

The 1st ipsilateral dual CG subtype consisted of a single vascular compartment with overlapping territories. Injection of one pedicle resulted in retrograde flow in the 2nd pedicle causing an unacceptable risk of non-target embolization. Attempts at coiling one of the dual ipsilateral pedicles was unsuccessful. Only contralateral unilateral PAE was achieved. The 2nd ipsilateral dual CG subtype consisted of two distinct vascular compartments without territorial overlap. PAE of each pedicle was performed separately. CBCT was necessary for recognition. Bilateral PAE was achieved.

Conclusions: Three separate patterns of dual central gland blood supply were identified demonstrating distinct anatomic and hemodynamic features; all having unique implications for PAE.

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Abstract No. 343

Radiation doses in prostatic artery embolization for benign prostatic hypertrophy: a single-institution series and meta-analysis

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Purpose: To evaluate patient radiation exposure during prostatic artery embolization (PAE) interventions at a single institution and present a meta-analysis of existing literature.

Materials: A query of a prospectively maintained database of patients who underwent PAE for Benign Prostatic Hypertrophy (BPH) without previous surgical intervention from January 2014 to April 2016. Procedural variables such as fluoroscopy time, kerma area product, and reference point air kerma were analyzed. A review of the literature regarding intraprocedural patient radiation exposure in PAE was performed to compare patient exposure data.

Results: This study had 23 patients who underwent 24 total procedures. The mean procedural time was 122 ± 5.4 minutes (66-172 mins). The mean fluoroscopy time was 36.7 ± 2.42 minutes (17.1-67.3 mins). The kerma area product was on average 26386 ± 2655 μGy-m² (2150-47848 μGy-m²). The reference point air kerma was 1477.04 ± 119.47 mGy (654-2771 mGy). These data were compared with results from 422 total procedures from 6 previously published prospective studies about PAE in BPH, as summarized in Table 1.

Study (No. of Procedures)	Mean Procedure Time (min)	Mean Fluoroscopy Time (min)	Average DAP (μGy•m ²)
Carnevale et al (15)	147.5 ± 30.4	45.8 ± 14.6	
Bagla et al (20)	72	30.2	55923
Bilhilm et al (20 in group 1 + 20 in group 2)	79.3 ± 42.3	23.4 ± 17.2	
	70.4 ± 26.0	20.0 ± 10.9	
Pisco et al (255)	73	18	
de Assis et al (35)	158 ± 53.2	55.4 ± 22.9	
Gao et al (57)	89.7 ± 17.1	33.2 ± 6.7	11305
Current series (24)	122 ± 5.4	36.7 ± 2.42	26386 ± 2655
Total (446)	87.34	36.65	23599

Conclusions: PAE has been previously demonstrated to be a safe procedure and radiation dosages are an important parameter regarding patient safety. Our data suggest that the reference point air kerma reached during PAE is well below the threshold for skin injury, even in patients receiving the highest dose.

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Abstract No. 344

Is CO₂ a suitable contrast agent for identification of the origin of the prostate artery during prostate artery embolization?

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Purpose: Patients with BPH-induced obstructive uropathy frequently present with renal failure, precluding them from undergoing PAE due to the risk of iodinated contrast-induced nephropathy (CIN). However, CO₂ gas has been shown to be a safe and effective alternative contrast agent for angiography. Thus, we investigated whether CO₂ angiography could successfully identify the origin of the prostatic artery during PAE.

Materials: From November 2015 to August 2016, 19 patients (mean age 69.2 ± 10.4 years) underwent PAE with analysis of 28 total hemi-pelvises. Indications for PAE included LUTS (7 patients), urinary retention (6 patients) and hematuria (5 patients). In addition, 7 patients had Stage 3 or greater chronic kidney disease, and 6 patients had creatinine values greater than 1.5 mg/dL. After obtaining right femoral access, 20 cc of CO₂ was first selectively injected to visualize the hemi-pelvic vasculature either unilaterally or bilaterally, followed by iodinated-contrast angiography to verify the prostatic artery origin prior to embolization. PAE was only attempted following contrast angiography in all cases except one, where PAE was performed after CO₂ angiography only. PAE was then performed by selective embolization of the prostatic artery with Embosphere Microspheres (Merit Medical, South Jordan, Utah). Our primary endpoint was successful prostatic artery origin identification with CO₂ as verified by iodinated contrast in each hemi-pelvis. International prostate symptom score (IPSS) and calculated prostate volumes were recorded before and after PAE to measure PAE success.

Results: CO₂ angiography identified the origin of the prostatic artery in 21/28 hemi-pelvises (75%). Successful

PAE was demonstrated by a 35% mean decrease in prostate volume ($n = 9$) and a significant improvement in IPSS ($n = 6$, $p = 0.0028$) after a mean follow-up of 3.1 months.

Conclusions: CO₂ angiography was able to successfully identify the prostatic artery in the majority of patients undergoing PAE. Therefore, CO₂ may be a particularly beneficial contrast medium for PAE when standard agents are contraindicated, and may broaden the patient population for which PAE is a viable treatment option.

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Abstract No. 345

Incidence of "occult" penile shunts during prostatic artery embolization

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Purpose: Previous studies have noted that anastomoses between prostatic arteries and the internal pudendal artery (IPA) make up 43% of all anastomoses and are commonly noted on angiography during prostatic artery embolization (PAE). There are multiple ways to manage these shunts to prevent non-target embolization to the penis. However, in our experience, many of these pathways do not opacify on initial angiography and only become visible after partial or complete PAE. We aimed to determine the incidence of "occult" intra- and peri-prostatic arterial shunts to the IPA seen during PAE.

Materials: Angiography from PAEs performed at a single site between April 2014 to April 2016 were retrospectively reviewed. The presence of shunts to the IPA was determined on pre-, intra- and post-embolization digital subtraction angiography (DSA) images. If an IPA shunt did not opacify on pre-embolization images but was seen on intra- or post-embolization images it was considered "occult."

Results: Eighty-three patients underwent PAE between April 2014 to April 2016 resulting in 164 unilateral prostatic artery angiograms. On 43/164 (26%), IPA shunts were identified. Of the 43 IPA shunts, 23 (53%) were considered "occult."

Conclusions: There is significant incidence of IPA shunts anastomosing with the prostatic arteries that do not opacify on initial prostatic artery angiography. Intra-embolization angiography should be considered to identify these pathways and manage them appropriately to prevent non-target embolization to the penis.

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Abstract No. 346

Factors predicting positive angiogram and the role of pre-peritoneal packing in pelvic trauma

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Purpose: To evaluate predictors for positive angiograms in pelvic trauma and to analyze the role of pre-peritoneal packing prior to angiogram.

Materials: This was an IRB approved retrospective study of 108 patients who underwent pelvic angiogram for trauma between 01/2011 to 07/2016 at a level I trauma center. Data collected included hemodynamic parameters, blood gas results, type and amount of blood products transfused, pelvic fracture type using the Young-Burgess classification, details of peritoneal packing or other surgical interventions, angiographic findings and intervention, length of stay and thirty day mortality. Multivariate logistic regression and Chi-square test were used for statistical analysis.

Results: Total of 108 patients were included in the study of which 48 were female, with an average age of 50.5 years. 86 (80%) patients were hemodynamically unstable and 96 (88%) had transfusion with a mean of 11.4 units of PRBC. There were 32 anteroposterior compression (APC), 35 lateral compression (LC), 12 vertical shear (VS) and 14 combined mechanism (CM) type pelvic fractures. 43 patients (39.8%) underwent pre-peritoneal pelvic packing prior to angiogram. 54 (50%) patients had active extravasation on angiogram, all of which were successfully embolized with Gelfoam, coil, plug or a combination. 19 patients (17.5%) underwent prophylactic embolization with Gelfoam based on CT findings. There was no difference in the rate of positive angiograms between those who had pelvic packing (26/43, 60.4%) vs. those who did not (28/65, 43%) ($p = 0.12$). APC II and VS type fractures were independent predictors of active extravasation ($p = 0.02$ and $p = 0.04$ respectively). Number of units of blood transfused on admission was the best independent predictor of 30 day mortality ($p = 0.003$).

Conclusions: Pelvic fracture type can be a useful predictor of active extravasation in trauma. The use of pre-peritoneal pelvic packing did not affect the rate of extravasation in pelvic trauma and its use may potentially delay definitive angiographic treatment. Number of units of blood transfused is an independent predictor of 30-day mortality.

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Abstract No. 347

Not all roads point to hysterectomy: clinical outcomes of embolization for the treatment of post-pregnancy uterine arterial injury

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Purpose: To determine the clinical outcomes of embolization in post-pregnancy uterine arterial injury including arteriovenous fistulas (AVF) and pseudoaneurysms.

Materials: A retrospective review of all consecutive patients with post-pregnancy uterine AVFs and pseudoaneurysms who underwent angiography and embolization between 2002 until 2016 at two academic institutions was performed. Patient characteristics, embolization technique, and clinical outcomes were reviewed.

Results: A total of 28 patients were identified, median age 35 (range: 24-45). 20 patients were diagnosed with uterine AVFs and 8 had uterine artery pseudoaneurysms on pre-procedure MRI or pelvic ultrasound. Of the patients diagnosed with uterine AVF, 17 patients underwent 23 embolization