



Feasibility of Pedal Access for Geniculate Artery Embolization

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Abstract

Geniculate artery embolization is a treatment option for refractory knee osteoarthritis in patients unable to receive total knee arthroplasty. This case report describes two patients for whom pedal access was used to embolize the geniculate arteries due to challenging groin anatomy secondary to significant comorbidities (morbid obesity, proximal atherosclerosis). Both patients achieved marked pain relief and enhanced knee function at 1-month follow-up. These cases suggest that pedal access is a viable alternative, offering a promising approach for patients with unfavorable anatomy and comorbidities that make groin access impractical. Further research is needed to validate these findings in larger patient populations.

Keywords

- ▶ geniculate
- ▶ embolization
- ▶ osteoarthritis

Introduction

Geniculate artery embolization (GAE) is a minimally invasive treatment option for patients with refractory symptomatic knee osteoarthritis (OA), particularly those who are not candidates for total knee arthroplasty (TKA).¹ Access for GAE is typically obtained in the groin through the contralateral common femoral artery or ipsilateral common femoral artery in an antegrade fashion.^{2,3} However, in patients with unfavorable groin anatomy, overlying infections, morbid obesity, or proximal peripheral artery disease, groin access can be technically challenging or infeasible.² In these cases, pedal access may provide a viable alternative approach,⁴ involving either the dorsalis pedis or the posterior tibial artery.³ This case report demonstrates two successful cases of pedal access for GAE in patients for whom groin access could not be achieved.

Case Reports

This study was approved by the institutional review board (IRB) of the institution where the study was conducted. Individual patient consent was obtained.

A 74-year-old man, with a history of lung cancer and morbid obesity, presented with painful right knee OA refractory to physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), and steroid injections. The patient initially had a Knee Injury and Osteoarthritis Outcome Score (KOOS) of 7 and Kellgren and Lawrence (KL) grade of 3, indicating substantial impairment (see ▶**Fig. 1** and ▶**Fig. 2**). Given his comorbidities, he was not a candidate for TKA. Thus, the patient was referred to interventional radiology for GAE.

Pedal access was used because groin access was not feasible, due to the patient's morbid obesity, precluding the use of standard-length micro-puncture sets. Three geniculate arteries were identified supplying hyperemic areas of synovium and were embolized with 100- to 300- μ m Embosphere particles (Merit Medical). Manual pressure was applied to the access site for 15 minutes to achieve hemostasis, followed by bed rest for 1 hour. The patient tolerated the procedure well without complication, with a total fluoroscopy time of 23.2 minutes and radiation dose of 286 mGy. One month after the procedure, the patient's KOOS score increased from 7 to 22, signifying substantial improvement in knee function and pain relief.

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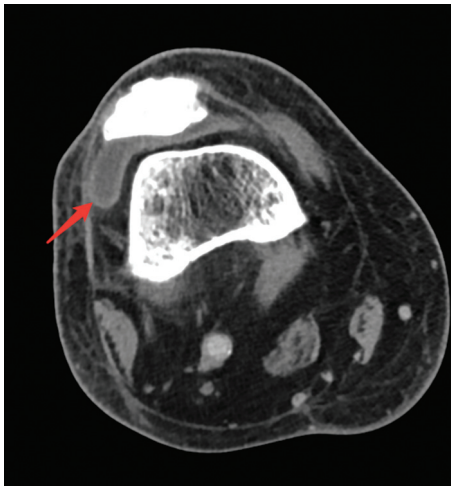


Fig. 1 Axial noncontrast computed tomography in the soft tissue window shows joint effusion and thickening of the synovium, consistent with osteoarthritis-related synovial inflammation.



Fig. 2 Coronal noncontrast computed tomography of the right knee shows typical findings of osteoarthritis, including osteophyte formation and subchondral sclerosis.

A 54-year-old woman, with history of factor V Leiden, pulmonary embolism on lifelong anticoagulation, and morbid obesity, presented with painful left knee OA, refractory to physical therapy, NSAIDs, and steroid and hyaluronic acid injections. She initially presented with a KOOS score of 10

and KL grade of 3, indicating substantial disability. Due to her comorbidities, she was not a candidate for TKA. The patient was referred to IR for GAE.

Pedal access was utilized because groin access was not feasible, due to the patient's morbid obesity and severe bilateral common femoral artery atherosclerosis. Four geniculate arteries were identified supplying hyperemic areas of synovium (see ►Fig. 3, ►Fig. 4, and ►Fig. 5) and were embolized with 100- to 300- μ m Embosphere particles (Merit Medical). Manual pressure was applied to the access site for 15 minutes to achieve hemostasis, followed by bed rest for 1 hour. She tolerated the procedure well without complication, with a total fluoroscopy time of 27.8 minutes and radiation dose of 397 mGy. One month after the procedure, the patient's KOOS score increased from 10 to 23, indicating significant improvement in knee function and pain relief.

Discussion

Utilizing pedal access for GAE, as demonstrated in the aforementioned cases, is promising as a feasible alternative to groin access. Both patients had significant comorbidities precluding them from surgical management and making groin access for GAE impractical. Pedal access provided a viable alternative route, and both patients achieved significant clinical improvement.

Morbid obesity increases the difficulty of achieving groin access, as the increased depth of the common or superficial femoral artery makes them inaccessible with standard-length access needles. Additionally, the increased risk of infection or hematoma in an obese patient makes groin access less favorable. Atherosclerosis of the common and superficial femoral arteries also makes groin access and subsequent hemostasis challenging, which is encountered often due to the high prevalence of peripheral artery disease in patients with OA.⁵ In such cases, pedal access may serve as an alternate access route.

Utilizing pedal access can avoid potential access site complications encountered with groin access, including retroperitoneal hematoma with a high puncture, arteriovenous fistula, or pseudoaneurysm. However, minor complications, including vasospasm, are more common with pedal access compared with groin access.³

Achieving successful pedal access can be more technically challenging than groin access due to smaller caliber vessels and anatomic variation in the pedal vasculature. Further research may be necessary to clarify the procedure time, fluoroscopy time, and radiation exposure of groin versus pedal access, although both approaches have similar efficacy rates in the treatment of knee OA.³

While these case reports provide important initial data on efficacy and safety, further investigation with a larger sample size is necessary to fully evaluate the advantages of pedal access for GAE in patients who are unable to undergo groin access.

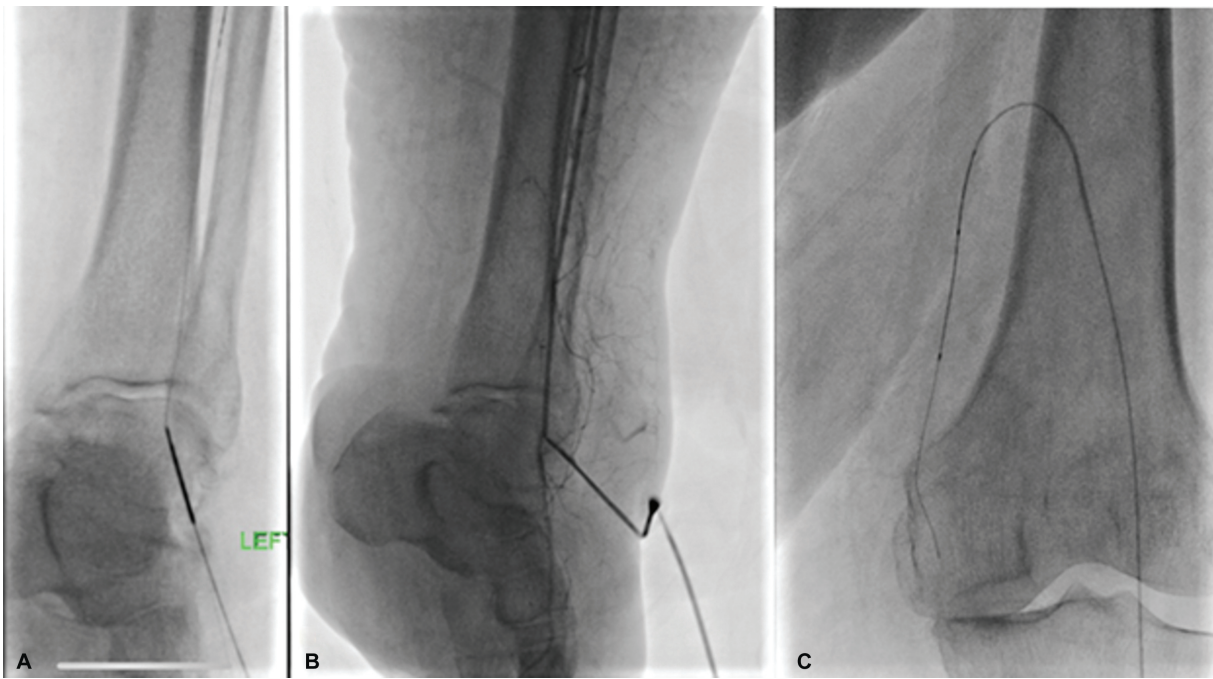


Fig. 3 (A) Fluoroscopic spot images during geniculate artery embolization demonstrate 21-gauge needle access into the dorsalis pedis artery with an 0.018 inch wire advanced into the anterior tibial artery. (B) A 5-Fr Glidesheath Slender (Terumo, Somerset, NJ, United States) was placed over the 0.018 inch wire with the tip positioned in the distal anterior tibial artery. (C) Contrast was injected confirming patency of the dorsalis pedis artery. Through the sheath, a 4-Fr Kumpe catheter (Angiodynamics, Latham, NY, United States) was positioned in the origin of the descending geniculate artery, through which a 2.0-Fr Progreat catheter (Terumo) was used to catheterize the distal aspect of the descending genicular artery.

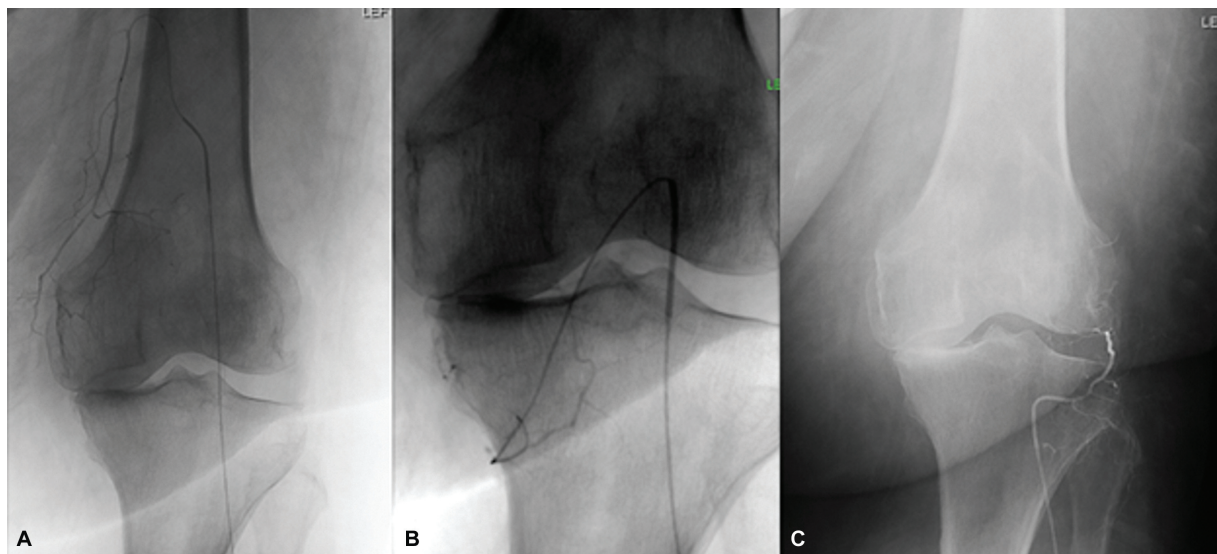


Fig. 4 Super-selected angiographies of the (A) descending genicular artery, (B) inferior medial genicular artery, and (C) inferior lateral genicular artery, which demonstrates anastomotic communication to terminal branches of the superior medial genicular artery.

Conclusion

Pedal access for GAE is a feasible second-line access point for patients with challenging anatomy or significant comorbidities (obesity, proximal atherosclerosis) that make groin access impractical. The two cases presented highlight the potential for pedal access to achieve similar clinical improvement in

knee function and pain relief for OA as with groin access. More research with larger patient populations is necessary to confirm these promising findings.

Funding

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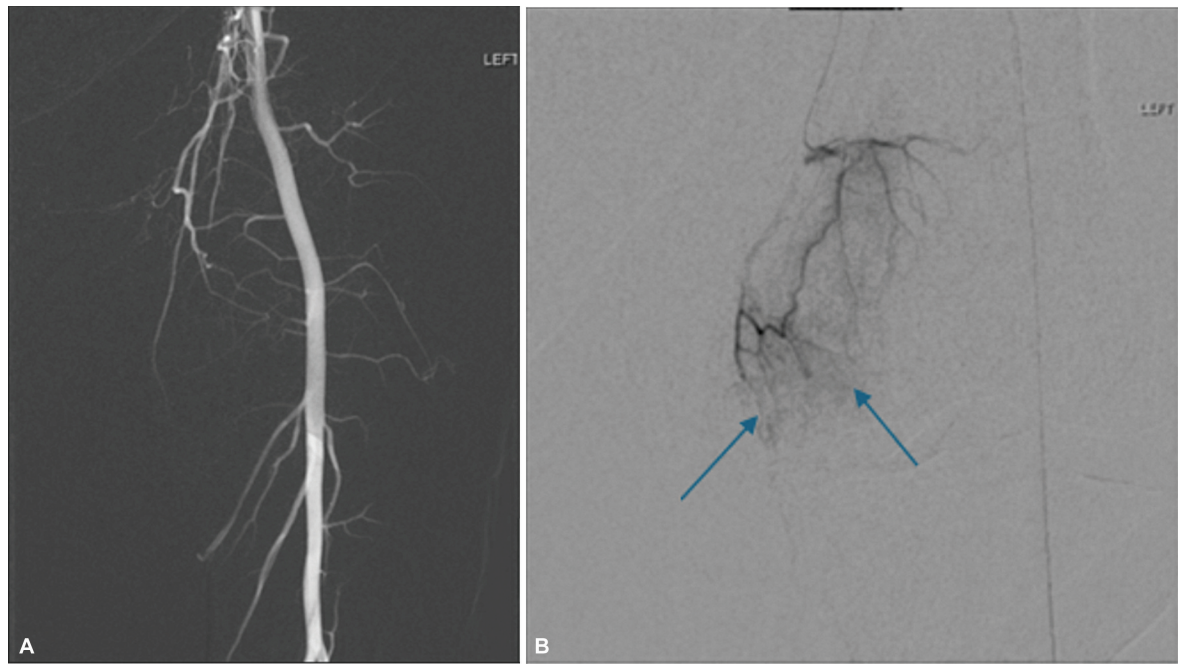


Fig. 5 (A) Negative digital subtraction angiography (DSA) of the superficial femoral artery, including genicular artery branches. (B) DSA of the descending genicular artery demonstrates synovial hyperemia.

Conflict of Interest

None declared.

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