

# Osteomyelitis After Calcium Phosphate Subchondroplasty

## A Case Report

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### Abstract

*Subchondroplasty is a relatively new procedure developed to treat bone marrow lesions by injecting a calcium phosphate bone substitute into the pathologic, subchondral area of bone under fluoroscopic guidance. The procedure is described as a minimally invasive strategy that provides reliable relief of pain while preserving the native joint with minimal risk of significant complications. No prospective, randomized clinical trials have reported the efficacy of the procedure. Here, we present the case of a 64-year-old healthy male who developed Staphylococcus aureus osteomyelitis following subchondroplasty requiring further surgical intervention and intravenous antibiotic therapy.*

**P**ercutaneous calcium phosphate injection (Subchondroplasty®; Zimmer Knee Creations, Inc., Exton, PA, USA) is a relatively new procedure used to treat chronic bone marrow lesions (BMLs), also referred to as bone marrow edemas (BMEs), which are commonly associated with pain and a rapid progression to osteoarthritis.<sup>1-4</sup> These subchondral osseous defects are generally unappreciated on standard radiographs, but appear as hyperintense water-consistent areas on fat-suppressed MRI sequences.<sup>5</sup> Subchondroplasty is generally performed under fluoroscopic-guidance by injecting a synthetic calcium phosphate (CaP) bone-substitute material into the pathologic area. The goal of the procedure is to improve the structural integrity of the subchondral bone in an attempt

to promote subchondral bone remodelling to relieve pain and associated symptoms and potentially prevent or limit the progression to osteoarthritis. To our knowledge, no prospective randomized trials have been conducted to assess the efficacy of subchondroplasty, and no complications have been reported in the literature. We describe the case of a patient who developed culture-positive osteomyelitis following a subchondroplasty procedure.

### Case Report

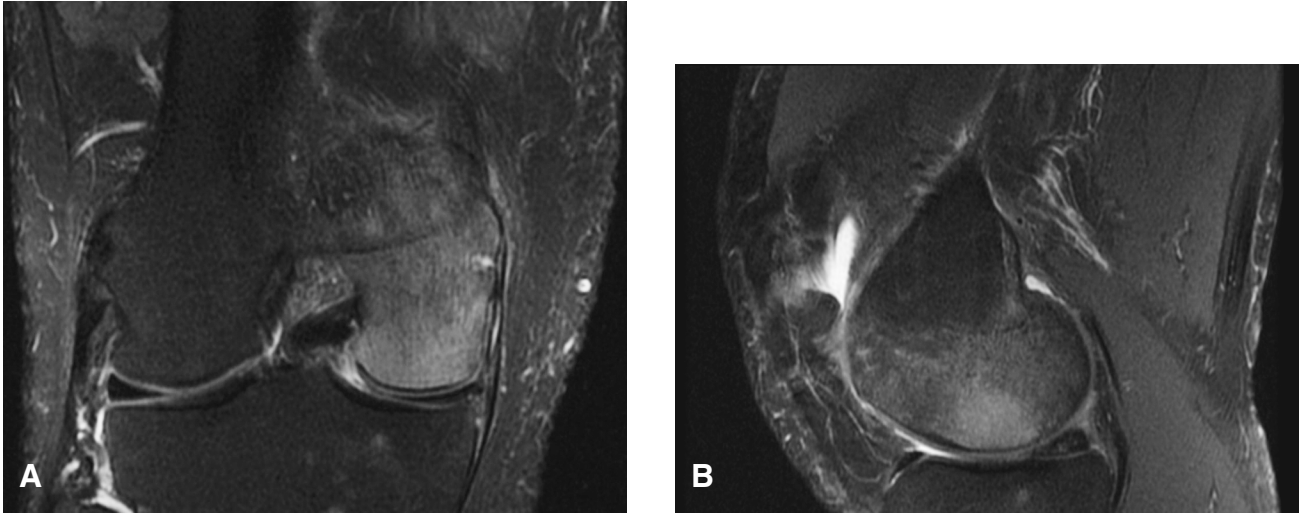
The patient was a 64-year-old healthy male with an 8-month history of medial-sided knee pain associated with mechanical clicking. His pain was atraumatic in onset and was noted to be aggravated with ambulation and impact activity. He failed a 6-month course of non-operative management. MRI examination revealed a medial meniscus tear and hyperintensity of the medial femoral condyle on fat suppressed T2-weighted imaging consistent with bone marrow edema (Fig. 1). The patient underwent arthroscopic partial medial meniscectomy and subchondroplasty. The articular surfaces were well preserved without any evidence of chondral collapse or osteoarthritis. The lesion correlating with the MRI hyperintensity in the subchondral bone of the medial femoral condyle was identified using biplanar fluoroscopy. Through a separate medial incision under sterile technique, this area was injected with 5 cc of calcium phosphate cement. The remainder of the operation was uncomplicated. Fluoroscopy was checked at the end of the case to confirm there was no extravasation of the bone cement into the surrounding soft tissue. The medial incision was thoroughly irrigated and closed with a combination of 2-0 vicryl and 3-0 monocryl sutures.

During postoperative week 1, the patient developed a non-purulent, non-erythematous draining wound over the medial femoral condyle where the calcium phosphate had been injected. The patient was prescribed a 1-week course

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**Figure 1** A, Coronal and B, Sagittal MRI images of the affected knee illustrating hyperintensity of the medial femoral condyle on fat suppressed T2-weighted imaging consistent with a bone marrow edema lesion.

of oral cephalexin, which seemed to resolve the wound complication. He returned for follow-up at the 2-week postoperative date with high satisfaction from the procedure, noting an improvement of his mechanical symptoms and a gradual resolution of his pain.

Approximately 4-months postoperatively, the patient developed purulent drainage from the medial incision (Fig. 2). He never developed constitutional symptoms or leukocytosis. He was started on a 7-day course of cephalexin. With no response, he was switched to bactrim and clindamycin for 1 week. The purulence stopped, and the wound seemed to be healing. However, the wound never completely healed to resolve the draining from the incision. Further imaging was performed at this point. Radiographs 4.5 months after the index procedure showed a lytic lesion with endosteal



**Figure 2** Clinical picture of the medial femoral condyle 4.5 months following subchondroplasty. The wound is draining purulent discharge. To view this figure in color, see [www.hjdbulletin.org](http://www.hjdbulletin.org)

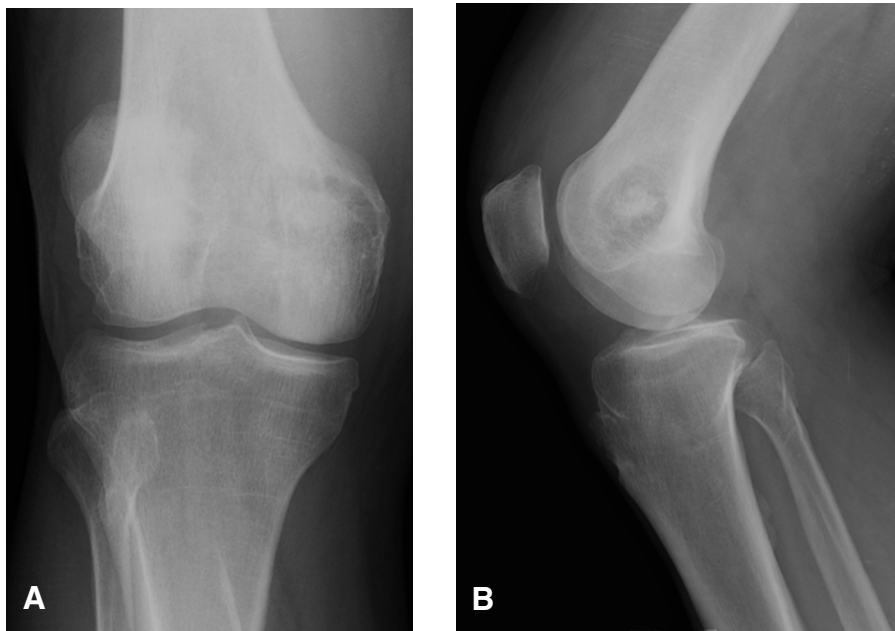
scalloping and retained radiopaque material, likely calcium phosphate (Fig. 3). Magnetic resonance imaging performed without contrast demonstrated a 2.2 x 6.5 x 2.1 cm intraosseous abscess contiguous with the sinus tract communicating with the skin. A soft tissue abscess was also present.

The patient was taken back to the operating room 5 months after the index procedure for irrigation and debridement. The sinus tract traced down to a hole approximately 15 x 15 mm in the cortex of the medial femoral condyle. This led directly to an intraosseous abscess within the femoral canal. There was gross purulence within the femoral canal along with retained fragments of calcium phosphate. The adjacent soft tissue abscess was debrided. The sinus tract was excised, and a thorough debridement was performed along with irrigation of the bone and surrounding soft tissues. The wound was closed primarily over a drain. Wound cultures grew pan-sensitive *Staphylococcus aureus*. Pathologic analysis of the debrided bone was consistent with acute osteomyelitis.

The patient was placed on IV ceftaroline, an advanced-generation cephalosporin, for 6 weeks. The infection resolved completely with the described treatment, and there have been no further complications up to 1-year follow-up.

## Discussion

Subchondroplasty is a relatively new procedure developed to treat BMLs by injecting a calcium phosphate bone substitute into pathologic subchondral bone under fluoroscopic guidance. Retrospective studies have shown this procedure to be effective for relieving pain and improving function in patients with documented BMLs; however, its role in patients with advanced knee osteoarthritis has been debated.<sup>3,6-8</sup> The theoretic advantage of calcium phosphate injection is to augment and support the pathologic area of subchondral bone, improving the structural integrity and biomechanical



**Figure 3** A, Anteroposterior and B, lateral radiographs of the treated knee taken 4.5 months postoperatively showed a lytic lesion within the medial femoral condyle with endosteal scalloping and retained radiopaque material.

strength while this area is gradually replaced by new, healthy bone capable of withstanding physiologic loads. This may help slow or prevent the progression to osteoarthritis in patients with these lesions while improving pain and associated symptoms. The highly-porous, osteoconductive nature of calcium phosphate supports this role.<sup>9</sup>

To our knowledge, no clinical trial has evaluated the efficacy of this novel procedure in a prospective, randomized fashion. Furthermore, no complications have been reported in the literature; the procedure is often described as a minimally invasive strategy that provides reliable relief of pain while preserving the native joint with minimal risk of significant complications.<sup>3</sup>

Here, we present a patient who developed an unfortunate complication secondary to injection of the medial femoral condyle for the management of a symptomatic BML. Calcium phosphate is commonly used in several other clinical scenarios to augment bony stability.<sup>7,10,11</sup> No reports of increased infection rate have previously been reported with calcium phosphate use in fracture surgery. Farr and Cohen reported early results of a series of 59 patients undergoing subchondroplasty in which there were no significant complications.<sup>12</sup>

There are several reasons why the injection of calcium phosphate may have led to osteomyelitis. There may have been direct seeding at the time of the index procedure secondary to loss of sterile technique. Additionally, since calcium phosphate is a hydrophilic substance, it may have contributed to prolonged wound drainage and poor healing of the surgical incision, which led to the formation of a sinus tract. The patient ultimately required an additional surgical procedure to treat the infection, which compromised his recovery and outcome from the index procedure. This

complication must be considered when injecting calcium phosphate substitutes for the management of BMLs.

#### *Disclosure Statement*

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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