Pretibial Ganglion Cyst Secondary to Anterior Cruciate Ligament Reconstruction and Its Conservative Management: A Two-Case Report

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ABSTRACT

Introduction: We present two cases of pretibial ganglion cyst, an uncommon postoperative complication after arthroscopic anterior cruciate ligament (ACL) reconstruction. In both cases, hamstring autografts and biodegradable interference screws were used for fixation. We discuss the rarity and multifactorial etiology of this complication, including fixation material and graft micromotion. Both conservative (aspiration) and surgical (curettage and bone grafting) treatment options are reviewed; however, surgery appears to be more effective in preventing recurrence. The choice of fixation material is highlighted as a key preventive factor. **Conclusion:** Management should be individualized, and close follow-up is essential.

Keywords: Cyst; pretibial ganglion; anterior cruciate ligament.
Level of Evidence: IV

Ganglión pretibial secundario a la reconstrucción del ligamento cruzado anterior y su tratamiento conservador. Reporte de dos casos

RESUMEN

Se presentan dos casos clínicos de ganglión pretibial, una complicación posoperatoria infrecuente tras la reconstrucción artroscópica del ligamento cruzado anterior; en ambos casos, se recurrió a un injerto de isquiotibiales y la fijación con tornillos interferenciales biodegradables. Se analizan la rareza y la etiología multifactorial de esta complicación, inclusive el material de fijación y la micromovilidad del injerto. Se exploran las opciones de tratamiento conservador (punción) y quirúrgico (curetaje y relleno). La cirugía parece más efectiva para prevenir las recurrencias. La elección del material de fijación se subraya como un factor preventivo crucial. **Conclusión:** El manejo debe ser individualizado y el seguimiento continuo es fundamental.

Palabras clave: Quiste; ganglión pretibial; ligamento cruzado anterior.
Nivel de Evidencia: IV

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is one of the most commonly performed procedures in knee surgery. With the evolution and variety of available surgical techniques and fixation materials, it has become a safer option with a high rate of favorable outcomes, leading to its increasing use. However, no surgical technique is free from complications. The most common postoperative complications associated with this procedure include pain, hemarthrosis, infection, deep vein thrombosis, arthrofibrosis, and saphenous neuropathy,[1-4] whereas less frequent complications include pretibial ganglion cyst and pigmented villonodular synovitis, among others.[5–13]

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We present two patients who underwent arthroscopic ACL reconstruction at different institutions and at different times and subsequently developed pretibial ganglion cysts as a complication. As previously mentioned, this is a rare complication that may occur even several years after surgery,[14] and multiple etiologies have been proposed.[15]

CLINICAL CASE 1

A 17-year-old female tennis player had undergone right ACL reconstruction using an autologous hamstring graft (semitendinosus-gracilis), fixed with a biodegradable interference screw in the tibial tunnel, in June 2022, and right meniscal allograft transplantation in August 2023. She also tended to develop keloids.

In July 2024, she presented with swelling near the surgical scar over the tibial tunnel that did not interfere with her athletic performance. She denied previous trauma.

On physical examination, a well-defined soft mass measuring approximately 2–3 cm was observed. It was painless, with no inflammatory signs. Keloid scars corresponding to previous arthroscopic portals were also noted, for which she was receiving dermatologic treatment (Figure 1). Magnetic resonance imaging showed an intact graft and preserved tibial tunnel, with no signs of local infection (Figure 2).

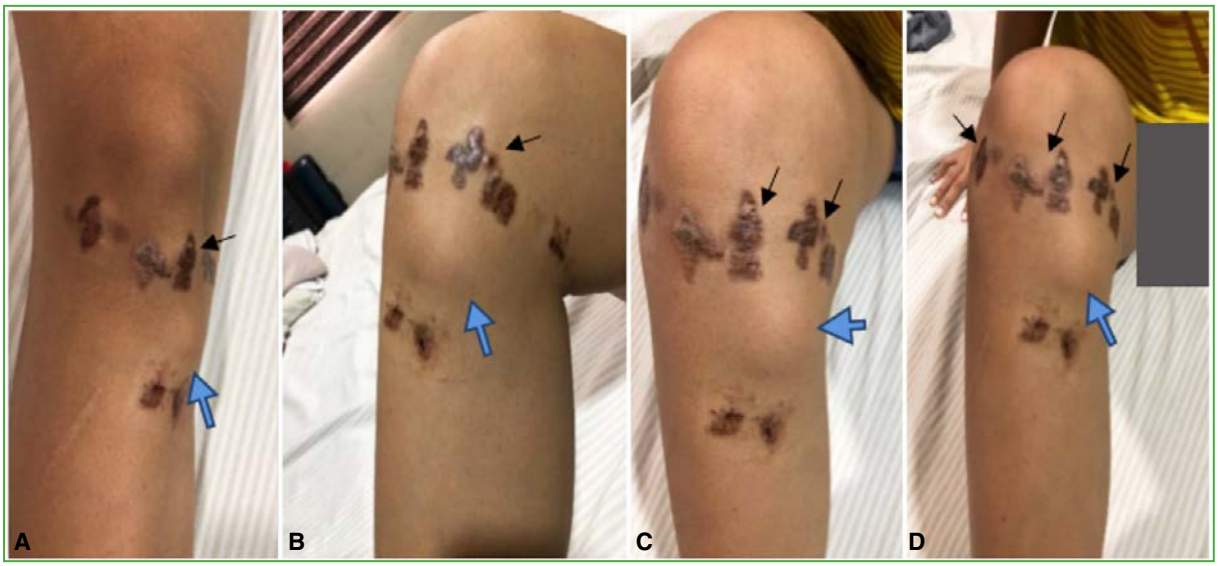

Figure 1. Anteroposterior (**A**), lateral (**B**), and oblique (**C and D**) views of the right knee. Swelling is observed in the anteromedial region of the knee at the tibial metaphysis (large arrows). The patient also presents keloid scars (small arrows) corresponding to previous arthroscopic portals, which were undergoing dermatologic treatment at the time the images were obtained.

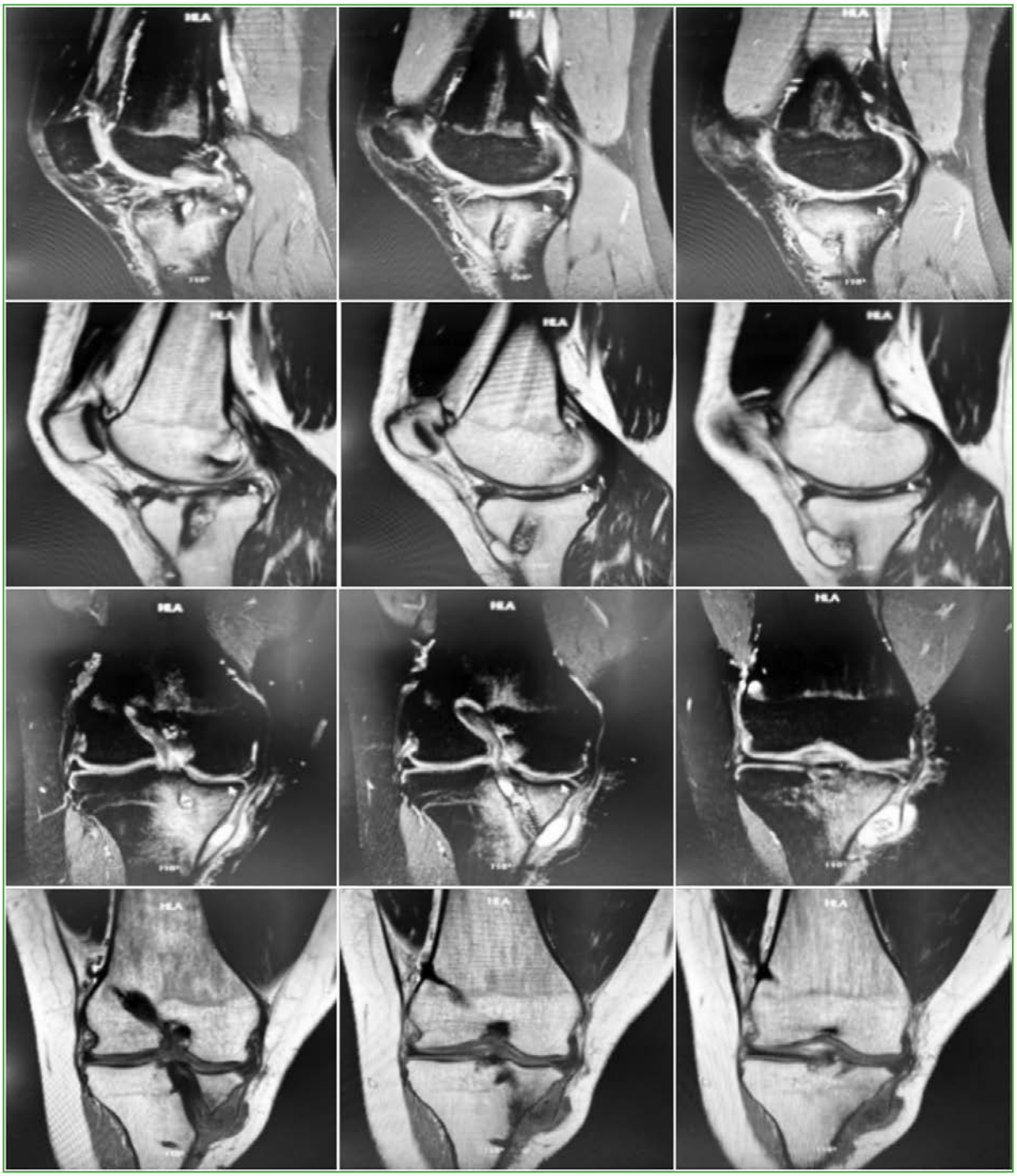

Figure 2. Magnetic resonance imaging of the right knee, sagittal and coronal T1-weighted and T2-weighted sequences, showing continuity of the graft along its course and preservation of its proximal and distal insertions, together with an anteromedial pretibial cystic mass and bone marrow edema around the tibial tunnel.

Surgical excision and biopsy of the ganglion cyst were proposed; however, the patient stated that she did not wish to undergo another procedure, having already had two surgeries in the previous two years. With her consent, ultrasound-guided aspiration of the pretibial ganglion cyst was performed in the outpatient clinic under sterile conditions (Figure 3). Clear, viscous fluid was aspirated (Figure 4). An elastic compressive dressing was then applied and indicated for 23 hours per day, and the patient was instructed regarding warning signs.

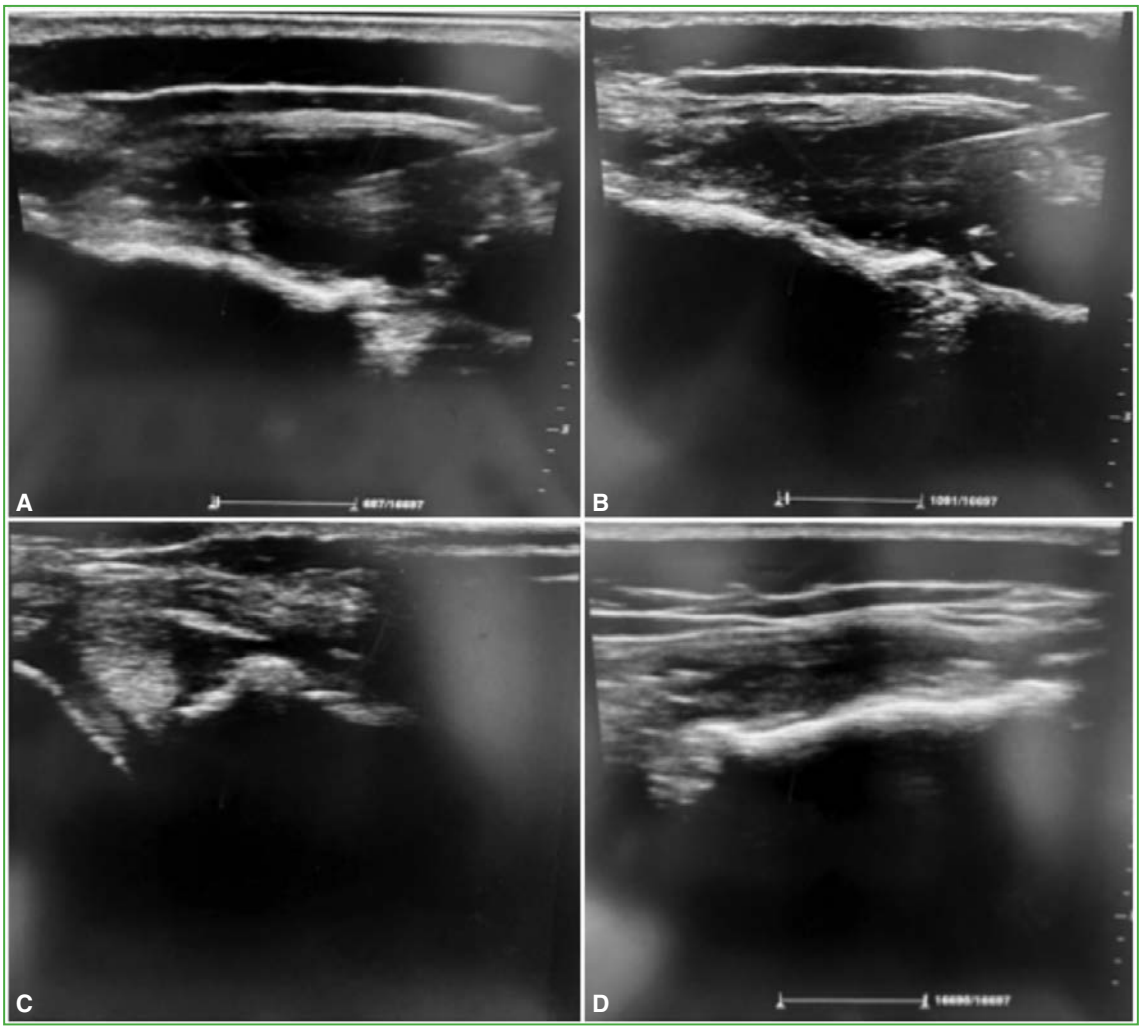

Figure 3. A and B. Ultrasound-guided aspiration and drainage of the pretibial ganglion cyst in the anteromedial region. **C and D.** Appearance after aspiration and drainage.

Figure 4. Clear, viscous fluid obtained during ultrasound-guided aspiration and drainage of the pretibial ganglion cyst.

At the two-month follow-up, the swelling had markedly decreased (Figure 5).

Figure 5. Case 1. Follow-up at 2 months after ultrasound-guided aspiration and drainage, showing marked reduction of swelling (blue arrow).

The patient returned one year after treatment and reported that she had not attended further follow-up visits because of symptomatic improvement and complete return to sports activity. Physical examination showed no relevant findings (Figure 6). During the visit, ultrasound examination of the anteromedial aspect of the proximal tibia revealed a small, collapsible hypoechoic image corresponding to the pretibial ganglion cyst capsule. The transplanted medial meniscus was also evaluated, with no pathological findings detected (Figure 7).

Figure 6. Case 1. Follow-up at 1 year after ultrasound-guided aspiration and drainage. Surgical scars from previous procedures are visible. The patient is asymptomatic.

Figure 7. Ultrasound of the right knee, over the anteromedial region of the proximal tibia showing a hypoechoic, collapsible image, identified as the pretibial ganglion cyst (**A and B**). The transplanted medial meniscus was also evaluated, with no pathological findings (**C**).

CLINICAL CASE 2

A 41-year-old man employed by an electrical utility company had undergone arthroscopic right ACL reconstruction in 2017 using a double-bundle hamstring autograft (semitendinosus-gracilis), fixed with a biodegradable interference screw in the tibial tunnel.

One week after surgery, a soft mass developed over the anteromedial proximal region of the right tibia. Magnetic resonance imaging and ultrasound confirmed the presence of a cystic lesion related to the tibial tunnel exit site (Figures 8 and 9). Ultrasound-guided aspiration and drainage were performed under sterile conditions in the preoperative area, obtaining clear fluid (Figure 10). An elastic compressive dressing was immediately applied. Its use was indicated for 23 hours per day for 2 months, followed by physical therapy beginning 2 months after the procedure. Follow-up continued for one year, with no recurrence.

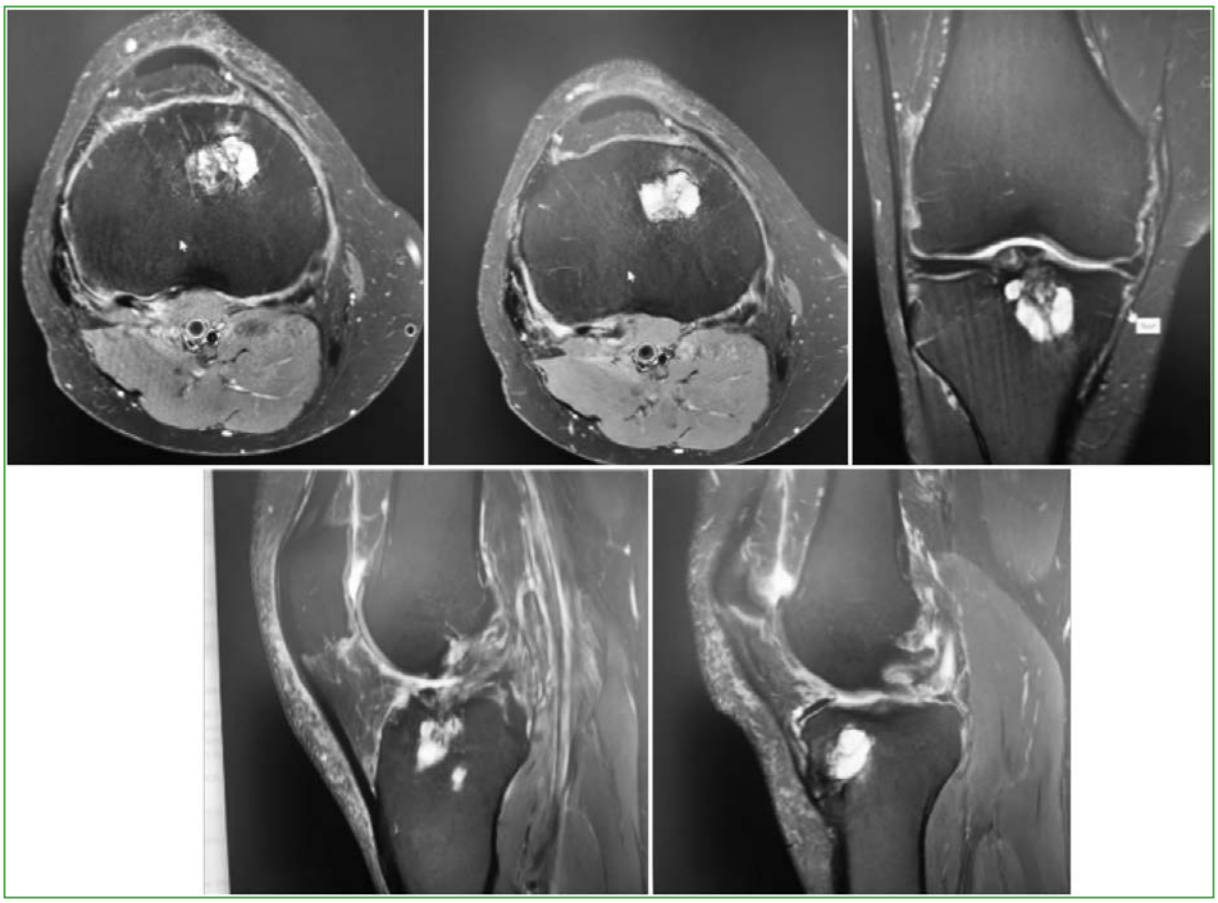

Figure 8. Magnetic resonance imaging of the right knee, axial and sagittal T2-weighted sequences, showing continuity of the graft along its course and preservation of its proximal and distal insertions, together with an anteromedial pretibial and intraosseous tibial cystic mass, as well as bone marrow edema around the tibial tunnel.

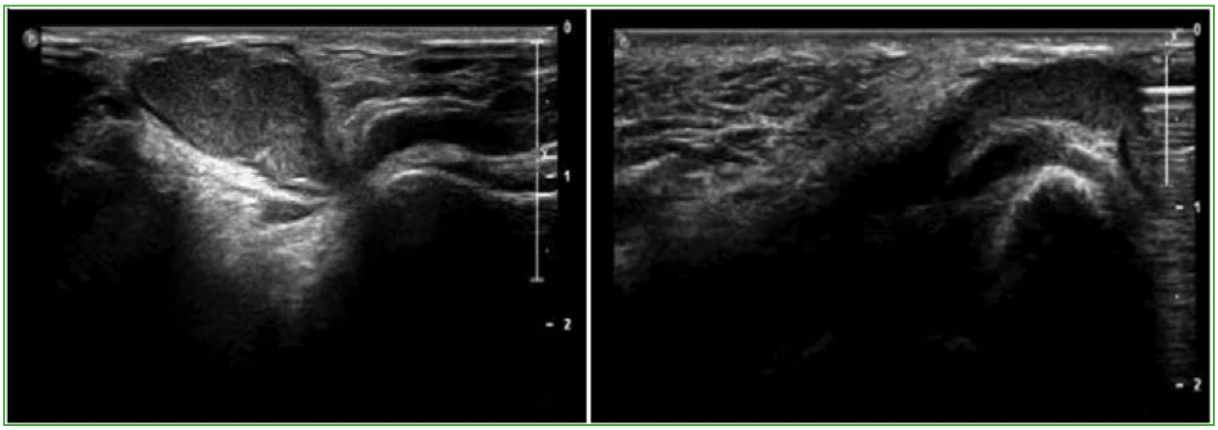

Figure 9. Ultrasound-guided aspiration and drainage of the pretibial ganglion cyst in the anteromedial region.

Figure 10. Clear, viscous fluid obtained during ultrasound-guided aspiration and drainage of the pretibial ganglion cyst.

Both patients developed a palpable soft mass located in the anteromedial proximal pretibial region, measuring approximately 2-3 cm in diameter, without signs of local infection or instability of the operated knee.

In the first case (17-year-old woman), the mass developed approximately two years after ACL reconstruction. Surgical treatment was proposed but declined because she had undergone two surgeries in the previous two years. Therefore, ultrasound-guided aspiration of the pretibial ganglion cyst was performed, followed by compressive bandaging, nonsteroidal anti-inflammatory drugs, temporary cessation of sports activity, and physical therapy. At two months, the reduction in lesion size was maintained, without recurrence (Figure 5). At the one-year follow-up, she reported being asymptomatic and having resumed her usual sports activity, which was the reason she had not returned for interim visits. She denied recurrence. Ultrasound examination demonstrated a small painless hypoechoic collapsible image corresponding to a residual pretibial ganglion cyst capsule (Figures 6 and 7).

In the second case (41-year-old man), pretibial swelling developed within days of arthroscopic surgery. Magnetic resonance imaging and ultrasound demonstrated a fluid-filled cystic pretibial lesion consistent with a ganglion cyst. Immediate aspiration of the pretibial ganglion cyst was performed (Figures 8-10), followed by strict compressive bandaging. Physical therapy began at two months, and serial follow-up was continued for one year. No recurrence occurred. The patient regained full painless range of motion and returned to his usual daily activities.

DISCUSSION

The development of pretibial ganglion cysts after ACL reconstruction is a relatively uncommon but clinically relevant complication. According to the review by Barbosa et al.,[8] these cysts may present with a wide range of symptoms, from painless swelling without functional impairment to limitation of range of motion. The estimated incidence ranges from 0.28% to 3.9%.[8,16,17]

Current evidence suggests a multifactorial etiology influenced by patient-related factors, fixation materials, surgical technique, and biological response.[8,15,18] Barbosa et al. reported that in approximately 44% of the publications included in their review (representing 84.56% of reported cases), pretibial cysts developed in the presence of bioabsorbable materials within the tibial tunnel, ranging from biodegradable screws to sutures, with predominance of poly-L-lactic acid (PLLA) interference screws. Only 11 studies (11.44% of reported cases) described cyst formation associated with nonabsorbable fixation devices.

In addition, 21% of the included studies reported associated factors such as tendon necrosis, inflammatory reaction to sutures, allograft use, infection, and graft micromotion. In the same review, magnetic resonance imaging demonstrated communication between the joint and the tibial tunnel in 14% of 93 patients.[8] However, these publications do not specify the time elapsed between identification of tunnel communication and cyst development.

Two meta-analyses[17,19] comparing bioabsorbable and metallic interference screws for ACL reconstruction found no significant differences in postoperative stability or recovery of joint function. However, both studies reported a higher frequency of joint effusion and tibial tunnel widening with bioabsorbable materials compared with metallic interference screws.

Although the mechanism underlying formation of these lesions remains unclear, a major contributing factor appears to be the use of biodegradable interference screws, particularly PLLA screws. Long-term follow-up studies evaluating these implants have shown a longer-than-expected resorption period, ranging from 7 to 10 years.[18,20] These authors suggest that such implants may induce a chronic inflammatory foreign-body reaction, thereby increasing the risk of pretibial cyst formation.[8,14,21]

Less commonly, this complication has also been reported in the presence of nonabsorbable fixation devices, where it has been associated with possible graft micromotion within the tunnel leading to a similar reaction.[8,22]

In one of the patients described here, the pretibial cyst developed approximately 2 years after surgery, whereas in the other, it appeared within days of the procedure. Most pretibial ganglion cysts reported after ACL reconstruction develop around 2 years postoperatively and, less frequently, after 5-7 years. In the second case, this short interval makes a chronic foreign-body inflammatory reaction less likely; communication with synovial fluid may reasonably be suspected as a facilitating factor, despite the absence of this finding on imaging studies.

In most published reports, pretibial ganglion cysts after ACL reconstruction have been managed surgically, either through an open or arthroscopic approach. Management generally consists of cyst excision and tunnel curettage, with removal of residual material from the primary procedure. Tunnel filling with autologous bone graft, allograft, or osteoconductive substitutes such as calcium hydroxyapatite has frequently been reported,[8,9,14,15,20,23,24] and the use of bone cement has also been described,[25] all with the aim of reducing recurrence. Among the reviews including the largest number of cases, the estimated recurrence rate ranges from 3% to 7.7%.[8,15,25] Two patients (of a total of six) were treated with excision and curettage alone.

Yacuzzi et al. and Munguina et al. reported patients initially treated with needle aspiration of the lesion without success, who subsequently underwent screw removal, curettage, and tunnel filling, achieving resolution.[15,25]

Recurrence of these cysts is not clearly characterized in the literature because this complication is uncommon (1.88%–14.28%).[8,15,20] Some studies suggest that when only drainage or cyst excision is performed, without tunnel resection or curettage with bone grafting, recurrence rates may be high.[25]

Complications associated with tibial cysts include recurrence, infection, and, in rare cases, the need for revision ACL reconstruction. Malhan et al.[26] and Ramsingh et al.[27] emphasized the importance of careful selection of fixation materials to minimize these risks. Yonga et al.[14] highlighted the need for long-term follow-up.

In the two cases presented here, pretibial ganglion cysts developed after ACL reconstruction using biodegradable interference screws. Neither patient reported pain nor showed local inflammatory signs other than swelling. Both patients, although treated at different institutions and at different times, underwent conservative management consisting of aspiration and drainage followed by elastic compressive bandaging and anti-inflammatory measures. In the first case, the patient's refusal of surgery justified the choice of a less invasive approach. In the second case, pretibial ganglion cyst developed one week after ACL reconstruction, and conservative treatment proved effective, with no recurrence during follow-up.

We have not identified other published reports describing a similar management strategy for this condition, which makes it difficult to determine with certainty the true recurrence rate associated with this approach. Current evidence suggests that it may provide short-term symptom relief, although with a higher risk of recurrence.

However, we believe that, in selected cases, conservative management with image-guided percutaneous aspiration may represent a valid alternative that does not require hospitalization and is less invasive, particularly in patients without significant functional impairment and with localized symptoms or no clear indication for surgery. Another advantage is that ultrasound is more cost-accessible, making it a particularly useful tool in the outpatient setting.

CONCLUSIONS

There is currently stronger evidence supporting surgical intervention as the safest option for definitive treatment of this complication and prevention of recurrence. However, we believe that in patients without concerning symptoms, aspiration of the lesion may be a reasonable initial management option when combined with appropriate follow-up, particularly given the advantages of avoiding hospitalization and being economically accessible.

The final decision should be based on an individualized assessment of each patient. Ongoing follow-up is essential to ensure favorable long-term outcomes and to address any complications that may arise. Further research is needed to establish best practices for management.

Conflicts of interest: The authors declare no conflicts of interest.

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