radiologist (Image guided surgeon). NICE also states that the procedure is technically demanding and should only be performed by an Interventional Radiologist with specific training and expertise in prostate artery embolisation.

Recommendation 1: *A team approach is required to select and treat patients referred for PAE. Consent is required under the Montgomery ruling and therefore requires both Urology and*

Interventional Radiology input. Units developing PAE are guided to include at least 2 urologists and 2 interventional radiologists.

NICE guidance was based on a review of the medical literature which identified 1600 patients whom had undergone PAE and results from the UK-ROPE (Registry of prostate embolisation) data which was funded by industry, BSIR, BAUS and NICE (funding for CEDAR to co-ordinate ROPE). UK-ROPE completed January 2016 and 1 yr follow up data was available in January 2017 with included data on comparison TURP procedures entered into the registry. UK-ROPE had a robust methodology / criterion for the undertaking of the procedure where all sites were required to have documented governance structure and team members with each interventional radiologist required to have had specific training in PAE, with at least 3-4 initial cases mentored/proctored by an expert to ensure safety and competency. PAE is universally agreed to be a complex technical procedure that requires complete understanding of the prostatic artery anatomy and its variations, microcatheter techniques and range of embolic agents available, CTA work up and QoL scores. It is generally felt that for the first 25-50 cases this is a procedure that should be undertaken by 2 operators.

Recommendation 2: *All new centres require their interventional radiologists to undergo training in the techniques of PAE and require mentoring for at least the initial 3-4 cases for patient safety. Centres should include the costs within their business case, that maybe incurred in arranging mentoring for the development of this PAE service. The BSIR has published the details of accredited interventional radiologists on its website (12 UK-ROPE accredited units) and can assist in the introductions.*

Pre-procedural Documentation:

- Patients require consultation with a Urologist to ensure surgical solutions are appropriate (including PAE).
- Formal uro-dynamic studies should be performed (it is a matter for each site to decide whether these need to be invasive)
 - I. Prostate volume
 - II. Q_{max} ml/s
 - III. Residual volume ml
- Pre-procedural QoL questionnaires require completion:
 - I. International Prostate Symptom Score (IPSS)
 - II. International Index of Erectile dysfunction (IIEF)

Recommendation 3: *All patients considered for PAE should receive formal patient information regarding the procedure and possible complications and should be reviewed by both the urologist and Interventional radiologist to ensure all options have been considered.*

Pre-procedural Imaging:

- **CT Angiography:** This is mandatory at present to allow the visualisation of the complex pelvic arterial anatomy and assess the 4 common types of prostatic arterial variation to aid embolisation. The imaging also allows a reproducible prostatic volume measurement, all be it inferior to prostate MRI.

Technique & reporting:

- I. Acceptable renal function.
 - II. Administration of 2 sprays of GTN immediately prior to the CT scan to elicit vasodilatation (unless contra-indicated).
 - III. Arterial and venous (better prostatic anatomy) scans obtained using bolus tracking off aorta with a 5/6s delay.
 - IV. Reported by interventional radiologists performing the PAE with thick MIP (10-30mm) sagittal reformats to demonstrate the anterior branch of the internal iliac in profile and show the common branches and origin and number of the prostate arteries.
 - V. Production of a pre-procedural diagram of anatomy on each side.
 - VI. Identify any anastomoses (rectal, penile, vesical etc).
- **MRI Prostate:** This is not mandatory but may already have been performed in a significant number of patients (raised PSA, exclude prostate carcinoma). It is advisable to consider MRI Prostate prior to PAE as a baseline assessment to aid centres audit infarction rates. It is the most accurate measure of prostate anatomy, especially the presence of a significant median lobe, and is ideal as a baseline study to assess infarction. Prostate MRA using contrast enhancement is at present suboptimal for detailed prostatic artery anatomy identification when compared to CTA.

Recommendation 4: CTA to be performed in all patients planning to have PAE and should be reviewed by the interventional radiologists (with proctor for initial cases) performing the PAE. An arterial map should be drawn on each case (template in appendix).

Procedure:

- The majority of PAE can be performed via a unilateral femoral artery access.
- Internal artery cannulation can be performed with an angled catheter or small guide sheath to allow anterior internal iliac (AII) DSA.
 - Right AII angiography: RAO 35° with CC 10°
 - Left AII angiography: LAO 35° with CC 10°
- Use of a microcatheter (2.4Fr or smaller) and micro-guidewire (0.016 or smaller) to cannulate the prostatic artery
- DSA runs in positions stated above performed using a contrast injector. 1 Fr/sec to minimize radiation dose
- 3D rotational angiography 3DRA (Siemens Dyna-CT and Philips Xperswing) is performed prior to embolisation on each side to ensure prostate supply and manage unwanted anastomoses, by repositioning the microcatheter or placing protective microcoils at the origin of 'non-target' vessels.
- Embolisation using the PErFecTED technique is advised which leads to improved prostate infarction.
 - **Procedural documentation:**
 - Procedural duration
 - PAE arterial anastomoses seen
 - Embolic agents
 - No of arteries embolised
 - In-dwelling catheter

- Complications
- Pain score post procedure
- Repeated procedures e.g PAE; TURP; prostatectomy
- Length of stay

Recommendation 5: *A database should be kept for all PAE cases to allow audit and outcome data to be generated. This may in future be able to be uploaded to a national IR database to allow hospital comparison data.*

Follow-up:

Follow up of these cases should be carried out by the local team of interventional radiologists and the urologists with clinical, urodynamics and QoL questionnaires performed at 3 months to assess response. For new centres performing this procedure it is strongly advised that post PAE prostate MRI is performed at 3 months to allow the centre to quantify the infarction within the gland and to allow modification of the PAE technique accordingly. It is accepted that after confidence in the technique has been gained local centres can make a professional judgment as to whether MRI prostate is required in all cases.

Recommendation 6: *Formal QoL and urodynamics should be performed post PAE at 3 months to assess benefit to the procedure. Formal audit should be performed after the first 20 and then 50 cases to ensure a safe service. MRI Prostate should be considered post PAE in the first 20 cases to ensure the adequacy of the embolisation technique.*

Complications:

NICE listed a number of complications that should be documented if they occur.

1. Groin haematoma:
2. Arterial dissection:
3. Non-target embolisation:
 - a. Bladder wall embolisation / ischaemia (occurs in <1% of all studies)
 - b. Penile ulceration (occurs in 1% resolves spontaneously)
 - c. Rectal bleeding: (reported in 8% of studies without coned beam CT)
4. Acute urinary retention:
5. New retrograde ejaculation: (commonly occurs in men already on alpha blockers)
6. Sepsis (UTI & prostatitis): (reported in 3% of PAE & 2% of TURP)
7. Dysuria: (common for 2-3 days after PAE, especially if PERFECTED technique)
8. New Urinary incontinence:
9. Urethral stricture:
10. Persistent peroneal pain: rare.

References:

I have supplied a short list of relevant references as a guide to the procedure although there is further literature available to read regarding the technique and outcomes.

1. National Institute for Health and Care Excellence (NICE). Prostate artery embolisation for benign prostatic hyperplasia. www.nice.org.uk/guidance/ipg611.
2. The UK ROPE study: efficacy and safety of prostate artery embolisation for benign prostatic hyperplasia. An observational study and propensity matched comparison with transurethral resection of the prostate. Ray A, Powell J, Speakman M, Longford N, DasGupta R, Bryant T, Modi S, Dyer J, Harris M, Carolan-Rees G, Hacking N. BJU Int 2018. Doi:10.1111/bju. 14249.
3. Benign prostatic hyperplasia: prostatic arterial embolisation versus transurethral resection of the prostate – a prospective randomised controlled clinical trial. Gao Y, Huang Y, Zhang R et al. Radiology 2014;270:920-8.
4. The PErFecTED technique: proximal embolisation first, then embolise distal for benign prostatic hyperplasia. Carnevale F, Moreira A, Antunes A. Cardiovasc Intervent Radiol 2014;37:1602-5.
5. 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 centre prospective urodynamic controlled analysis. Carnevale F, Iscaife A, Yoshinaga E et al. Cardiovasc Intervent Radiol 2016;39:44-52.
6. Prostate arterial embolisation to treat benign prostatic hyperplasia. Pisco J, Pinheiro L, Bilhim T. J Vasc Interv Radiol 2010;22:11-19.
7. Planning prostate artery embolisation: Is it essential to perform a pre-procedural CTA? Maclean D, Maher B, Harris M, Dyer J, Modi S, Hacking N, Bryant T. Cardiovasc Intervent Radiol 2018;41:628-632.
8. Pelvic arterial anatomy relevant to prostate artery embolisation and proposal for angiographic classification. de Assis A, Moreira A, Rodrigues V, Harward S, Antunes A, Srougi M, Carnevale F. Cardiovasc Intervent Radiol 2015;38:855-861.
9. Medium and long term outcome of prostate artery embolisation for patients with benign prostatic hyperplasia: Results in 630 patients. Pisco J, Bilhim T, Pinheiro L, Fernandes L, Pereira J, Costa N, Duarte M Oliveira A. J Vasc Interv Radiol 2016;27:1115-1122.
10. Angiographic anatomy of the male pelvis. Bilhim T, Pereira J, Fernandes L, Tinto H, Pisco J. AJR 2014;203:W373-382.

Appendices:

Appendix 1: International Prostate Symptom Score (IPSS). Reformat to show all

INTERNATIONAL PROSTATE SYMPTOM SCORE (I-PSS)

Patient Name:	Not At All	Less Than 1 Time In 5	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	YOUR SCORE
Date:							
1. Incomplete Emptying Over the past month, how often have you had a sensation of not emptying your bladder completely after you finish urinating?	0	1	2	3	4	5	
2. Frequency Over the past month, how often have you had to urinate again less than two hours after you have finished urinating?	0	1	2	3	4	5	
3. Intermittency Over the past month, how often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5	
4. Urgency Over the past month, how often have you found it difficult to postpone urination?	0	1	2	3	4	5	
5. Weak Stream Over the last month, how often have you had a weak urinary stream?	0	1	2	3	4	5	
6. Straining Over the past month, how often have you had to push or strain to begin urination?	0	1	2	3	4	5	
	None	Once	Twice	3 times	4 times	5 or more	YOUR SCORE
7. Nocturia Over the past month how many times did you most typically get up each night to urinate from the time you went to bed until the time you got up in the morning?	0	1	2	3	4	5	
Total I-PSS Score							

Quality of Life due to Urinary Symptoms

	Delighted	Pleased	Mostly satisfied	Mixed	Mostly unhappy	Unhappy	Terrible
If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?	0	1	2	3	4	5	6

The I-PSS is based on the answers to seven questions concerning urinary symptoms. Each question is assigned points from 0 to 5 indicating increasing severity of the particular symptom. The total score can therefore range from 0 to 35 (asymptomatic to very symptomatic).

Although there are presently no standard recommendations into grading patients with mild, moderate or severe symptoms, patients can be tentatively classified as follows: **0 - 7 = mildly symptomatic; 8 - 19 = moderately symptomatic; 20 - 35 = severely symptomatic.**

The International Consensus Committee (ICC) recommends the use of only a single question to assess the patient's quality of life. The answers to this question range from "delighted" to "terrible" or 0 to 6. Although this single question may or may not capture the global impact of BPH symptoms on quality of life, it may serve as a valuable starting point for doctor-patient conversation.

Appendix 2: International Index of Erectile Function (IIEF).

INTERNATIONAL INDEX OF ERECTILE FUNCTION

Patient Questionnaire

HOSPITAL NUMBER (IF KNOWN)

NAME
 DATE OF BIRTH AGE
 ADDRESS

 TELEPHONE

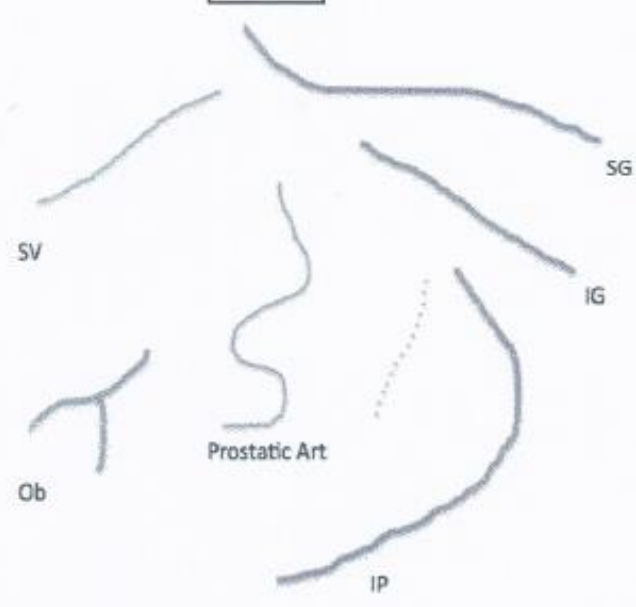
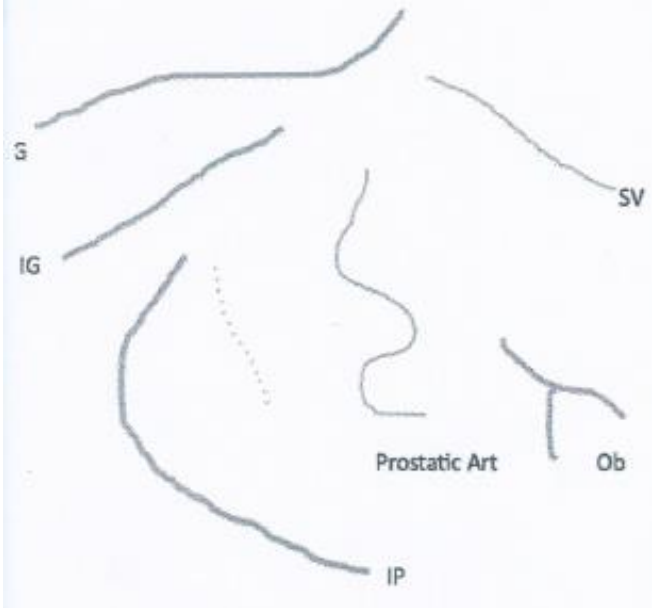
These questions ask about the effects that your erection problems have had on your sex life **over the last four weeks**. Please try to answer the questions as honestly and as clearly as you are able. Your answers will help your doctor to choose the most effective treatment suited to your condition. In answering the questions, the following definitions apply:

- **sexual activity** includes intercourse, caressing, foreplay & masturbation
- **sexual intercourse** is defined as sexual penetration of your partner
- **sexual stimulation** includes situation such as foreplay, erotic pictures etc.
- **ejaculation** is the ejection of semen from the penis (or the feeling of this)
- **orgasm** is the fulfilment or climax following sexual stimulation or intercourse

OVER THE PAST 4 WEEKS
CHECK ONE BOX ONLY

☐ Q1	How often were you able to get an erection during sexual activity?	0 No sexual activity 1 Almost never or never 2 A few times (less than half the time) 3 Sometimes (about half the time) 4 Most times (more than half the time) 5 Almost always or always
☐ Q2	When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	0 No sexual activity 1 Almost never or never 2 A few times (less than half the time) 3 Sometimes (about half the time) 4 Most times (more than half the time) 5 Almost always or always
☐ Q3	When you attempted intercourse, how often were you able to penetrate (enter) your partner?	0 Did not attempt intercourse 1 Almost never or never 2 A few times (less than half the time) 3 Sometimes (about half the time) 4 Most times (more than half the time) 5 Almost always or always
☐ Q4	During sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?	0 Did not attempt intercourse 1 Almost never or never 2 A few times (less than half the time) 3 Sometimes (about half the time) 4 Most times (more than half the time) 5 Almost always or always
☐ Q5	During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?	0 Did not attempt intercourse 1 Extremely difficult 2 Very difficult 3 Difficult 4 Slightly difficult 5 Not difficult

Appendix 3: Proposed CTA anatomy template

Anatomical Data Form for PAE		
Patient name/ID:	Age:	Prostate volume:
Left  Anatomical data - Aorto-iliac Ectasia Mild ☐ Moderate ☐ Severe ☐ - Aorto-iliac Atheroma Mild ☐ Moderate ☐ Severe ☐ - Common Gluteal trunk ☐ - Gluteo-Pudendal trunk ☐ - Replaced Obturator artery ☐ - Prostatic artery n. _____ - Origin of PA/s: Straight ☐ Tortuous ☐ - PA from _____ / _____ - Anastomosis with _____		
NOTES:		
Right  Anatomical data - Aorto-iliac Ectasia Mild ☐ Moderate ☐ Severe ☐ - Aorto-iliac Atheroma Mild ☐ Moderate ☐ Severe ☐ - Common Gluteal trunk ☐ - Gluteo-Pudendal trunk ☐ - Replaced Obturator artery ☐ - Prostatic artery n. _____ - Origin of PA/s: Straight ☐ Tortuous ☐ - PA from _____ / _____ - Anastomosis with _____		
NOTES:		