ARTHROSCOPICALLY ASSISTED SURGICAL TREATMENT OF A CALCANEAL BONE CYST IN AN ATHLETE

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Abstract—Solitary bone cysts are benign, fluid filled lesions that frequently occur in adolescence. They are treated when there is a fracture, impending fracture, or persistent pain. Treatments range from non-surgical methods such as steroid injection to surgical techniques, including open curettage with bone grafting, percutaneous techniques, or more recently, arthroscopic techniques. We describe a patient who presented with progressive heel pain and tenderness. Imaging was consistent with a bone cyst. Due to the patient's desire to return to athletics as quickly as possible, he underwent percutaneous endoscopic treatment of the calcaneal cyst with cortical and demineralized bone matrix graft. At 12 months follow-up, physical exam and x-ray examination showed that it was well-healed. This treatment is compared with other surgical treatments for calcaneal cysts.

Keywords—unicameral bone cyst, calcaneus, endoscopic treatment

1. Introduction

Solitary bone cysts are benign, fluid-filled lesions that can occur in the calcaneus. If surgical treatment is necessary, they are most often treated with open surgery with curettage and autologous grafting or bioceramic filling.[6, 10] We report on a unicameral bone cyst (UBC) that was treated using curettage and grafting arthroscopically.

Figure 1: Preoperative x-ray demonstrating the calcaneal lesion Figure 2: Preoperative CT demonstrating calcaneal lesion

2. Case Description

An 18-year-old male collegiate football player presented with progressive heel pain for the past several months. There was tenderness to deep palpation in the posterior plantar hindfoot. Sensory and motor exams revealed no deficits. X-rays showed a 3.3 cm x 3.0 cm radiolucent cystic lesion in the right calcaneus (Figure 1), computerized tomography scan and technetium bone scan suggested a possible pathologic fracture (Figure 2), and magnetic resonance image confirmed a cystic structure with low T1 and high signal T2 intensity with homogenous intensity (Figure 3, 4). Both operative and non-operative options were discussed with the patient and his family. Due to progressive symptoms and a desire to return to athletics in the shortest period of time, the patient agreed to arthroscopic surgical treatment with open curettage if necessary.

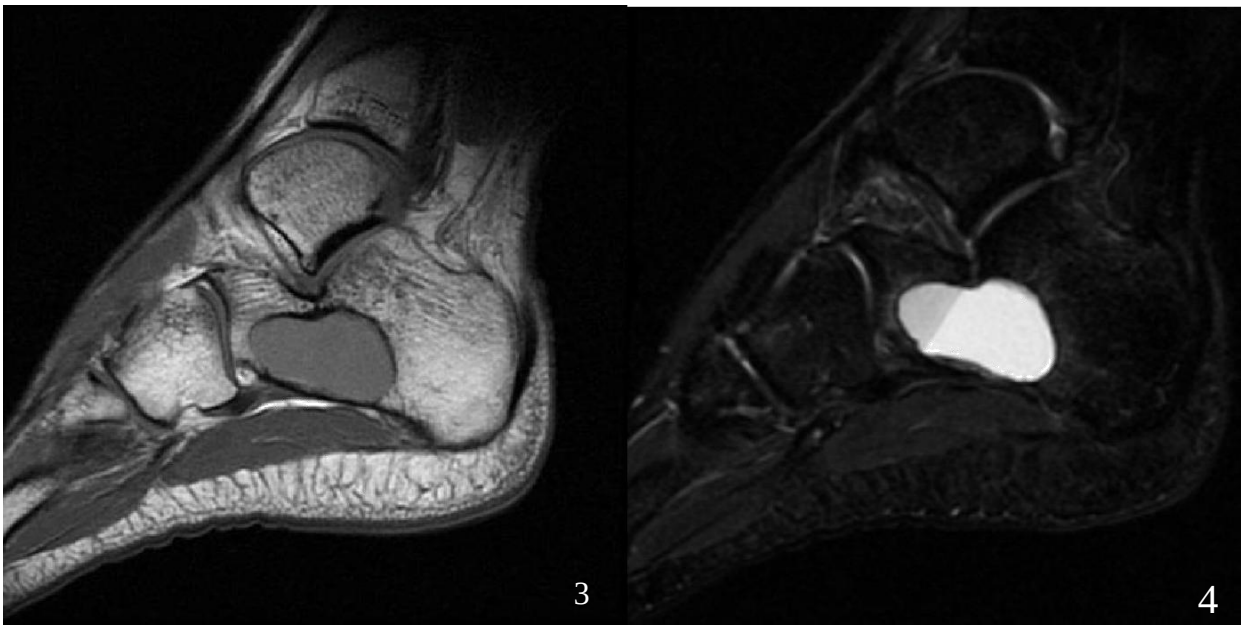
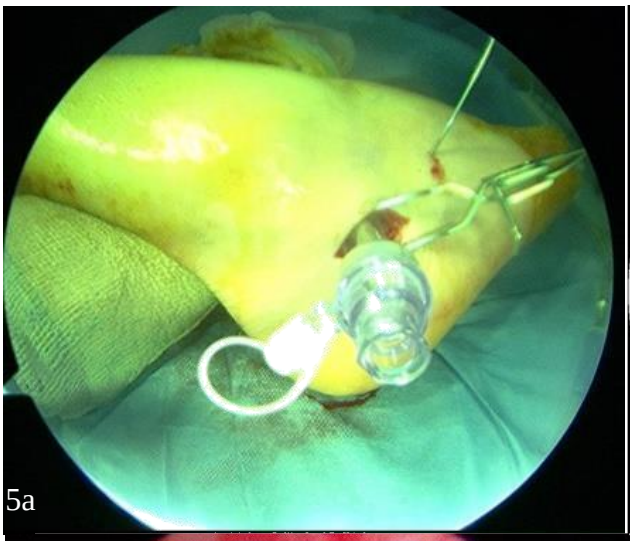


Figure 3: Preoperative T1-Weighted MRI
Figure 4: T2-Weighted MRI. Note fluid level

Following normal preparation, the lesion was localized under fluoroscopy and an incision was made just distal to the tip of the fibula. (Figure 5a) The peroneal tendons were identified and protected, and a spinal needle was inserted. Clear fluid was noted and pressure measurement was consistent with a simple cyst. Contrast was injected showing a unicameral space (Figure 5b).

Biopsy was performed using a trephine and intraoperative pathology confirmed the lesion was a UBC. The cavity was sequentially curetted using the arthroscope and a second portal for visualization (Figure 5c). Using fluoroscopic guidance, it was meticulously debrided with arthroscopic curettes and pituitary rongeurs before being lavaged with multiple liters of fluid. Bleeding cancellous surfaces were noted throughout the bone cavity (Figure 5d), then the cavity was packed with morselized cortical cancellous graft and demineralized bone allograft. (Figure 5e) At 12 months follow-up, physical exam and x-ray examination showed that it was well-healed. (Figure 6)



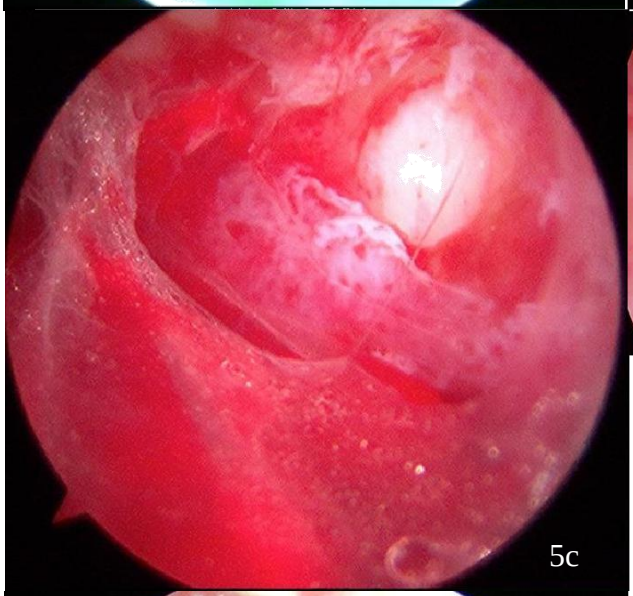


Figure 5a: Image depicting trocar entry point

Figure 5b: Fluoroscopic image with contrast showing the unicameral space

Figure 5c: Endoscopic image of the cyst. Note the lining.

Figure 5d: Cyst cavity after curettage. Note bleeding cancellous surfaces

Figure 5e: Cyst cavity filled with bone graft

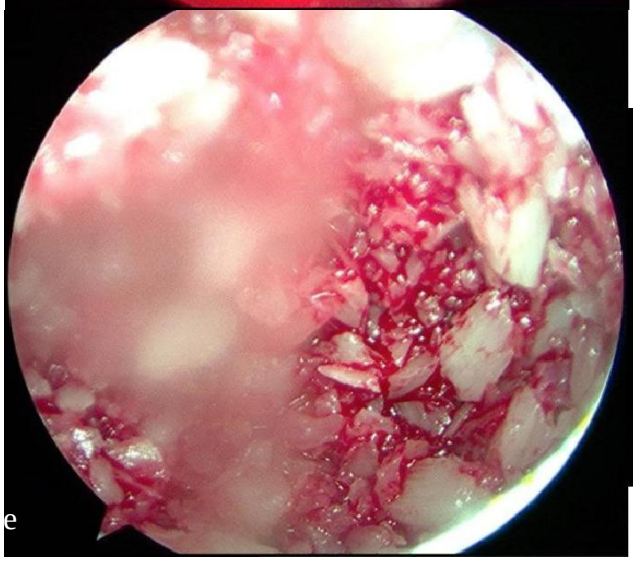


Figure 6: Post-operative x-ray at 8 months demonstrating good healing

3. Discussion

Approximately 3% of all bone tumors are UBCs,[10] with few of these occurring in the calcaneus.[6] These lesions typically occur in children and adolescents and are about twice as common in males than females. They are thought to be a pathologic response to bone trauma or as a result of a venous obstruction that leads to intramedullary accumulation of interstitial fluid and cavity formation. There are several treatment strategies, including injection, decompression, and combined surgical techniques, though no method is considered superior.[10] These benign lesions are treated surgically when a pathologic fracture is impending, though the threshold for treatment in the calcaneus may be lower since it is weight-bearing bone that is often symptomatic.[6] Open curettage and bone grafting was first described in 1974,[13] and was often used as an ultimate treatment after failed steroid injection, which gained popularity after Scaglietti et al. reported 96% positive result and 60% healing in 1979.[12] These methods were followed by percutaneous techniques such as trephination[14] or injection of demineralized bone matrix[11], which were first considered in 1981 but gained popularity in the 2000s.

To our knowledge, arthroscopic curettage of the calcaneus was first reported in 2005 by Dormans et al.[2] The largest series to date was by Innami et al. and involved 16 patients.[4] Preoperative planning is important to minimize the chance of disrupting the articular surface, especially in a young athlete.[5] Endoscopic techniques are worth investigating in this lesion because UBCs are benign and their treatment does not require a margin. This makes the sacrifice of open visualization in exchange for the benefit of minimizing tissue trauma worthwhile. Though there have been limited published reports, endoscopic procedures appear to be as safe and effective as traditional methods (Table 1). In this case, a minimally invasive surgery with bone graft offered the best combination of minimizing tissue trauma and offering immediate stability to assist in a return to sport.

4. Conclusion

This minimally invasive form of treatment may have advantages over open curettage and warrants further study and consideration.

Table 1

Year - Author	# calcaneal cases (total)	Treatment	Follow up	Complications
1974 Smith[13]	20	Open curettage/steroid injection	3 months-25 yrs	1 curettage has occasional pain
1999 Glaser[3]	12	Open curettage/steroid injection	29 months (12-77)	3 patients fail injections → surgery
2002 Tsuchiya[14]	10 (26)	Percutaneous trephination	29 months	Delayed healing, fracture, recurrence
2002 Abdel-Wanis[1]	12	Percutaneous trephination	91 months	1 titanium screw replacement
2004 Pogoda[8]	50	18% Open, 82% steroid injection	32 months (6-98) surgical patients	
2005 Dormans[2]	3 (28)	Endoscopic	22 months (4-48)	1 suture abscess
2008 Park[7]	23	57% Open, 43% percutaneous	49.4 months (25-128)	4 'healing with defect' from open; 3 'healing with defect' and 2 'persistent cyst'
2008 Polat[9]	36	50% Open, 50% non-op	25 months (6-123)	3 pain, 1 subtalar arthritis
2011 Innami[4]	16 (13 with sufficient follow-up)	Endoscopic	36 months	

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