



## Case report

## Intraoperative external iliac venogram and intravenous ultrasound to assist retrieval of intrapelvic acetabular screw

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## ABSTRACT

Intrapelvic acetabular screw placement is a known complication of total hip arthroplasty and is associated with risks including damage to neurovascular and intrapelvic structures such as the external iliac vessels, obturator vessels, and iliopsoas muscles. Retrieval of intrapelvic acetabular screws is similarly fraught with risk, and appropriate imaging should be performed preoperatively. We report on a case of intrapelvic acetabular screw placement with abutment of the external iliac vein, which was managed with intraoperative venogram and intravenous ultrasound to maintain access to the external iliac vein and successfully show no vascular tear before and after screw removal.

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## Introduction

Vascular injuries during total hip arthroplasty are rare, with a prevalence of 0.1%–0.2%. These injuries can result in catastrophic complications such as the development of uncontrolled hemorrhage, thrombosis, or development of a false aneurysm [1]. During a total hip arthroplasty, placement of acetabular screws can put multiple vascular structures at risk unless the surgeon is particularly vigilant and aware of the local anatomy.

The safe zones for acetabular screw placement during total hip arthroplasty have been described in the literature at length. When viewing the hip, one line drawn from the anterior superior iliac spine through the center of the acetabulum, crossed with a perpendicular line, will separate the acetabulum into quadrants. Of these, the posterior-superior and posterior-inferior quadrants were found to be the least associated with risk to vital structures compared with the anterior superior and anterior inferior quadrants [2]. Specifically, acetabular screws placed into the anterior

zones have been shown to be directed toward the external iliac and obturator vessels and the obturator nerve. Any screw with length greater than 35 mm must be placed in the posterior-superior quadrant to ensure consistent safety (Fig. 1) [2].

Several articles have discussed the complication of iliopsoas impingement with anteriorly placed screws and the irritation it causes. Management for this, after exhausting all conservative measures, involves screw removal [3]. To date, however, there is a paucity of reports discussing management of symptomatic screws that are in close proximity to the external iliac and obturator vessels. As with acetabular screw placement, safe screw retrieval remains vital to preventing vascular injury when dealing with intrapelvic hardware, and adequate imaging is crucial preoperatively [4]. As such, in the following paragraphs we discuss a case where intrapelvic screw placement that was causing iliopsoas impingement was found on preoperative venogram to be impinging on the external iliac vein, and through the use of intraoperative and postoperative venogram and intravenous ultrasound (IVUS), we were able to accomplish safe retrieval and maintain the ability to rapidly gain control of the vessel as needed.

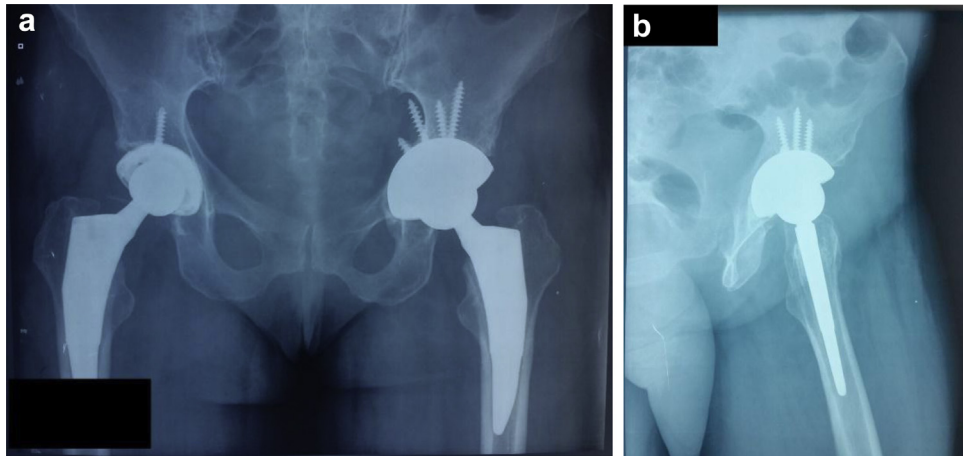
## Case history

A 59-year-old female patient with no significant medical history underwent a left total hip arthroplasty at another institution

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**Figure 1.** Anteroposterior (AP) (a) and lateral (b) radiographs prior to revision surgery showing screws protruding beyond the pelvic bone.

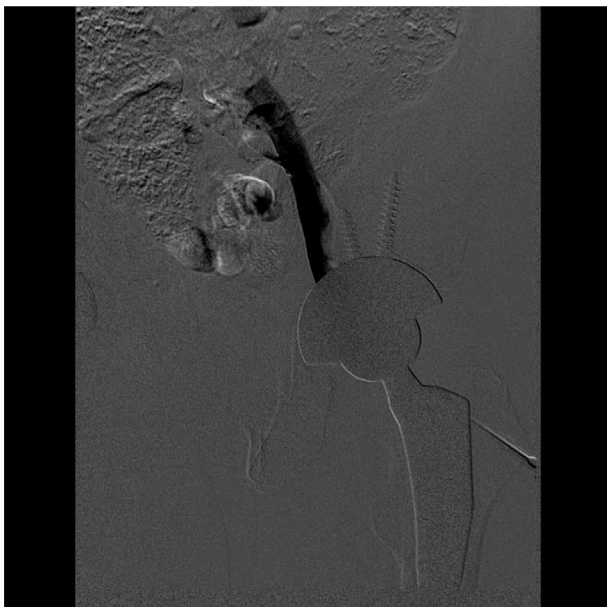
because of the development of metallosis after a left femoral head resurfacing. After the left total hip arthroplasty, she developed significant groin pain, groin swelling, and discomfort with active hip flexion, but an otherwise normal examination with intact sensation and pedal pulses in the left leg. Radiographs revealed 3 acetabular screws were prominent medially into the pelvis (Fig. 1). Preoperative venogram demonstrated one screw abutting the external iliac vein (Fig. 2). Owing to the patient's continued symptoms and the concerning venogram images, the decision was made to remove the prominent acetabulum screws, reassess the stability of the acetabular component, and potentially place new screws. The patient consented for retrieval of the intrapelvic acetabular screws with possible revision of the femoral head and polyethylene liner and possible revision of femoral and acetabular components, as well as any other necessary procedures. Risks and benefits were discussed preoperatively, with risks including injury to the iliac vein with associated bleeding, injury to nerve and surrounding soft tissues, need for revision of the implants, leg length

discrepancy, infection, need for reoperation, and death. Benefits discussed included amelioration of patient's presenting symptom of pain, safe decompression of the iliac vein, and increased longevity of the implants secondary to new polyethylene surfaces without wear. Before the hip approach, a vascular surgeon performed a venogram and IVUS to identify the involved screw and obtain access to the external iliac vein. IVUS involves a piezoelectric transducer placed on the end of a catheter, from which ultrasound signals originate. The modality of the transducer being intravascular allows better characterization of vessels because of lack of interference from the soft tissues covering it. This modality, combined with different types of analysis software programs, produces qualitative and quantitative information about vessel integrity and lumen size [5].

The vessel appeared completely round with no new erosion or penetration but remained directly adjacent to the most medial acetabular screw. The hip was then exposed and dislocated, and the polyethylene liner was removed. The distal and medial screw, which was tenting the vein, was then gently removed. No significant bleeding was noted. We continued to remove the other 2 prominent screws in the anterosuperior region that had violated the medial wall. No additional bleeding was noted. A new polyethylene liner and femoral head were placed, the hip was reduced, and the wound was then closed in standard fashion. The vascular surgeon administered additional contrast and performed IVUS via the external iliac vein (Fig. 3), and it was again demonstrated that there was no extravasation and therefore no venous penetration. At 1-year follow-up, the patient has complete relief of her left groin pain and is ambulating well.

## Discussion

The most commonly described complications after medial acetabulum penetration with screw for total hip arthroplasty include damage to the iliac vessels as well as intrapelvic musculature. Iliacus hematoma leading to femoral nerve palsy has been demonstrated as a complication of medial wall screw penetration from Wooten and McLaughlin in 1984 [6]. Uchida et al described a case of a delayed hematoma from iliacus injury secondary to intrapelvic screw placement which was associated with bone resorption and necessity for hardware removal and revision arthroplasty [7]. In a combined cadaver and in vivo study performed by Keating et al in 1990, 14 acetabula were examined for at-



**Figure 2.** Pre-revision venogram demonstrating obstruction of contrast flow.



**Figure 3.** Venogram after screw removal demonstrating lack of extravasation.

risk structures with medial cortex penetration, and these screws were found to threaten the external iliac vein, obturator artery nerve and vein, and tributaries of the internal iliac vein [8]. These studies reiterate the importance of adherence to placement of acetabular fixation screws in the “safe zone” described by Wasielewski and the rare but real complications that can develop with nonadherence [2].

In the case presented previously, acetabular screw penetration of the medial wall had led to iliopsoas impingement, and further diagnostic interrogation with venogram was found to be in position abutting the external iliac vein. While Barrack has described the importance of delicate screw retrieval supplemented with imaging, the literature has not described nor suggested methods for minimizing bleeding emergently should a vascular injury be sustained with screw removal [4]. The presence of a fellowship-trained

vascular surgeon at the time of hardware removal, after gaining access to the external iliac vein, is helpful from both a diagnostic as well as therapeutic standpoint.

### Summary

Intrapelvic acetabular screw placement is associated with potential injury to intrapelvic musculature and vasculature, at times leading to expanding hemorrhage, iliopsoas impingement, and direct vessel injury. Preoperative assessment with venogram, combined with intraoperative and postoperative venogram and IVUS to visualize the proximity of the screw being retrieved to the vessels, is a safe and effective means of monitoring and provides a rapid means of gaining vascular control in cases of vascular injury.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.artd.2019.06.002>.

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