

Calcaneal Bone Bruise After Surgery for Insertional Achilles Tendinopathy

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Abstract

Objective: Excision of the posterolateral corner of the calcaneus (EPCC) is routinely undertaken in athletes after failure of conservative management of insertional Achilles tendinopathy. Some patients can experience sharp calcaneal pain during postoperative rehabilitation, a sign of a calcaneal bone bruise (CBB). **Design:** Case series, level of evidence IV. **Setting:** University teaching hospital. **Patients:** This study reports 8 patients who developed postoperative CBB after having started impact training too early. **Intervention:** Patients in whom a diagnosis of CBB had been formulated were followed to return-to-play and resolution of bone edema by MRI. **Main Outcome Measures:** Detection of CBB after EPCC. **Results:** After routine EPCC for insertional Achilles tendinopathy, 8 patients presented with sharp pain for a mean 7.1 weeks (median 6 weeks, range 5-11 weeks) before clinical suspicion of CBB. At that stage, MRI showed clear evidence of a bone bruise, with a diagnosis of CBB formulated at an average of 10.8 postoperative weeks (range 6-16 weeks). Calcaneal bone bruise resolved with modified symptom-free loading. Patients returned to play at average on 5.6 months (range 2-9 months) after the diagnosis of postoperative CBB. **Conclusions:** We describe 8 athletes who developed painful CBB following routine EPCC for insertional Achilles tendinopathy after having increased their level of activities too soon after the index procedure. In these patients, the diagnosis of postoperative CBB can be formulated by MRI and more cautious rehabilitation implemented.

Key Words: insertional Achilles tendinopathy, surgical treatment, calcaneal bone bruise, MRI, athletes

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INTRODUCTION

Insertional Achilles tendinopathy is a frequent cause of chronic heel pain in athletes.^{1,2} As part of the process, ossification of enthesial fibrocartilage may lead to the formation of enthesophytes within the insertional portion of the Achilles tendon, with pain and stiffness in that area.² Chronic and disabling symptoms that have been resistant to conservative management can be relieved with excision of the posterolateral corner of the calcaneus (EPCC).³⁻⁵ Postoperatively, patients mobilize in a step-by-step progression.³ Attempts at too early return to sport can however result in sharp pain in the operated calcaneus.

Bone bruises to calcaneus can be seen in MRI after acute axial overloading and may progress to actual calcaneal stress fractures.^{6,7} However, bone bruises can also be associated with a sudden sustained change in activity levels and repetitive

regular stress without acute trauma.⁸⁻¹¹ A bone bruise can present as a subperiosteal hematoma and intraosseous bruising seen on T2-weighted MRI as well as subchondral lesions on T1-weighted MRI images.¹¹ A calcaneal bone bruise (CBB) can be a risk factor for subsequent stress fracture, as submaximal and repetitive calcaneus load results in an imbalance between bone resorption and formation.^{12,13} To the best of our knowledge, no previous reports document the development of CBB after EPCC.

We report 8 athletes who underwent routine EPCC and developed CBB, an atypical adverse event after EPCC. We share our experience in CBB diagnosis and management.

METHODS

This study was approved by the investigational review board of our institution. All patients gave their written informed consent to take part in this study.

In the period 2015 to 2018, we performed an EPCC procedure on a total of 152 patients, in whom the original diagnosis of chronic insertional Achilles tendinopathy was formulated clinically and confirmed by MRI (Figure 1).^{7,8} The clinical diagnosis was formulated when intense pain was elicited when compressing the bony portion of the insertion of the Achilles tendon at its attachment on the medial and lateral calcaneus. In all the 152 patients operated during the above period, including the 8 patients reported in this article, the main body of the Achilles tendon was asymptomatic and presented no swelling, no pain, and no tenderness on palpation.^{15,16} The patients had no other tendon or posterior heel pathologies clinically nor detected at MRI nor noted at

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The authors report no conflicts of interest.

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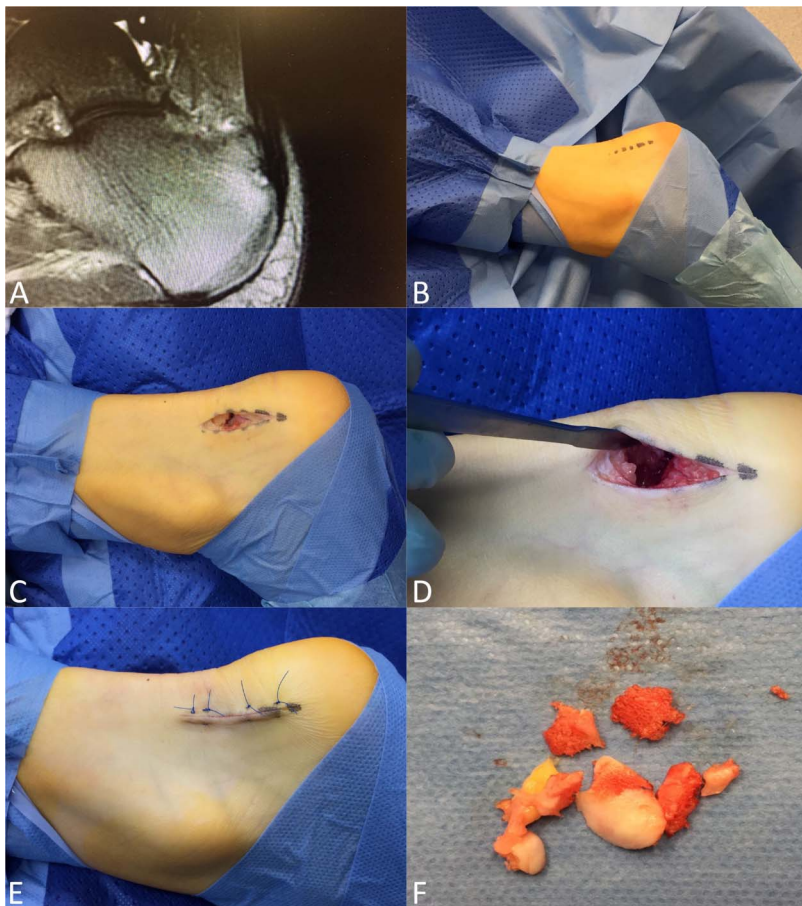


Figure 1. Perioperative images of EPCC using a posterolateral para-Achilles tendon incision: (A) preoperative MRI; (B) marking of the planned skin incision; (C) skin incision and a single longitudinal lateral para-Achilles tendon incision was made, exposing the Achilles tendon insertion; (D) the posterosuperior corner of the calcaneus is visualized and resected that the calcaneal bone did not come into contact with the anterior aspect of the Achilles tendon during dorsiflexion of the ankle; (E) simple mattress sutures for wound closure; and (F) the excised bony parts.

surgery. Also, because the Achilles tendon was not disinserted from the calcaneus, no anchor augmentation was undertaken (more detailed surgical technique showed in Figure 1).

After surgery, a standard postoperative rehabilitation program was implemented (Table 2). Patients were routinely followed at 2 weeks, 8 weeks, and 5 months postoperatively. At these outpatient visits, orthopedic surgeons check gait abnormalities, palpation pain at the area of surgery, pain at calcaneal compression, wound infection, ankle range of motion, and pain at motion of the ankle and subtalar joint.

Of the patients operated, 8 patients (7 men) presented with marked postoperative pain 6 weeks (median; range 5-11 weeks) after the index procedure (Table 1).

Clinically, these patients presented marked tenderness on the medial and/or lateral aspect of the calcaneus on palpation. A routine MRI was taken postoperatively if sharp pain occurred during training (Figure 2). In MRI, a CBB with intraosseous edema and cortex lesions in the posterior facet of the calcaneus near the site of the resected bony tuberosity were seen (Figure 2).

After such findings, protected weight-bearing without immobilization was started. No bony stimulators, vitamin D, or calcium supplements were used. The time to occurrence of sharp postoperative pain, the time to diagnosis, and the time to full activity after surgery are shown in Table 2.

RESULTS

We identified 8 patients with postoperative CBB after EPCC. All were running athletes aged between 17 and 51 years (mean age 35 years) at the time of the index operation. All the athletes reported to have experienced sharp pain at the heel at a mean of 7.1 weeks (range 5-11 weeks) after the index procedure. All patients reported to have become pain-free after the procedure and were fully weight-bearing. All reported to have increased their level of weight-bearing activities and, being pain free, to have introduced impact activities without consulting the operating surgeon. A positive diagnosis of CBB was formulated at a mean of 10.8 weeks (range 6-16 weeks) after the onset of symptoms. In all patients, impact activities were suspended. We implemented a regimen of nonimpact mobilization, with proprioception exercises, core training, cycling, closed chain exercises of the lower limb, and gentle isometric and concentric exercises of the gastro-soleus complex. All 8 patients with postoperative CBB improved with such a conservative management regimen. Overall, 7 patients returned to their preoperative level of activity at an average of 5.6 months (2-9 months) after the diagnosis of CBB, and one patient decided to forgo his professional football career. An MRI taken after returning to pain-free full loading activities showed absence of bone bruise (Figures 2 and 3).

TABLE 1. Postoperative Rehabilitation Protocol After EPCC.
Rehabilitation protocol stages (1-7)
1: Removal of sutures: 10-12 d
2: First 1-2 weeks: Limited weight-bearing, crutches, and elastic bandage with light ankle movements
3: Gradually increasing weight-bearing with crutches, increasing the mechanical stresses imposed on the Achilles tendon and calcaneus following a step-by-step rehabilitation protocol
4: Aqua training after 3 wk
5: Stationary cycling, spinning, and cross-trainer after 4-6 wk
6: After pain-free cycling, proceeding to Alter-G treadmill running and walking
7: Progressive return to sports-specific exercise without pain, usually at 4-6 months from the operation

DISCUSSION

This case series highlights the necessity to be aware of CBB after surgery for insertional Achilles tendinopathy if a sudden onset of sharp pain occurs during postoperative rehabilitation after EPCC. Our patients with CBB recovered fully with simple pain-free weight-bearing restriction without any additional immobilization. We suggest that postoperative CBB should be managed stopping impact activities until pain subsides.

Calcaneal bone bruise typically heals with conservative treatment, consisting of rest and modified activities.¹⁷ Most CBB are located in the posterior facet of the calcaneus, and

our patients experienced CBB close to the area of excision, the site—posterior aspect of the calcaneus—where bone edema could be seen on MRI. In these patients, the onset of CBB is likely related to a too rapid increase of impact loading to the heel area.¹⁸ After ankle or foot surgery, there is usually a period of restricted mobilization that could induce osteopenia.¹⁹ Also, the calcaneus may be temporarily weaker because part of the posterosuperior cortical bone is excised during the index operation. After the procedure,²⁰ we allow our patients limited weight-bearing to avoid the adverse effects of total immobilization, such as ankle joint stiffness, muscle atrophy, and soft tissue swelling.²⁰

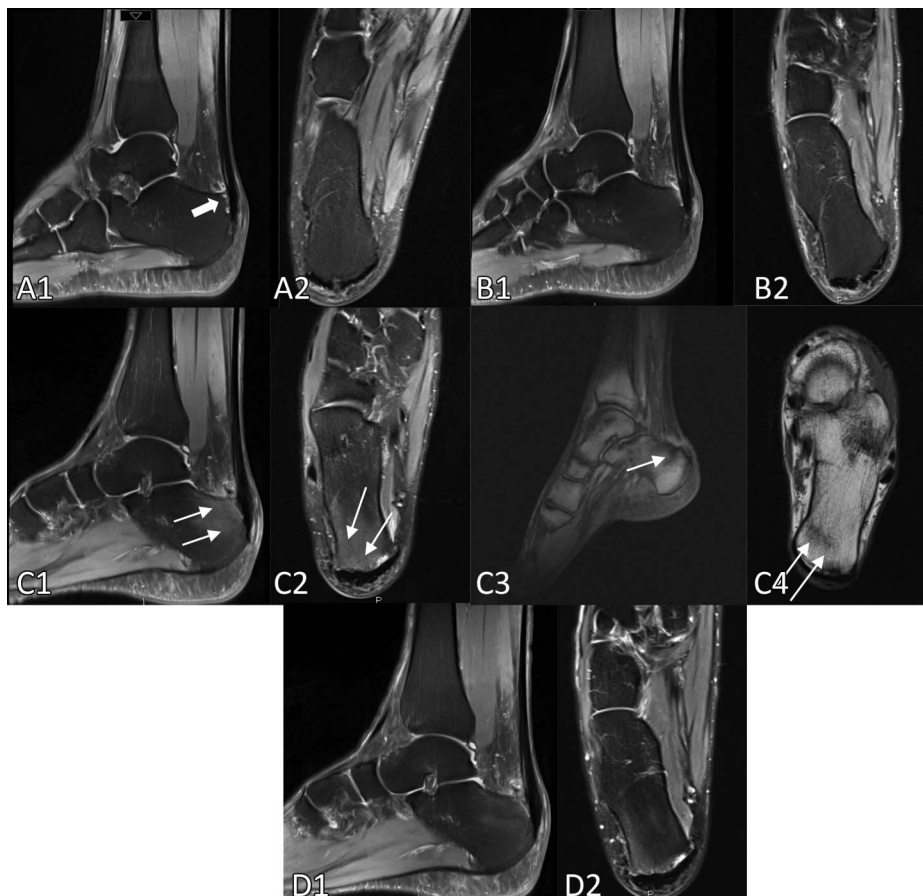


Figure 2. Images (MRI) of the development and resolution of CBB after successful resection of Haglund deformity (1 = sagittal; 2 = axial): (A) preoperative (arrow = bony prominence); (B) one-month postoperatively (no CBB); and (C) three months postoperative, at the time for the diagnosis of CBB (T1-images and T2-images, arrows showing CBB, C1-C4), pain started while patient was running in the snow. D, Six months postoperative, pain-free, symptomless and healed CBB.

TABLE 2. Patients With Postoperative CBBs

Activity Level	Gender	Age (yr)	Emergence of Sharp Postoperative Pain (Stage of Rehabilitation Program)	Time to Diagnosis of CBB	Full RTP After CBB Diagnosis
Orienteering, national, top level	Male	17	10 wk (stage: 6)	16 wk	7 mo
Soccer, international top-level player	Male	25	6 wk (stage: 6)	6 wk	4 mo
Soccer, international top-level player	Male	29	5 wk (stage: 5)	12 wk	Retired
Track and field, 1500m, international top-level runner	Male	32	6 wk (stage: 6)	12 wk	9 mo
Recreational runner	Male	34	8 wk (stage: 6)	12 wk	2 mo
Recreational runner	Male	45	5 wk (stage: 5)	10 wk	5 mo
Recreational runner	Male	50	11 wk (stage: 7)	12 wk	6 mo
Recreational runner	Female	51	6 wk (stage: 6)	6 wk	6 mo

Our patients reported to have been pain free soon after the operation and, being keen to return to their usual activities, autonomously decided to start impact activities, developing a CBB when they tried to return to full sports activity too rapidly. Essentially, they started running too soon, abruptly increasing mechanical stresses to the operated calcaneus. Accordingly, MRI obtained after the onset of the sharp pain showed acute CBB. This contrasts with the MRI findings in asymptomatic athletes, in whom an MRI taken 1-month after EPCC for the purposes of another study did not show any evidence of bone edema.

Physicians should be aware that there could be a marked delay to diagnose a CBB. Therefore, after operation, patients should be informed about the risk of CBB so that they do not progress to impact activities without explicit advice from their surgeon. If patient experience postoperative pain at the calcaneus and clinical examination shows sharp pain on palpation of the medial and the lateral aspects of the calcaneus, a high suspicion of CBB is warranted, and MRI is indicated.¹³

Bone bruises can occur to the talus or medial malleolus after lateral ligament injury,²¹⁻²³ and a CBB typically follows axial loading.¹³ The time of resolution for CBB is debated. If

identified promptly, bone marrow edema ameliorates within 2-4 weeks as the level of activity is reduced.²⁴ Based on the findings of this study, the clinical symptoms seem to correlate with the MRI findings, and as symptoms subside, the increased signal at MRI attenuates. Dienst and Blauth⁶ reported a patient in whom a CBB resolved in 6 months. In our experience, too fast progression to intensive activity will expose the patients to a high risk of CBB after EPCC. Normally, return-to-play (RTP) takes at least 6 months and more commonly 9 months after uneventful postoperative rehabilitation.^{20,25} Surgery involving the Achilles tendon may delay the return to normal function compared with the simple EPCC reported in this investigation.²⁶

Most studies emphasize the effectiveness of MRI to diagnose bone marrow edema. Kijowski et al²⁷ have classified tibial stress injuries by MRI, but such a classification is not available for calcaneus. In our patients, postoperative CBB was seen in MRI as a large area of edema located in the posterior portion of the calcaneus. This is in line with a previous study where MRI was used to diagnose CBB, at times associated with an actual stress fracture, in the posterior tuberosity in 56% of Finnish army recruits.¹⁸ Calcaneal bone bruise-related edema in our patients was monocortical; if

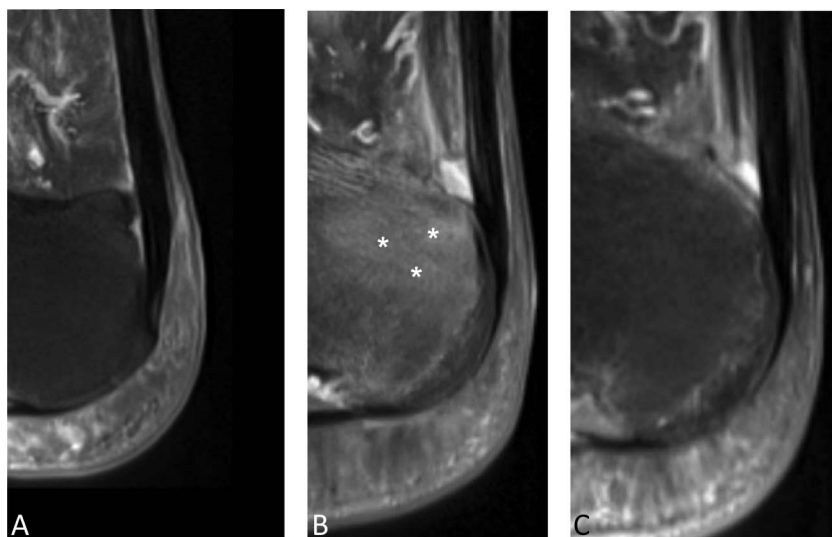


Figure 3. Preoperative and postoperative images from calcaneus near the Achilles tendon insertion: (A) preoperative (T2-image on MRI); (B) the onset of sharp pain at 4-month postoperative (T2-image on MRI, *); and (C) resolution of CBB (T2-image on MRI) at 7-month postoperative.

bone edema extends to both cortices, the diagnosis of a stress fracture should be considered.¹⁴ Gehrmann and Renard¹⁷ proposed a treatment algorithm for actual calcaneus stress fracture that emphasizes pain-free level of activity and healing takes 6-8 weeks. Postoperative CBB, as in our patients, can take up to 9 months for full RTP, although athletes can return to normal activities quicker.

This study has several limitations. For example, it includes a cohort of only 8 individuals. However, in our hands this event has proven to be rare. We cannot exclude, obviously, that some athletes may have developed a CBB and interpreted the symptoms as part of the normal recovery process after the surgery they underwent. Team physician and physiotherapist followed our patients during postoperative rehabilitation, and we are confident that we would have been able to identify such abnormal postoperative course, had a CBB occurred. In addition, we did not use any patient-reported outcome measures or objective pain scores that could have given more information regarding the rehabilitation after CBB. However, these subjective outcome measures differ with different type and level of sports, and the small number of patients reported in this investigation might not give reliable conclusions.

CONCLUSIONS

Our series of 8 patients developed an atypical postoperative condition—CBB—after surgery for a common ailment of the insertion of the Achilles tendon. Calcaneal bone bruise resolved with appropriate conservative management, consisting of pain-free weight-bearing without immobilization. Physicians should have a high level of suspicion of CBB if uneventful EPCC is followed by a sudden onset of sharp calcaneal pain during rehabilitation and if the patients reported to have started impact loading without the advice of the operating surgeon. MRI is a useful tool to diagnose and follow-up CBB to plan RTP.

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