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Multivessel Transcatheter Arterial Embolization to Treat Hip Osteoarthritis: A Pilot Case Series

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Abstract

Chronic hip pain due to osteoarthritis (OA) is a prevalent source of disability in older adults. While total hip arthroplasty (THA) remains the standard treatment for end-stage disease, many patients are not surgical candidates due to comorbidities or personal preferences. Transcatheter Arterial Embolization (TAE) of the hip has emerged as a minimally invasive treatment for OA-related pain, but further evidence is warranted to establish its role in treatment pathways.

This prospective, single-center pilot case series was conducted under IRB approval and reviewed the feasibility of multivessel hip TAE for pain treatment. Four patients with OA-related chronic hip pain underwent hip TAE which targeted the medial and lateral circumflex arteries, and obturator arteries. Technical success was reached in all cases, defined as a resolution in synovial blush on post-embolization angiography. Pain outcomes were measured at baseline, 1, 3, and 6 months post-procedure using the Visual Analog Scale (VAS). All four patients achieved ≥50% reduction in VAS from baseline (average 9.75 baseline --> 1.75 at the end of the study period). No ischemic complications were observed.

Study results demonstrate multivessel hip TAE may be viable as an effective minimally invasive treatment for patients with OA-related hip pain, with meaningful and sustained pain reduction and no adverse complications occurring. Larger and sham-controlled studies are necessary to further generalize these findings and establish hip TAE.

Keywords: Osteoarthritis, hip, pain, embolization.

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Introduction

Chronic hip pain from osteoarthritis (OA) is a prevalent source of disability and joint pain, particularly among older adults (1 - 3). The lifetime risk of symptomatic hip OA in individuals living to the age of 85 is estimated to be over 25% (2). OA is a complex and multifactorial disease, characterized by pathological changes in cartilage, bone, and surrounding structures of the joint. Recent literature suggests that OA may be influenced by increased vascularity of the synovium (3 - 5). This results in joint pain, mobility impairment, and reduced quality of life (1, 4, 6).

Conservative treatments are typically used to alleviate pain and improve function. Many patients experience temporary benefit from measures such as oral analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), physical therapy, and/or intra-articular steroid injections (7, 8). For end-stage OA, total hip arthroplasty (THA) remains the definitive option. However, arthroplasty is not always feasible for patients due to advanced age, comorbidities, or personal preference (8, 9).

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Table 1: Summary of patient demographics and outcomes.

	Age	Sex	BMI	Diagnosis	Initial VAS	1 mo. VAS	3 mo. VAS	6 mo. VAS
Case 1	79	Female	25.5	Left Hip OA	10	1	0	0
Case 2	85	Female	27.3	Left Hip OA	10	2	5	5
Case 3	83	Female	23.2	Left Hip OA	9	5	2	2
Case 4	76	Male	22.4	Right Hip OA	10	0	0	0

As a result, there is a need for adjunctive, minimally invasive alternatives that can reduce pain and maintain mobility (10 - 12).

Transcatheter arterial embolization (TAE) has shown promise in managing OA-related pain in the knee and shoulder (8, 10, 11, 13). The procedure involves selective cannulation and embolization of abnormal synovial hypervascularity to reduce inflammation (8, 10). By targeting synovial neoangiogenesis, hip TAE disrupts the inflammatory cascade and provides pain relief and functional improvement (13, 14). Although TAE has shown efficacy in various joints, there is limited research on application of this technique within the hip (14). Early studies have evaluated short-term outcomes of hip TAE among patients with moderate to severe OA of the hip, but long-term evaluation is necessary (12, 15).

Given this relatively unexplored avenue, this pilot case series assesses the feasibility of multivessel TAE for OA-related hip pain. We present four patients with advanced hip OA and multiple comorbidities who underwent the procedure for pain relief.

Methods

This single-center prospective case series was conducted under full IRB approval. All four patients had chronic and persistent hip pain secondary to osteoarthritis, which was refractory to conservative treatments. Following clinical and imaging evaluation, the procedures were performed by an experienced interventional cardiologist with certification from the American Board of Endovascular Medicine. The procedure was performed using a multivessel approach, defined as the embolization of two or more arterial contributors to the hip joint (notably the medial and lateral circumflex femoral and obturator arteries). These vessels were selectively cannulated and embolized using Primaxin, a suspension of imipenem-cilastatin, and 50 - 100 µm or 100 - 300 µm Embospheres, to achieve complete cessation of pathological blush. Technical success was defined as the resolution of abnormal synovial hypervascularity or blush displayed in the post-embolization angiography.

Pain outcomes were assessed using the Visual Analog Scale (VAS), a validated 0–10 measure of pain intensity, where 0 indicates no pain and 10 represents the worst pain imaginable (17). The objective was to evaluate the clinical success of hip TAE for OA-related pain. Clinical success was defined as a ≥50% reduction in VAS score from baseline, measured during follow-up evaluations at 1, 3, and 6 months.

Case 1

A 79-year-old female with frailty, type II diabetes mellitus, OA, and chronic venous insufficiency presented with progressive bilateral hip osteoarthritis-related pain, worse on the left. Her symptoms were associated with severe limitations in activities of daily living (ADLs), with pain reaching a 10/10 VAS score. The patient had previously tried multiple conservative therapies, including oral analgesics, physical therapy, and intra-articular steroid injections, all of which failed to provide lasting relief. Due to her comorbidities and frailty, she was not a candidate for total hip arthroplasty and elected to undergo TAE for her left hip pain.

Ultrasound-guided retrograde access of the right (contralateral) common femoral artery was obtained. A 5F Prelude sheath (Merit Medical) was placed and exchanged for a 5F 45 cm Roadster sheath, which was advanced into the left (ipsilateral) common femoral artery through an up-and-over approach. An abdominal aortogram was performed using a 4F 65 cm Berenstein catheter (Merit Medical) to delineate pelvic inflow prior to selective catheterization of the left-sided hip-supplying vessels. Using a Fielder XT-R wire and 1.4F

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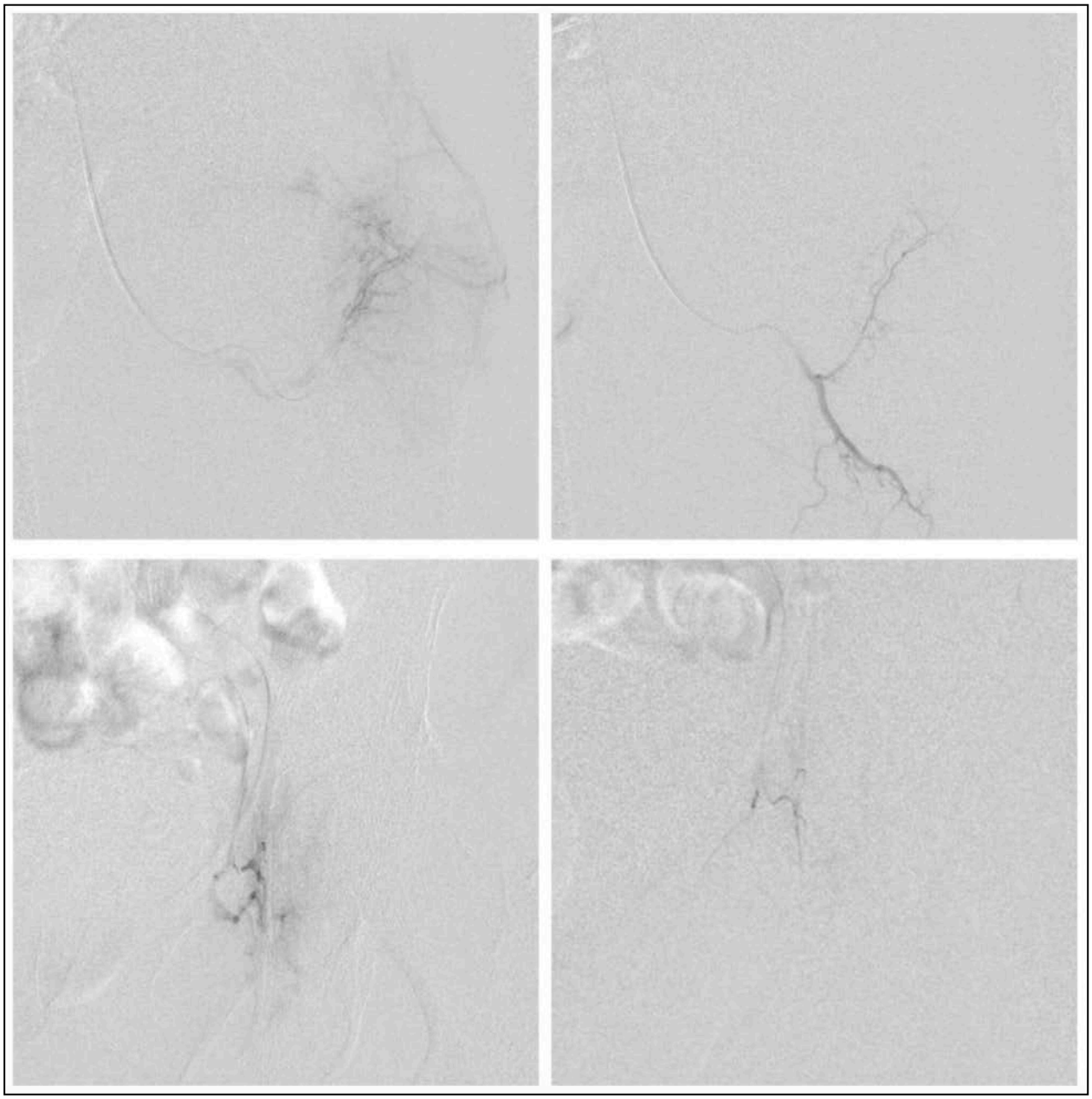

Figure 1: Pre (left) and post (right) angiographic imaging for left medial circumflex artery (top) and obturator artery (bottom).

135 cm Caravel microcatheter (Asahi Intecc Medical), target arteries were selectively cannulated and injected with 50 mcg nitroglycerin, saline flush, and contrast dye to demonstrate angiographic blush. After confirming angiographic blush visualized in Figure 1, embolization of the left medial circumflex femoral artery was performed with 0.5 mL of Primaxin, the left lateral circumflex femoral artery with 0.2 mL of 100–300 µm Embospheres, and the left obturator artery with 0.2 mL of Primaxin. Post-embolization angiography confirmed a reduction of abnormal blush with preserved femoropopliteal flow. Hemostasis was achieved using a 5F Celt closure device (Vasorum) at the access site.

At 1-month post-embolization, the patient reported marked improvement, with her VAS pain score decreasing from 10/10 to 1/10. By this time, she was able to resume routine activities such as standing, cooking, and shopping with minimal limitations. At 3 months, she reported complete resolution of left hip and compensatory back pain (VAS 0/10), an effect that sustained at her 6-month follow-up. In this case, hip TAE provided effective pain relief with meaningful improvement in daily function.

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Case 2

An 85-year-old female with hypertension, atrial fibrillation, and OA presented with progressive osteoarthritis-related left hip pain. Her discomfort limited ADLs, and she rated her pain 10/10 VAS score. Multiple intra-articular steroid injections to the left hip and knee provided only temporary relief. Given the persistence of pain, functional decline, and lack of further surgical options, she elected to undergo left-hip transcatheter arterial embolization (TAE) as a minimally invasive treatment.

Ultrasound-guided retrograde access of the right (contralateral) common femoral artery was obtained, and a 5F Prelude sheath (Merit Medical) was placed. Following placement, the 5F Prelude sheath (Merit Medical) was exchanged for a 5F 45 cm Roadster sheath, which was advanced into the left (ipsilateral) common femoral artery through an up-and-over approach. An abdominal aortogram was performed using a 4F 65 cm Berenstein catheter, which delineated pelvic inflow before selective catheterization of the left-sided hip vessels. Using a Fielder XT-R wire and 1.4F 135 cm Caravel microcatheter (Asahi Intecc Medical), the left lateral circumflex femoral artery was selectively cannulated. Intra-arterial nitroglycerin (50 mcg) was given before angiography to minimize vasospasm. Embolization was performed with 1.0 mL of Primaxin, resulting in reduction of angiographic blush while preserving femoropopliteal flow, visualized in Figure 2. The medial circumflex femoral artery was not able to be cannulated due to diffuse calcific disease and thus not treated, and the obturator artery showed no significant blush. Hemostasis was achieved using a 5F Celt closure device (Vasorum).

At baseline, the patient reported severe left hip pain rated 10/10 on the VAS, which significantly limited her activities of daily living. At 1 month, her pain improved to VAS 2/10, with increased mobility and reduced discomfort. At 3 months, she continued to note improvement (VAS 5/10) but described ongoing bilateral lower-extremity tenderness and swelling, consistent with previously documented chronic venous insufficiency. At 6 months, her hip pain remained improved relative to baseline (VAS 5/10) and she reported a sense of tightness, particularly when sitting. No ischemic or procedural complications were observed. Overall, hip TAE resulted in meaningful pain reduction and functional improvement over the 6-month follow-up period in a patient with multiple comorbidities.

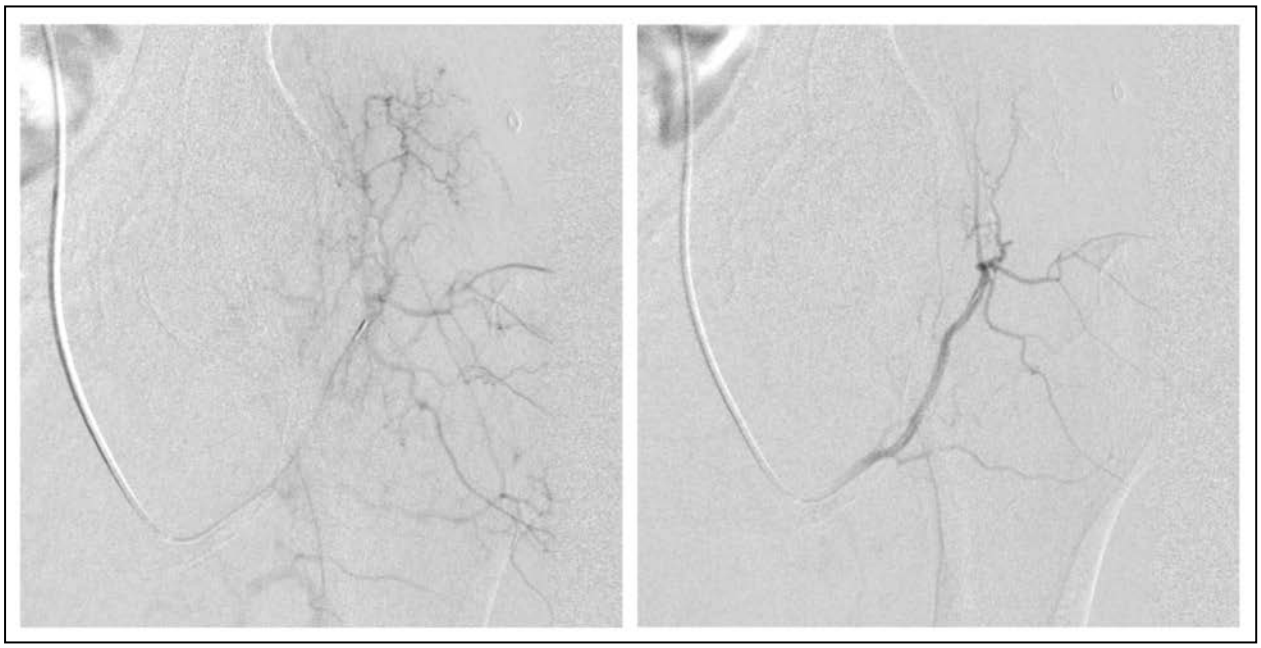

Figure 2: Pre (left) and post (right) angiographic imaging for left lateral circumflex artery.

Case 3

An 83-year-old female with a history of type II diabetes mellitus, hypertension, and OA, presented with progressive left hip pain. The patient described a gradual onset of symp-

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toms over several years without antecedent trauma or recent falls. Diagnostic imaging demonstrated osteoarthritis of the left hip. Conservative measures, including physical therapy, steroid injections, and prescription analgesics, provided only minimal pain relief. At baseline, she required a cane for ambulation assistance and rated her pain 9/10 on the VAS. Given the severity of her disease, limited response to conservative therapies, and hesitancy to pursue arthroplasty, she elected to proceed with left hip TAE for her pain.

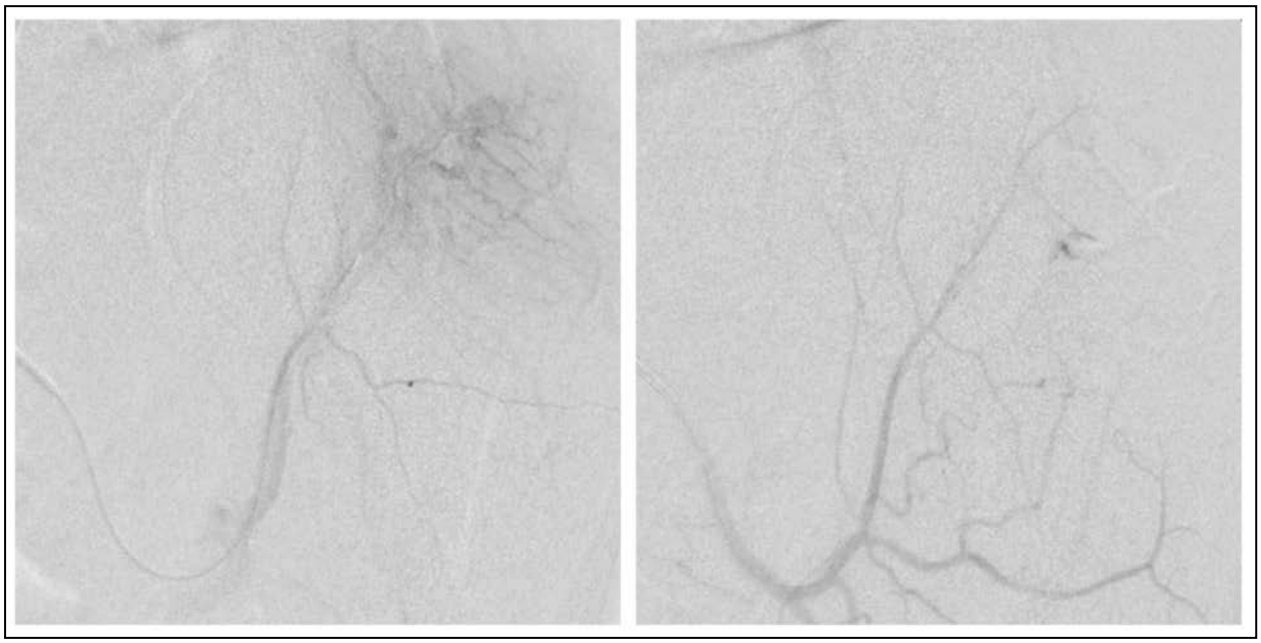

Figure 3: Pre (left) and post (right) angiographic imaging for left lateral circumflex artery.

Ultrasound-guided retrograde access of the right (contralateral) common femoral artery was obtained, and a 5F 10 cm Terumo Pinnacle sheath was placed. This was subsequently exchanged for a 5F 45 cm Roadster sheath, which was advanced into the left (ipsilateral) common femoral artery through an up-and-over approach. Selective angiography of the left profunda femoris and lateral circumflex femoral arteries demonstrated significant blush, visualized in Figure 3. An abdominal aortogram was performed using 4F 65 cm Berenstein catheter (Merit Medical).

A 1.4F 135cm Asahi Caravel microcatheter and Fielder XT-R wire were used for selective catheterization of the target vessels. Intra-arterial nitroglycerin (50 mcg) was administered prior to angiography to minimize vasospasm. Embolization was performed with 0.2 mL of 100–300 µm Embosphere particles under fluoroscopic guidance, resulting in resolution of the blush while preserving femoropopliteal flow. The medial circumflex and obturator arteries were selectively cannulated but showed no significant blush. Hemostasis was achieved using a 5F Celt closure device (Vasorum) at the access site.

At baseline, the patient reported severe left hip pain rated 9/10 on the VAS with substantial restriction in mobility and daily activities.

At 1-month post-embolization, she reported significant improvement in pain and function, noting marked improvement in hip pain and no longer requires routine cane use to ambulate in her home, after relying on it for 4–5 months before the procedure.

At 3 months post-embolization, the patient continued to report significant improvement in her left hip symptoms compared to baseline, rating her pain level a 2/10 on the VAS. At 6-month post-embolization, she continued to report durable pain relief, with pain rated 2/10 on the VAS. In this case, left hip TAE provided substantial and sustained pain reduction with improved mobility and functional recovery in a patient with severe osteoarthritis and limited surgical options.

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Case 4

A 76-year-old male with a history of carotid artery stenosis, coronary artery disease, and hyperlipidemia presented with progressively worsening right hip pain secondary to radiographically confirmed moderate OA. He described that his pain and stiffness limited his ability to walk long distances, climb stairs, and play golf. Conservative therapies, including physical therapy, intra-articular steroid injections, and oral analgesics, failed to resolve his hip pain, which was rated 10/10 on the VAS. Due to the persistence of his symptoms and hesitancy to pursue arthroplasty, he opted for right hip TAE for his pain.

Under ultrasound guidance, contralateral common femoral artery retrograde access was obtained, and a 5F sheath (Merit Medical) was placed. This was subsequently exchanged for a 5F 45 cm Roadster sheath, which was advanced into the right (ipsilateral) common femoral artery through an up-and-over approach. Intra-arterial nitroglycerin (50 mcg) was administered to minimize vasospasm. After an abdominal aortogram was performed using a 4F Berenstein catheter (Merit Medical), selective angiography of

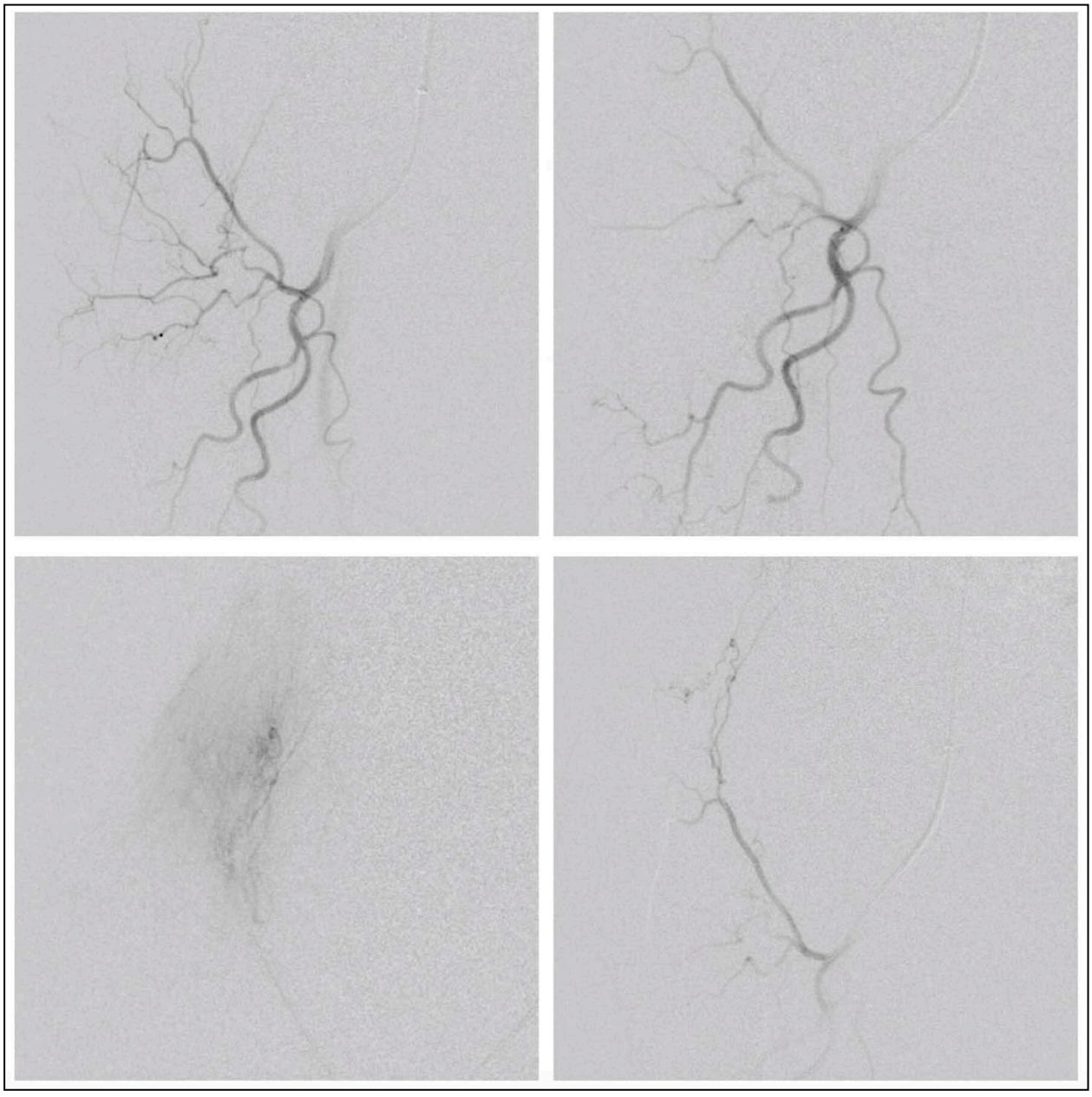

Figure 4: Pre (left) and post (right) angiographic imaging for left medial circumflex artery (top) and obturator artery (bottom).

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the right profunda femoris as well as lateral and medial circumflex femoral arteries demonstrated significant angiographic blush, as shown in Figure 4. Selective catheterization of the target hip vessels followed through usage of a 1.4F Asahi Caravel microcatheter and Fielder XT-R wire. Under fluoroscopic guidance, embolization was performed on the ascending and transverse branches of the right lateral circumflex with 1 mL of Primaxin and 0.5 ml of 50-100 µm Embosphere embolization particles injected into the ascending and 1 mL of Primaxin injected into the transverse branches respectively. The right medial circumflex femoral artery was treated with 0.3 mL Primaxin. Moreover, the obturator artery was selectively cannulated but showed no significant blush. Following the procedure, fluoroscopic guidance confirmed significant improvement of blush with preservation of femoropopliteal flow. Hemostasis was achieved using a 5F Celt closure device (Vasorum) at the access site.

At 1-, 3-, and 6-month follow-up, the patient reported complete resolution of right hip pain (VAS 0/10) with full return to normal mobility and daily activities. In this case, right hip TAE provided substantial and durable pain relief with restoration of functional ability in a patient with moderate osteoarthritis and limited surgical options.

Discussion

In this case series, hip TAE provided meaningful and sustained pain reduction in patients with end-stage OA where THA was not appropriate. Once conservative treatments fail, effective alternatives remain sparse for resolving pain in this patient population. However, all four patients achieved clinical success, defined as a greater than 50% reduction in VAS scores at six months post-procedure. Although standardized functional scales were not employed, all patients reported improved mobility and independence in ADLs and decreased reliance on pain medications.

This pilot series builds on the foundational TAE studies of Okuno et al. (10, 11) and expands upon the findings of Correa et al. for hip TAE (12, 13). Our multivessel approach, targeting the synovial hypervascularity or blush surrounding the hip joint, supports the feasibility of hip TAE as a minimally invasive treatment for OA-related hip pain.

Procedural technique was crucial to ensure both safety and efficacy. Subselective catheterization of the medial and lateral circumflex femoral and obturator arteries was performed under angiographic guidance, with intra-arterial nitroglycerin administered to minimize vasospasm. Selective cannulation and embolization followed. Embolization was carried out using a combination of transient Primaxin (imipenem-cilastatin) and non-resorbable 50-100 µm or 100–300 µm Embosphere (Merit Medical) particles until pathological blush resolved. This technique avoided ischemic complications and preserved femoropopliteal flow. No major adverse events, including soft tissue necrosis, osteonecrosis, or access-site injury, were observed. Mild lower extremity edema was noted in the patients (Case 1 and 2) with pre-existing venous insufficiency and remained stable with conservative management. The use of temporary embolic agents such as Primaxin mitigated this risk, allowing for transient vascular occlusion (17). Non-target embolization did not occur, underscoring the safety of the procedure when performed with careful fluoroscopic guidance and judicious embolic delivery.

Although these results are encouraging, several limitations must be acknowledged. The small sample size, lack of randomized design, and follow-up period limited to six months restrict the generalizability of these findings. Pain assessment relied on patient-reported VAS scores, which, while validated, are subjective and may not fully reflect clinical outcomes (18). Future studies with larger cohorts, sham-controlled designs, objective activity measures, and longer follow-up will be necessary to confirm TAE's long-term efficacy and safety.

Conclusion

This case series demonstrates that transcatheter arterial embolization of the hip offers significant and durable pain relief for patients with end-stage osteoarthritis refractory to treatment. All patients achieved clinical success (≥50% reduction from baseline VAS score) and demonstrated improved mobility without any procedural complications. Findings imply that hip TAE may be utilized as a

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safe and effective minimally invasive alternative for patients where conservative measures have failed to resolve their OA-related pain. Further prospective investigations are necessary to confirm these outcomes and generalize findings.

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Declarations
Consent for publication: The author clarifies that written informed consent was obtained and the anonymity of the patient was ensured. This study submitted to Swiss J. Rad. Nucl. Med. has been conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards. All authors contributed to the conception and design of the manuscript, participated in drafting and revising the content critically for important intellectual input, and approved the final version for publication. Each author agrees to be accountable for all aspects of the work, ensuring its accuracy and integrity.

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Conflict of interest:

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