

Embolization of genicular arteries for the treatment of inflamatory osteoarthritis of the knee. A case report

Embolización de arterias geniculares para el tratamiento de osteoartritis inflamatoria de rodilla. Presentación de un caso

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Summary
Geniculate artery embolization is a minimally invasive endovascular intervention that has recently been implemented as a therapeutic option for knee osteoarthritis in patients who do not show improvement with medical treatment and who do not benefit from invasive surgery. The therapeutic aim is to stop the inflammatory cycle that promotes angiogenesis associated with osteoarthritis. A clinical case of a patient with varus deformity associated with significant osteoarthritis of the left knee refractory to conservative medical management who underwent successful selective embolization of geniculate arteries for pain reduction is presented.

Resumen
La embolización selectiva de las arterias geniculares es una intervención endovascular mínimamente invasiva que se ha implementado recientemente como opción terapéutica para la osteoartritis inflamatoria leve a moderada de rodilla en pacientes que no mejoran con tratamiento médico conservador y no se benefician de cirugía invasiva. El objetivo terapéutico es detener el ciclo inflamatorio que favorece la neovascularización asociado a osteoartritis. Se presenta el caso clínico de una paciente con deformidad en varo y osteoartritis significativa de la rodilla izquierda refractaria a manejo médico conservador, a quien se le realizó embolización selectiva de arterias geniculares con el fin de disminuir el dolor.

Introduction

Osteoarthritis is the leading cause of chronic pain and disability in older adults, and the knee is the joint most commonly affected, reaching figures of up to 80% (1). The management of osteoarthritis has been based on two pillars: conservative therapy and surgical management. Conservative therapy consists of education, physical therapy, and pharmacological treatment with anti-inflammatory drugs (2). Invasive management consists of knee replacement surgery and is used in patients with advanced osteoarthritis (1). Patients with moderate osteoarthritis who are not candidates for surgery but remain symptomatic despite conservative management represent a therapeutic challenge (3). Recently, a new treatment has gained importance that consists of selective embolization of areas of periarticular neovascularization generated by the inflammatory cascade in osteoarthritis (4).

It is essential to understand the inflammatory mechanisms that lead to osteoarthritis in order to comprehend the therapeutic objectives of genicular artery embolization. Osteoarthritis develops due to excessive and prolonged stress on the joint, which causes cartilage degradation. Associated with this is the release of inflammatory mediators and factors that promote neovascularization of the adjacent tissue. This cycle results in the growth of vascular networks and inflammatory mediators that generate neoinnervation, angiogenesis, synovial hypertrophy, and cartilage destruction. The therapeutic goal is to selectively stop hyperemia in the joint in order to reduce the cascade of inflammatory mediators and improve pain (1, 5, 6).

The procedure consists of performing a selective arteriography of the affected limb to identify the genicular arteries and the areas of greatest periarticular hyperemia. Subsequently, each artery is selectively catheterized with a microcatheter and embolic material is administered into the neovascularization branches until occlusion of the pathological vascular network is achieved (1). Although it is a safe procedure, it is not recommended in patients with infrapopliteal occlusive peripheral arterial disease, as they are at greater risk of atheroembolic complications and occlusion of the vascular flow necessary for distal compensatory irrigation of the leg and foot (7).

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Clinical case

We present the case of a 66-year-old female patient with bilateral knee pain. The X-ray showed bilateral grade II-III osteoarthritis, according to the Kellgren-Lawrence scale (8), with decreased femorotibial joint space and sclerotic edges. Multiple therapeutic attempts were made with cycles of anti-inflammatory drugs and physical therapy over two years, with no improvement during this period. Due to therapeutic failure, treatment with selective endovascular embolization of the genicular arteries of the left knee was indicated.

The procedure was performed with local anesthesia infiltration in the right inguinal region. The common femoral artery was punctured under ultrasound guidance with 5Fr micropuncture equipment (Cook), and a 5Fr × 11 cm Super Sheath® vascular introducer (Boston Scientific), a 0.035 mm × 150 cm angled radiofocus hydrophilic exchange guidewire (Terumo), a universal guidewire rotator (Merit Medical), a 5Fr × 65 cm Glidecath Cobra® diagnostic catheter (Terumo), and a 5Fr × 100 cm Glidecath Non-Taper (DAV)® diagnostic catheter (Terumo) to selectively catheterize the left lower limb.

A selective arteriography of the left lower limb with intravascular contrast medium revealed adequate patency of the superficial femoral artery, the femoropopliteal axis, and the three infrapopliteal vessels, with no areas of stenosis or dilation. Vascular hyperemia was identified at the expense of the superolateral, inferolateral, and superomedial genicular arteries at the level of the left knee (Figure 1).

A 6Fr × 45 cm vascular introducer (Destination Terumo) was exchanged over a Magic Torque® 0.035 × 260 cm high-support peripheral metal guidewire (Boston Scientific), and the genicular arteries causing the knee hyperemia were then selectively catheterized. Using a high-flow Progreat® microcatheter (Terumo) microcatheter and 300-micron microspheres (Embosoft Scitech), selective embolization was performed with total occlusion of the superomedial genicular artery (Figure 2), superolateral genicular artery (Figure 3), and inferolateral genicular artery (Figure 4), with adequate exclusion in subsequent controls. The patient tolerated the procedure well. On physical examination, the puncture site showed no infection, hematoma, or edema, and there were no skin abnormalities.

At the two-week clinical follow-up, the patient reported subjective improvement in pain and was able to climb stairs and walk without limitations. She was satisfied with the procedure and there were no late adverse effects.

Discussion

Selective embolization of neovascularization originating from the genicular arteries is a recent therapeutic option for the management of osteoarthritis that has shown promising results. In the first study published in 2014, Okuno et al. (9) observed significant improvement in pain after embolization of areas with neovascularization in all patients with periarticular hypervascularization of the knee.

Increased interest in recent years has led to an expansion of the literature with favorable results, documenting high rates of improvement with genicular artery embolization. In a study conducted by Padia et al. (3), they found that 68% of patients showed a 50% improvement in pain at 12 months. In the United Kingdom, in 2021, the "Genesis" study, involving 60 patients with osteoarthritis, found similar results, demonstrating a statistically significant improvement in pain (10). In 2023, Taslakian et al. conducted a systematic review of the efficacy of this procedure. They found that it was successful in 99.7% of patients, with few adverse effects and complications. There was a significant improvement in pain scales in all studies (VAS and WOMAC) (5).

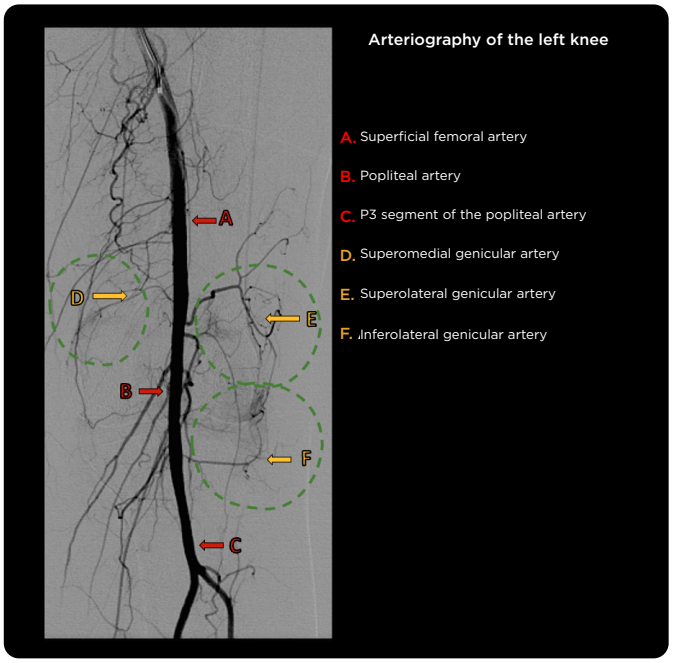


Figure 1. Selective arteriography of the left knee in a patient with osteoarthritis. Adequate patency of the superficial femoral and popliteal arteries and tibiofibular trunk. Hyperemia and periarticular neovascularization process as a result of chronic inflammation in the knee affecting the superolateral, inferolateral, and superomedial genicular arteries (green circles represent areas of hyperemia).

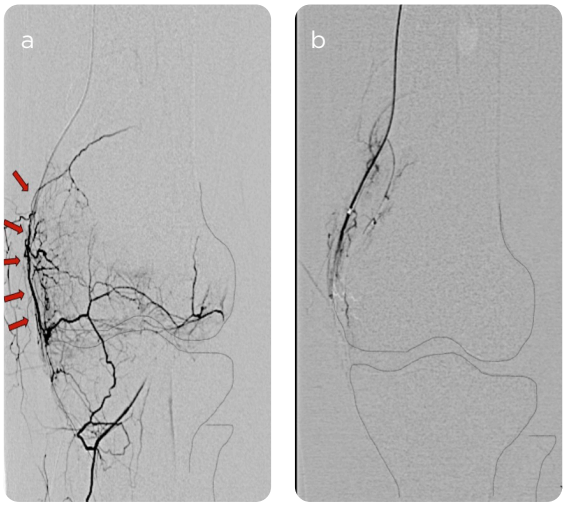


Figure 2. a) Hyperemia and neovascularization in the periarticular tissue of the left knee (red arrows) showing angiogenesis nourished by the superomedial genicular artery prior to selective embolization. b) Arteriography after selective embolization: decrease in hyperemia and adequate exclusion of newly formed vessels.



Figure 3. Arteriography of the superolateral genicular artery before and after selective embolization with 300-micron microspheres (Embosoft Scitech). a) Hyperemia and neovascularization originating from the superolateral genicular artery in the left knee (red arrows). b) Image after selective embolization: embolization of the area of hyperemia contributing to osteoarthritis.

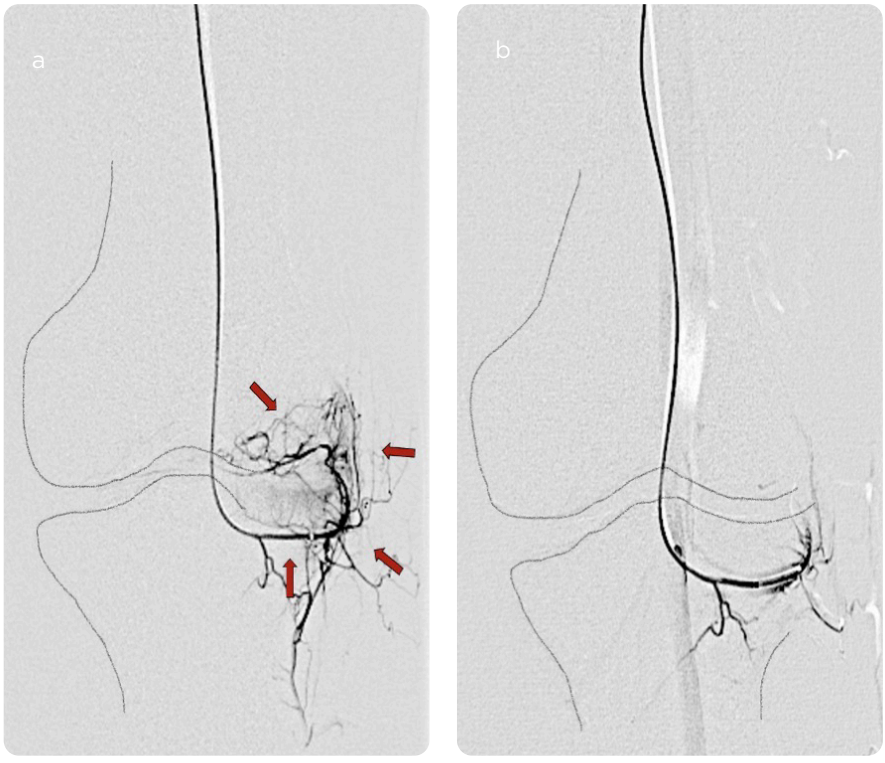


Figure 4. Arteriography of the inferolateral genicular artery before and after selective embolization with 300-micron microspheres (Embosoft Scitech). a) Increased vascularization in the lateral periarticular soft tissues (red arrows), hyperemia originating from the inferolateral genicular artery. b) Image after selective embolization of the inferolateral genicular artery: reduction of the abnormal vascular network in this region.

In Colombia, scientific evidence for this technique is scarce; there is no literature on the subject to date. In the experience of the authors of this article, selective embolization of the genicular arteries in a patient with significant osteoarthritis of the left knee had excellent results, improving the chronic pain reported by the patient and allowing greater activity and mobility of the knee. There were no immediate complications during the procedure, and subjective improvement in pain was observed during follow-up. This revolutionary therapeutic option has been shown to have a beneficial effect on the hyperemic pathophysiology of osteoarthritis, demonstrating the potential benefits of selective embolization of the genicular arteries.

Conclusion

Selective embolization of the genicular arteries for the treatment of moderate osteoarthritis is a safe and minimally invasive therapeutic option that has been shown to be effective in recent literature worldwide. We present the case of a patient with osteoarthritis who underwent selective embolization with improvement at short-term follow-up. This report adds to the growing evidence of the potential of this procedure.

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