# Radiodermitis after prostatic artery embolization. Case report and review of the literature

Prostate Artery Embolization (PAE) is a technically demanding new treatment option for Benign Prostatic Hyperplasia (BPH). We present a case of radiation-induced dermitis in a 63-year-old patient after a technically successful PAE, due to high radiation exposure and long procedural time. Anatomical and technical aspects are discussed, as well as recommendations to decrease radiation exposure in these procedures.

**Keywords**

Prostatic artery embolization, benign prostatic hyperplasia, radiation exposure, radiodermitis, complications.

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## INTRODUCTION

Recently, PAE has been adopted for the treatment of low-urinary tract symptoms (LUTS) due to BPH. Previous studies have established PAE as a safe and effective treatment, associated with reduction in prostate volume, significant symptom reduction, and improvement of functional and clinical outcomes (1-3). However, PAE requires a well-trained interventional radiologist because of the complex prostatic vascular anatomy and the potential for complications in elderly patients with atherosclerosis, very thin prostatic arteries and comorbidities. Moreover, these features can lead to major radiation exposure during the procedure.

To authors' knowledge, no case of radiation exposure complication has been reported so far in this type of procedure. Herein, we describe a case of radiodermitis following a technically successful PAE and discuss specific aspects related.

**CASE REPORT**

A 63-year-old man with multiple comorbidities including non-ST segment elevation acute coronary syndrome (NSTE-ACS), sleep apnea/hypopnea syndrome (SAHS) in treatment with continuous positive airway pressure (CPAP) and morbid obesity (body mass index 44.1 Kg/m$^2$) underwent PAE for treatment of LUTS due to BPH. His symptoms were classified as moderate according to the International Prostate Symptom Score (IPSS 19), being manifested as increased urinary frequency, nycturia, urgency, incontinence and weak urine stream, all of them refractory to optimized medical treatment (selective α-blockers and 5α-reductase inhibitors). Of note, patient had negative histopathology reports by various US-guided and CT-guided biopsies despite persisting high serum prostate specific antigen (PSA) levels during the last 15 years. Patient's preembolization serum PSA level was 13.7 ng/mL (reference range 0–4 ng/mL). The prostate volume was 230 cm$^3$ as determined by transabdominal US and 243 cm$^3$ as determined by CT. Urodynamic study revealed maximum flow rate (Qmax) of 11 mL/s, postvoid residual volume of 294 mL and voided urinary volume of 98 mL.

After multidisciplinary decision, patient underwent PAE procedure according to previously described methods (4,5), after informed consent was obtained. PAE was performed in the interventional radiology suite (Allura Xper FD20, Philips Medical Systems, Nederland B.V., Holland) with nonionic contrast medium (Optiray Ultraject 320 mg/mL. Mallinckrodt Spain S.L, Spain). A Foley catheter was inserted, and its balloon inflated with contrast solution, and patient received a single 400 mg intravenous dose of ciprofloxacin. After digital subtraction angiographies (DSA) from both internal iliac arteries, selective catheterization of the right and left inferior vesical arteries (IVA) was performed using a microcatheter (Progreat 2.0. Terumo, Japan), which was especially difficult due to atherosclerosis (Figure 1). An important anastomosis between the left prostatic lobe artery and the dorsal penile artery was then identified, and selective occlusion with a platinum microcoil was performed (Axium detachable coil system. Ev3 Micro Therapeutics, Inc, USA) in order to avoid non-target embolization (Figure 2). After that, we embolized bilaterally to total stasis with 300-500 μm Embosphere® Microspheres (Biosphere Medical, Roissy, France), avoiding reflux of embolic agent to undesired arteries.

Procedure lasted 310 minutes, with 72 minutes of total fluoroscopy time. Measurements of radiation exposure demonstrated a Kerma-area-product of 8023949 mGy . $cm^2$ and an effective-dose of 9.8 Sv.

Within 12 days of follow-up, patient developed an erythematous lesion in the lower back/sacral area, associated with skin edema and pigmentation, characterizing radiodermitis. Related symptoms included local pain and pruritus. Local treatment with an urea-based lotion, thrice a day for 15 days (Ureadin. Laboratorios Isdin. Barcelona, Spain) was initiated with progressive improvement of lesion aspect and symptomatology, and after 60 days there was just a small area of skin atrophy (figure 3). Regarding LUTS, an important improvement was observed since the first month of follow-up, characterized by reduction of IPSS and QoL scores. Within 3 months, miccional interval was > 3 hours and there was a complete resolution of nycturia and miccional urgency. There was no recurrence of LUTS so far.

## DISCUSSION

For several reasons, PAE for BPH can be a technically challenging procedure, leading to excessively radiation exposure for both patient and performing interventionists. Atherosclerosis and other anatomical features seem to be especially important, since identifying and catheterizing target arterial branches are among the most technical and time-consuming steps. Multiple different origins of the IVA and its prostatic branches had been described, including the anterior trunk of internal iliac artery, obturatory, internal pudendal arteries and others (6), and its identification can be somewhat difficult. Besides, pelvic arterial supply is markedly interconnected by anastomosis, some of them of clinical interest, as in several cases embolization can lead to non-target organ ischemia.

Long procedure and fluoroscopy times are described for PAE, which can be explained the inherent challenge of the procedure, learning curve and rigorous protocols used by researchers. In one recent study including 34 PAE patients with prostates exceeding 90g (7), procedures lasted 95 to 295 minutes, with a mean of 158 minutes, and fluoroscopy time varied from 19 to 143 minutes, mean of 55.4 minutes. In a work from Pisco et al. (3), PAE was performed in a mean procedure time of 72 minutes and a mean fluoroscopy time of 18 minutes, which is somewhat lower than other published data. In this study, some of the patients were excluded due to atherosclerotic changes seen in pre-procedure AngioCT or AngioMRI, which probably collaborate to reduce those figures. Considering other procedures involving pelvic embolization, several studies addressing radiation dose during uterine artery embolization (UAE) were published in the last two decades (8). In most of them, values observed were considerable lower comparing to PAE data, fact that can probably be explained by anatomical aspects (i.e. vessels size) and atherosclerotic changes seen in the elderly population, as UAE patients are usually younger. Overall, the radiation exposure in the presented case was higher than mean values for both PAE and UAE published series.

Several factors contributed for the major radiation exposure seen in this case, particularly. Older age and obesity had lead to diffuse arterial degeneration characterized by atherosclerotic changes, making catheterization and distal progression more difficult than usual (figure 1). Moreover, an important anastomosis connecting the left inferior vesical artery and an internal pudendal branch was identified and needed selective coiling in order to avoid non-target embolization (figure 2). Obesity itself also played an important role: in a digital C-arm, as patient thickness increases, the input dose of radiation required for sufficient penetration increases in an exponential manner (automatic kV increase). Image quality also deteriorates because of the generation of more scattered radiation (9). In this particular case, we have estimated a 2-3x increase of radiation exposure due to patient's obesity. Finally, this case was performed during a teaching session, following the previously described "perfected technique" (4), in which embolization of prostatic branches involves a bilateral two-step approach. After the usual embolization from the prostatic artery, the microcatheter is pushed distally into the intraprostatic branches in order to continue embolization, avoiding this way any kind of early occlusion of target arteries and possibly leading to better clinical outcomes (4,5). All those aspects worked together increasing overall radiation exposure and leading to radiodermitis seen in this case.

To avoid radiation injuries, any available dose-reducing features such as low-dose fluoroscopy mode, pulsed fluoroscopy, collimation, and image-hold capabilities should be used. Reducing the number of DSA runs also plays a major role, once it corresponds to approximately 70% of the total radiation dose in interventional procedures. Moreover, adequate procedure planning using all available information is also crucial (9,10). In selected cases, a 3D-angiography performed from the internal iliac artery can be of special value helping to individualize the IVA itself and its origin, avoiding DSA series in multiple angulations. Society of Interventional Radiology guidelines for patient radiation dose management (9) recommends specific clinical follow-up of patients who received significant dose of radiation, being the suggested thresholds 3000 mGy for peak skin dose and 500 mGy . $cm^2$ for Kerma-area-product. In fact, a single-site acute skin dose of 2000 mGy can lead to transient erythema and epilation, besides the risk for other stochastic injuries that cannot be predicted. Fluoroscopy time can be used as an indirect indicator of radiation dose, and values grater than 60 min should also trigger specific follow-up.

Adequate material selection is also important, and considering the small size of target arteries and the eventual tortuosity, we believe 2.4 Fr or smaller microcatheters and a high-torque 0.014”or 0.016” guidewires would be useful for distal catheterization. Regarding selective embolization of anastomosis, those that involve bladder, rectum and penis are of particular importance. Probably, migration of small amounts of microspheres through anastomosis involving obturatory territory or other pelvic parietal structures will not lead to a clinical relevant complication; therefore, usually there is no need for coiling those connections, saving fluoroscopy time. The same way, particle reflux to seminal vesicle branches does not seem to cause major complications.

Overall, knowledge of pelvic arterial anatomy, strict application of methods of radiation reduction and familiarity with advanced microcatheterization techniques are fundamental to decrease radiation exposure in PAE procedures and to avoid potential related complications.

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<u>COI Disclosure Statement</u>

All authors declare that they have no conflicts of interest.

**FIGURES**

**Figure 1.** Radiodermitis lesion aspect within 12-days (A), 30-days (B) and 60-days (C) after PAE.

**Figure 2.** (A) Ipsilateral oblique DSA demonstrating IVA origin in the proximal segment of the obturator artery (arrow). Note tortuosity due to atherosclerosis (*) difficulting distal catheterization. (B) Posterior-anterior DSA showing right prostatic lobe parenquimatous blush just below Foley catheter balloon (F).

**Figure 3.** (A) DSA after selective catheterization of distal right IVA showing an important anastomosis connecting prostatic and pudendal territories (arrow). (B) A slightly later phase demonstrating prostatic parenquimatous blush (*) and also corpus cavernous blush (arrow). (C) After selective catheterization of the anastomosis, embolization was performed with a platinum microcoil (arrow). (D) Control DSA showing successful embolization of the shunt.


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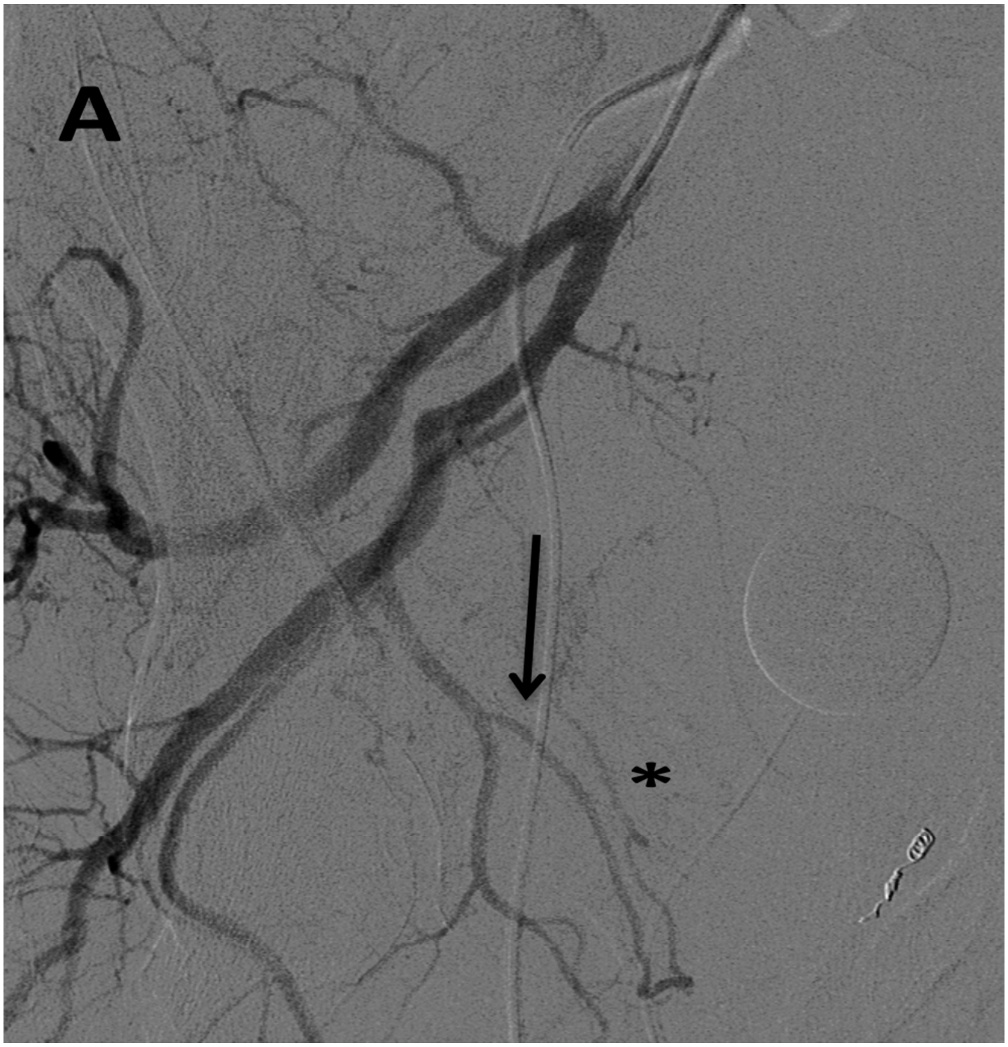


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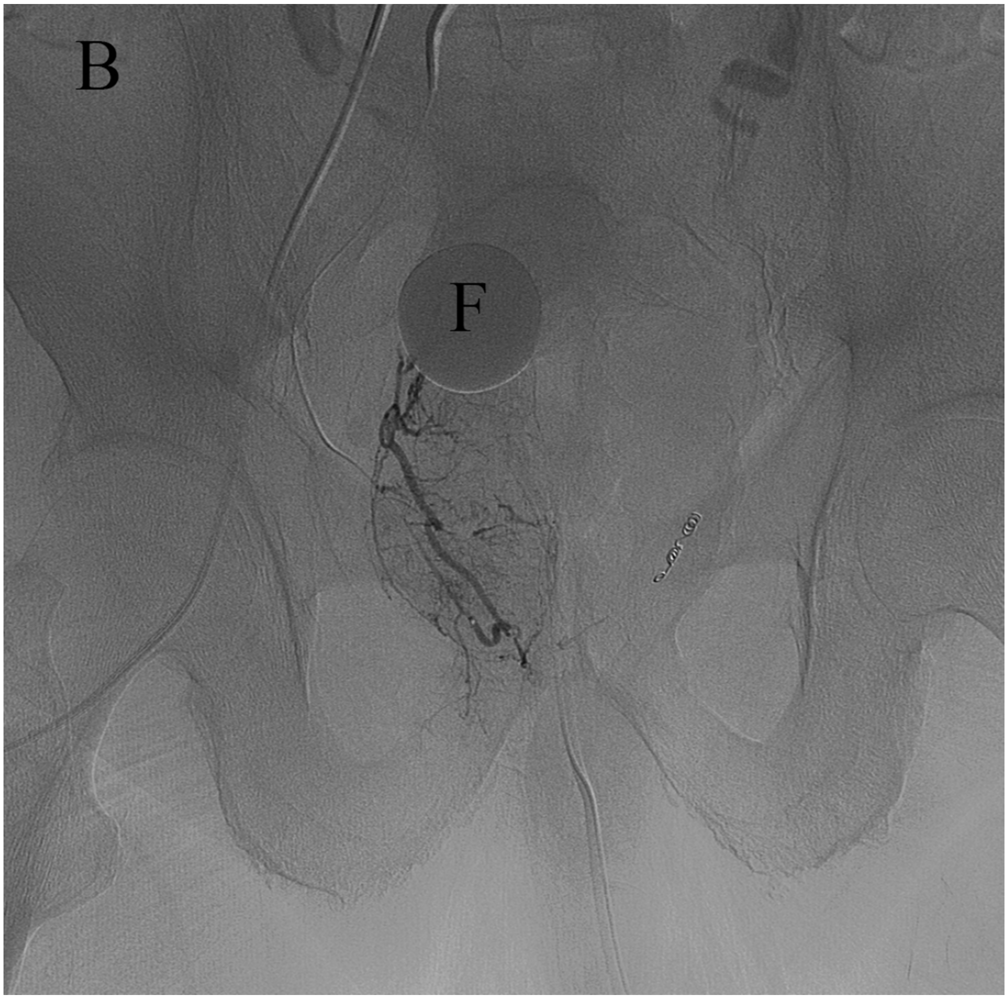


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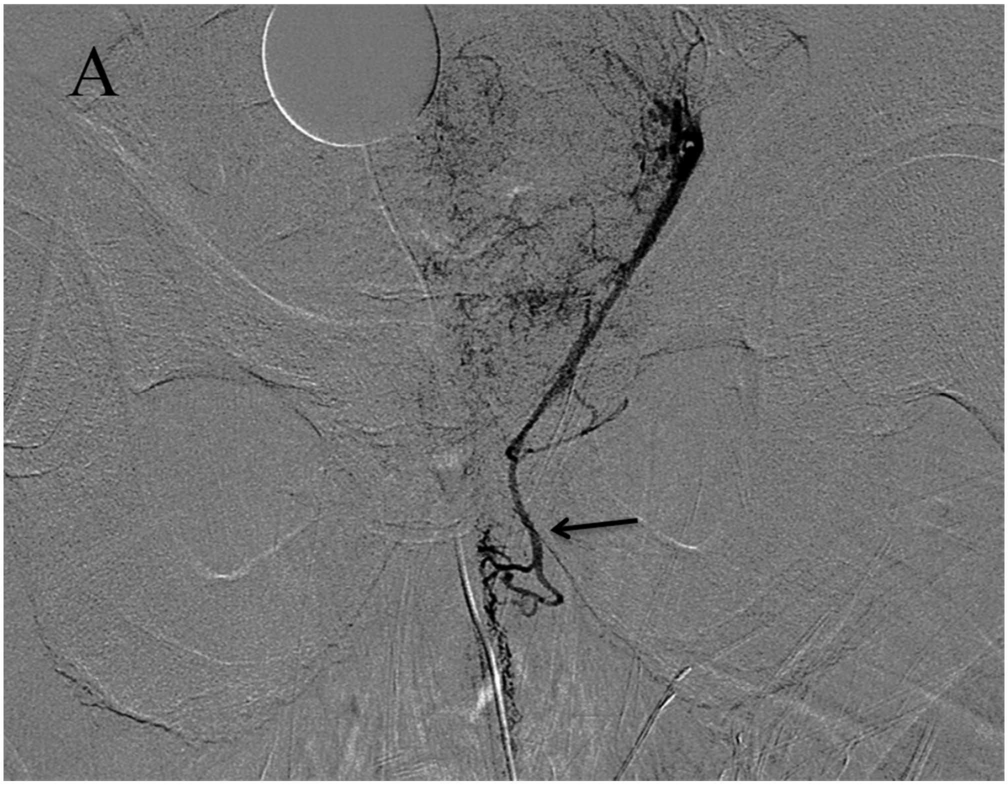


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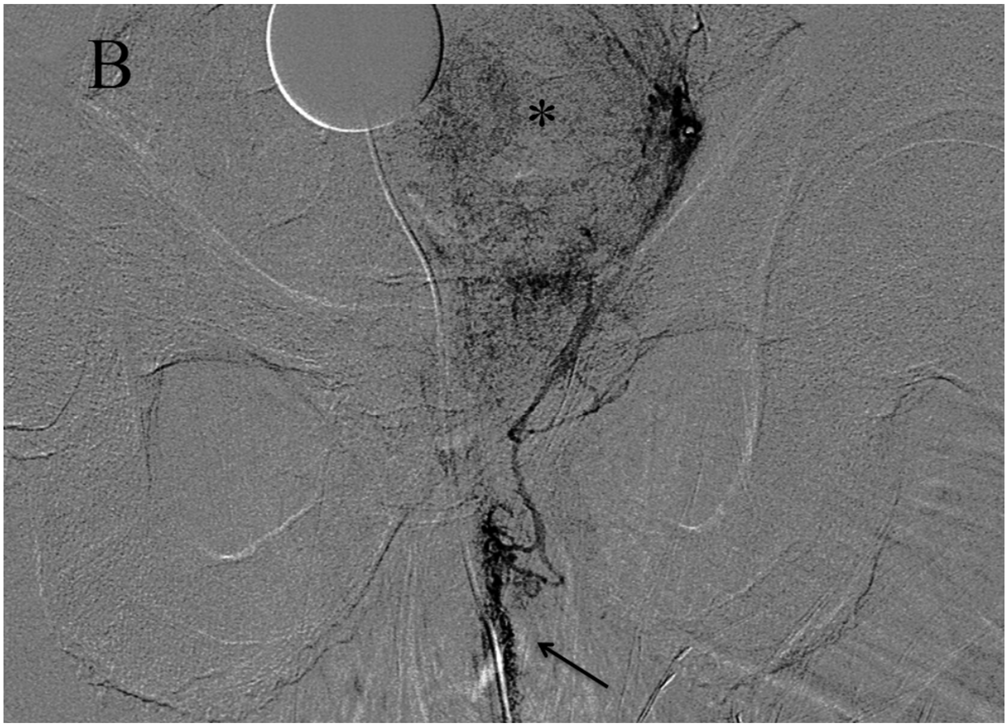


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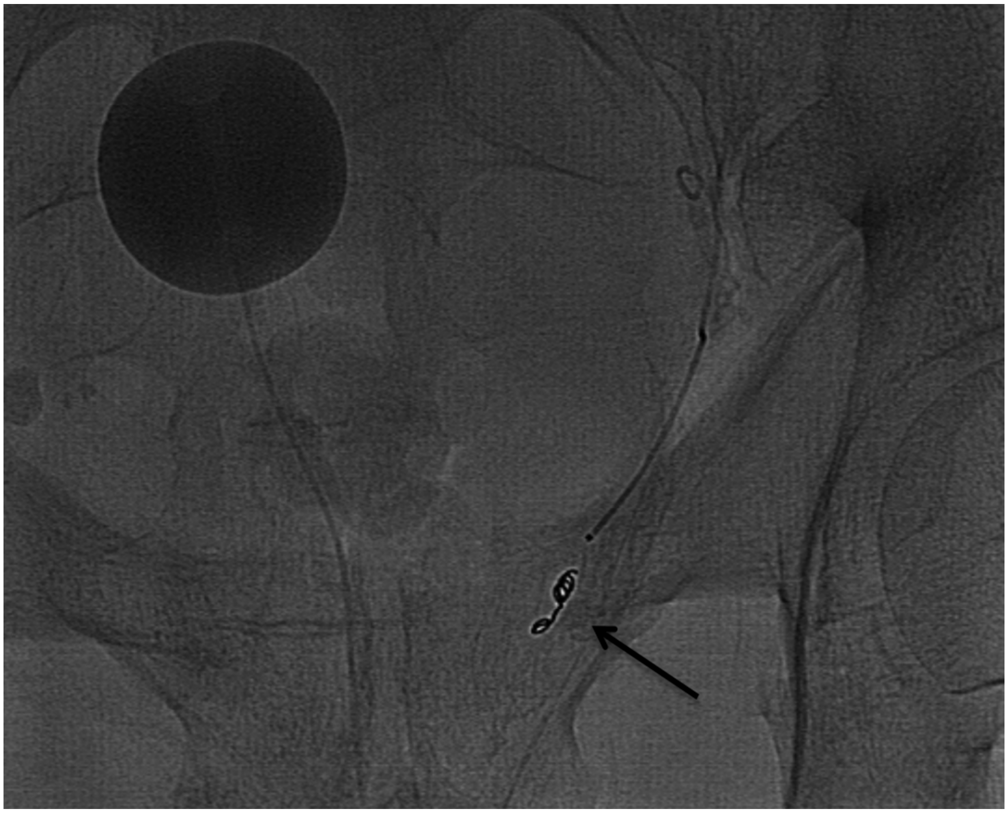

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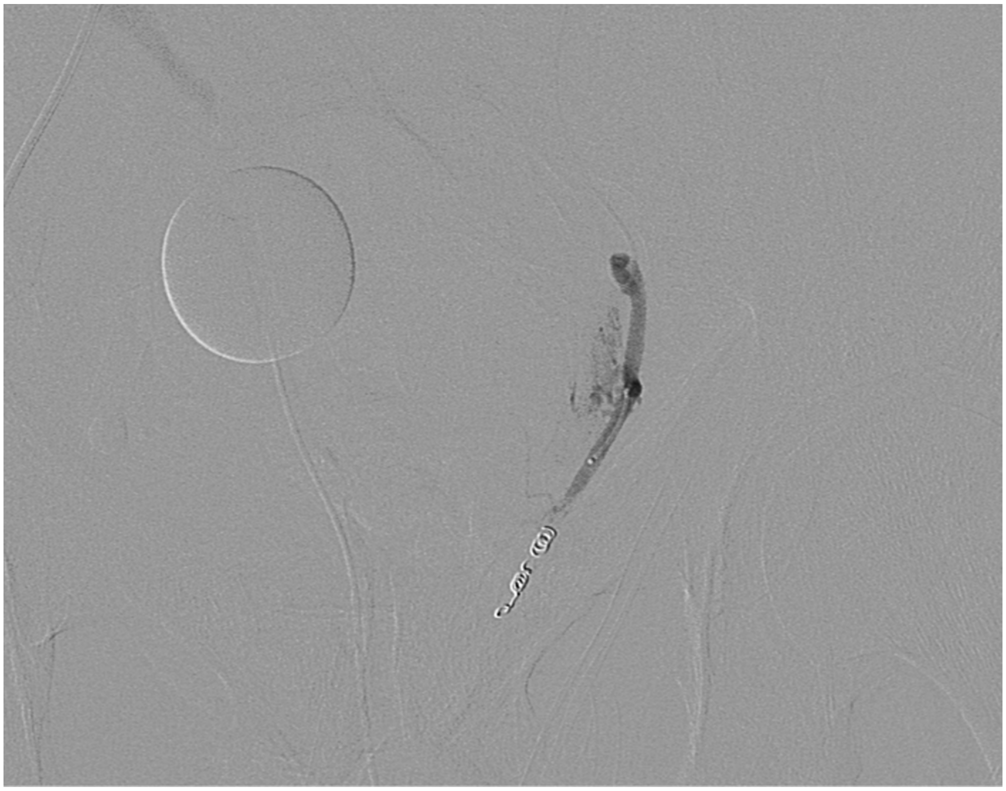

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