RADY 401 Case Presentation

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Ed. John Lilly, MD
69 yo male with PMH Benign Prostatic Hypertrophy (BPH), HTN, DM, coronary angioplasty, and 1 year hx of urinary retention presents for prostate artery embolization (PAE)

- T 97.7F, BP 142/80, HR 88, SpO2 95%

- Pt previously failed trial of void (TOV), FLOMAX (tamsulosin), terazosin (both are alpha-1 blockers -> relax prostatic smooth muscle)

- Reliant on urinary catheter for 1 year
  - Episodes of hematuria and catheter trauma
69 yo male with PMH BPH, HTN, DM, and 1 year hx of urinary retention presents for prostate artery embolization (PAE)

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Trial of Voids: measures bladder emptying -> fail if post-void residual > 1/2*pre-void volume

Tamsulosin and Terazosin: alpha-1 blocker -> relaxes prostatic smooth muscle
List of imaging studies

- Imaging studies not recommended by American Urologic Association for diagnosing BPH
  - Diagnosis is clinical
  - Can use transrectal or transabdominal US to measure prostate volume

- CT urography to evaluate hematuria
  - CT of abdomen and pelvis, with and without contrast

- Imaging during PAE: Ultrasound, Fluoroscopy
Hematuria (rating; relative radiation level):
- CT abdomen and pelvis without and with IV contrast (9; 4)

Suspected BPH with Lower Urinary Tract Symptoms
- US Pelvis (bladder and prostate) transabdominal (6; 0)
- US Kidney retroperitoneal (5; 0)
- MRI pelvis without IV contrast (3; 0)
- X-ray intravenous urography (2; 3)
CT Urography; axial plane (9/2017)

Findings?
CT Urography; axial plane (9/2017)
Findings: enlarged prostate → estimated 350 gm
- Average prostate size in grams = 11 gm; Large is considered > 50 gm
- No further imaging performed to measure prostate volume
PAE is treatment for refractory BPH
Goal: Block vascular supply to prostate causing ischemic necrosis and subsequent volume reduction of prostate, thereby relieving urinary symptoms\(^6\)
Anatomy and vasculature\(^7\):
Patient treatment: Prostate Artery Embolization (PAE)

- Improvement compared to baseline in:
  - International Prostate Symptom Score (IPSS)
  - Maximal urinary flow (Qmax)

- Compared to transurethral resection of prostate (TURP) or open prostatectomy, PAE exhibits:
  - Decreased invasiveness and morbidity
  - PAE good option for poor surgical candidates

- In randomized comparative trials, PAE was considered inferior to TURP or prostatectomy in IPSS, Qmax, and prostate volume\(^7\)
Patient treatment: The Procedure

- Diagnostic catheter enters left radial artery. Advances to right internal iliac artery.
- A J-tip Direxion microcatheter was inserted into right anterior lateral prostatic artery arising from vesicle-prostatic trunk.
- 100 mcg nitroglycerin injection for arterial dilation.
- Digital subtraction angiography (DSA) performed to determine optimal catheter position from embolization.
- Embolization performed with 100-300 micrometer Gel-Beads until stasis was achieved.
- Same procedure repeated on left side for left anterior lateral prostatic artery.
- 42.8 minutes total under fluoroscopy
Fluoroscopy, with C-arm: Real-time viewing of catheters and arterial blood flow, with use of contrast

Prostatic Artery Embolization: Minimally invasive

Standard surgery for BPH: Transurethral Resection of the Prostate
Ultrasound: evaluation of left radial artery.

Findings?
- Ultrasound: evaluation of left radial artery.
- Findings? Patent radial artery, for initial catheter entry
Imaging studies from PACS 3.a.

- Fluoroscopy: Right pelvis
- What do we see?
- Fluoroscopy: Right pelvis
- What do we see?

Catheter in common iliac artery (blue arrow).
Femoral head (green arrow).
Right anterior oblique angle.

Catheter advancing to right internal iliac artery.
Right anterior oblique angle.

Catheter advancing to right inferior vesicular artery and prostatic artery.
Coronal plane.
Fluoroscopy with contrast: Right pelvis, coronal plane

What do we see?
Imaging studies from PACS 3.b.

- Fluoroscopy with contrast: Right pelvis, coronal plane
- What do we see?

Fluoroscopy of Pelvis with contrast injection at site of Gel-bead injection. Right lateral prostate lobe (blue outline). Note hemi-hypertrophy of right prostate, and catheter (green arrow).

Digital Subtraction Angiography of right pelvis, illustrating prostatic artery branches.
Imaging studies from PACS 4

- Fluoroscopy without and with contrast: Left pelvis
- What do we see?
Imaging studies from PACS 4

- Fluoroscopy without and with contrast: Left pelvis
- What do we see?

Catheter advancing in left internal iliac artery (blue arrow).
Left femoral head (green arrow)
Left anterior oblique angle.

Contrast injection at site of Gel-bead injection.
Left lateral prostate lobe (blue outline)
Coronal plane.

Digital Subtraction Angiography of left pelvis,
illustrating prostatic artery branches.
Was the correct imaging done for the patient?

- **Diagnostic Imaging:**
  - CT urography for hematuria = correct
  - Did not perform ultrasound = correct. No further imaging was required to assess BPH

- **Procedural Imaging:**
  - Ultrasound = necessary to confirm radial artery patency
  - Fluoroscopy = necessary for real-time imaging of relevant structures during PAE
Imaging discussion 2: Classic Imaging Findings

- CT urography; axial plane

Normal sized prostate (blue arrow)
Colon (green arrow)\(^{11}\)

Patient’s Prostate with BPH (blue arrow)
Colon (green arrow)
CT of Abdomen and Pelvis

- Sensitivity and specificity:
  - Imaging not utilized for diagnosis of BPH. BPH is typically a clinical diagnosis without imaging.
- Cost: $1,039\textsuperscript{11}
- Radiation doses: 14.8 mSv\textsuperscript{12}
PAE procedure, including ultrasound and fluoroscopy imaging
- Sensitivity and specificity: Not applicable
- Cost: $1678.14
  - Including intraprocedural supplies, anesthesia, nursing, staff
  - TURP cost for comparison: $5338.31
    - Difference in costs primarily due to longer hospital stay for TURP: 1.38 d, vs 0.125 d for PAE

Radiation doses:
- $450.7 \text{ Dose Area Product (DAP)} \text{ (Gy} \cdot \text{cm}^2) \text{ per procedure}
  - DAP indicates radiation absorbed by a specific tissue
  - $\approx 180 \text{ mSv}^{14} \approx 12 \text{ CTs}
  - 71.5\%: \text{digital subtraction angiography}; \ 19.9\%: \text{fluoroscopy}; \ 8.6\%: \text{cone-beam CT}
  - Ultrasound for artery patency: no radiation exposure
  - Average time under fluoroscopy: 30.9 minutes$^{15}$
What is the average size of a prostate in grams?

Name three surgical procedures for treating benign prostatic hyperplasia:

Which of those procedures is
  ▪ More effective?
  ▪ Less expensive?
  ▪ Less invasive?
What is the average size of a prostate in grams? 11 gm

Name three surgical procedures for treating benign prostatic hyperplasia: PAE, TURP, prostatectomy

Which of those procedures is
- More effective? TURP, prostatectomy
- Less expensive? PAE
- Less invasive? PAE
References