Prostate artery embolisation: ready for adoption?

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**Prostatic artery embolisation can be used to block the blood supply in benign prostatic hypertrophy (BPH), leading to a significant reduction in size and improvement in associated lower urinary tract symptoms. In this article the author describes the results of a recently published multicentre registry study and looks at where this technique can fit in the management of BPH.**

Embolisation was first utilised in the 1960s for controlling bleeding after trauma, including iatrogenic, post-partum haemorrhage and bleeding from the urinary and gastro-intestinal tracts. This evolved into pre-operative embolisation for hypervascular tumours, such as renal cell carcinoma, nasopharyngeal and hepatic tumours, to reduce blood loss from definitive resection surgery.

In 1996 a report was published where pre-operative embolisation was utilised in two Jehovah’s Witnesses with large uterine fibroids, prior to myomectomy, who had ongoing fertility wishes. At the time of myomectomy it was noted that not only was the surgery relatively bloodless, but the fibroid had actually undergone complete devascularisation and, given enough time, the myomectomy may have been avoided altogether. Uterine fibroid embolisation has since become one of the primary procedures for symptomatic fibroids in women wanting to avoid hysterectomy.

**Prostate artery embolisation**

Similar embolisation techniques have been used for prostatic and bladder bleeding for several decades. Initially, these were fairly non-selective, with catheters placed in the anterior divisions of the internal iliac arteries that were then occluded with temporary embolic agents such as gelatin sponge. As angiographic imaging and catheter technology progressed, particularly micro-catheter technology, it became possible to catheterise ever-smaller vessels and achieve super-selective embolisation of arteries directly feeding the two halves of the prostate shown clearly on subtraction angiography (Figure 1) and then a Dyna-CT image from a microcatheter injection deep into the left prostate artery (Figure 2).

Prostate artery embolisation (PAE) for symptomatic BPH was first described in 2000 and has attracted much interest in the interventional radiology and urology worlds. Initial small series have been followed by much larger single-centre cohort studies with follow-up out to seven years. There have also been three randomised controlled trials (RCTs) published from China, Brazil and Spain. Other RCTs are recruiting and should report findings over the next few years.

**PAE guidelines and the UK-ROPE registry study**

Various countries have issued guidelines concerning PAE. In the USA, the American Urological Association updated its treatment for lower urinary tract symptoms (LUTS) guidelines in 2014, but these did not include PAE. Similarly, the current European Association of Urology and the Urological Society of Australia and New Zealand guidelines do not include PAE as a treatment option.

In Australia and New Zealand, PAE can only be offered in the setting of an approved clinical trial. In the UK, the National Institute for Health and Care Excellence (NICE) issued guidelines in 2013, again suggesting that evidence for PAE was insufficient for it to be approved in routine use. It did, however, approve PAE within research studies or a well-organised multidisciplinary registry. A steering committee was set up to initiate such a registry, to be called UK-ROPE (Registry of Prostate Embolisation). Funding was provided from industry and from the British
Society of Interventional Radiology and the British Association of Urological Surgeons. NICE also provided funding for an independent medical assessment organisation (CEDAR) to run the registry. UK-ROPE, was initiated in 2014 and completed by January 2016. One-year follow-up data was available by early 2017.

Results from the UK-ROPE study

The primary endpoint of UK-ROPE was 12-month International Prostate Symptom Score (IPSS), and there were multiple secondary endpoints such as length of hospital stay, complications, re-intervention rates, prostate volumes, flow, and MRI findings. A total of 305 patients (PAE, 216; transurethral resection of the prostate [TURP], 89) were recruited from 17 centres and followed out to 12 months post-procedure. PAE produced a median 10-point reduction in the IPSS at 12 months with no significant complications compared to a 15-point reduction in the TURP cohort. On a six-point quality-of-life scale, there was a three-point reduction with PAE compared with four points after TURP.

Urinary flow was measured as Qmax and improved by 3ml/s compared with 7.5ml/s after TURP. Median prostate volume was reduced by 28% after PAE. There was also a significant reduction in hospital stay. Over 70% of PAE cases were performed as a same-day discharge, whereas 30% of TURP patients spent one night in hospital and 49% spent two nights. A few patients needed even longer stays after their TURP.

High procedural radiation doses have been reported with PAE and this is often noted by urologists criticising the procedure. In the UK-ROPE study, doses were much lower than previously reported and there was a learning curve observed: doses were significantly reduced after the first 10 cases in each centre as they acquired experience after the initial proctoring period. The routine use of cone beam computed tomography was encouraged to increase confidence during super-selective embolisation and to reduce the risk of non-target embolisation (Figure 2).

Complications reported were few and categorised as I–II on the Clavien-Dindo grading system. After PAE, 18% of patients reported any degree of haematuria, which was less than after TURP (64%). Haematospermia was reported in 12.6% and patients should be warned about this after PAE. There was one urinary tract infection compared with two in the TURP cohort, and four groin haematomas, one requiring drainage and blood transfusion after failure of a closure device.

Because there is minimal blood loss after PAE, it is not contraindicated in patients with anaemia or clotting disorders or those on anticoagulant therapy. Erectile function, as measured by the International Index of Erectile Function short form, showed a slight improvement in both groups. Retrograde ejaculation was reported only half as often after PAE compared with TURP. There were two cases of self-limiting penile ulceration, but no other reported non-target embolisations.

Although not quite as effective as TURP in this cohort, investigators concluded that PAE is very effective at reducing symptom scores and, due to its good safety profile, is worth considering in men who want to avoid TURP and the almost inevitable side-effects associated with it.

The UK-ROPE report was instigated by NICE, who were the first to receive the results. Alongside the other published data on PAE, this provides a first-hand understanding of the procedure. NICE approved PAE for routine use in April 2018.

A team approach was mandatory in this study. All actively involved units had to include two urologists and two interventional radiologists (IRs). All centres visited a training centre in Europe or the UK, and all had in-house proctoring for at least the first four cases. All published series to date have shown almost the same results.

Some further improvement has been reported by Carnevale et al using the ‘PERFectED’ technique (Proximal Embolisation First, Then Embolise Distal), where the initial endpoint of arterial stasis is reached followed by deeper or more distal embolisation, allowing around 20% more embolic particles to be introduced. Where possible, this appears to cause more glandular infarction, which should provide longer-lasting symptomatic improvement (Figure 3). Care must be taken with overall radiation doses in all cases using the PErFectED technique.

Obstacles to implementation

National and International guidelines need to be updated to include PAE as a treatment option for men with enlarged symptomatic prostates with no evidence of malignancy who would like to avoid conventional or laser prostatectomy.

Urologists need to be convinced that, rather than competing for patients, IRs are providing a very effective, even if only temporary, solution for men who would like to avoid or at least delay surgery if possible. Far from reducing a urologist’s practice, it actually increases it: only a proportion of men presenting with LUTS will, after appropriate investigation, be suitable...
PAE is a complex interventional procedure fraught with potential complications for the inexperienced operator. IRs performing large numbers of embolisations, particularly when requiring micro-catheters, are the ideal physicians to offer PAE. With proper equipment, training, and proctoring, most will be able to provide a very safe and effective service.

The variable and, at first glance, complex anatomical variations of prostatic arterial supply can readily be learned through training courses and at a physician's base hospital by using a clear anatomic template and applying the five types and origins of the prostatic artery.12

Suitably qualified IRs who have attended a PAE training course at an approved centre can usually learn to safely perform PAE after two proctored sessions with a minimum of two cases per session.

Conclusion
In my view, PAE is now ready for adoption in the UK and internationally. The initial report from UK-ROPE has been published in the British Journal of Urology International, and NICE approved PAE in April this year. With NICE approval, I have little doubt that PAE will spread rapidly in the UK. Many other countries follow NICE guidelines, but some may require further evidence.

Declaration of interests
Nigel Hacking is a clinical lead for the UK-ROPE study.

References