

# Giant Cell Tumor at Tibial Screw Site After Anterior Cruciate Ligament Reconstruction

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## Abstract

We report a case of giant cell tumor that occurred in the proximal tibia of a 52-year-old man 13 years after bone-patella-bone anterior cruciate ligament reconstruction. The tumor was at the site of the metal interference screw. We discuss the differential diagnosis of proximal tibia lesions that occur after anterior cruciate ligament reconstruction and the importance of recognizing potentially life-threatening sports tumors.

**G**iant cell tumor (GCT) is a rare tumor that is most commonly found in the proximal tibia and distal femur. To our knowledge, there are no case reports of GCT at the site of a tibial interference screw after anterior cruciate ligament (ACL) reconstruction.

Here we report the case of a 52-year-old man with GCT that occurred in the proximal tibia after bone-patella-bone ACL reconstruction using a metal interference screw. As ACL reconstruction is a common procedure for patients in this man's age group, and GCT can occur in this age group, particularly in the proximal tibia, presence of the lesion is likely a coincidence. The patient provided written informed consent for print and electronic publication of this case report.

## CASE REPORT

A 52-year-old man presented with knee pain 13 years after an arthroscopically assisted ACL patellar tendon autograft. He complained of progressive pain and tenderness along the medial aspect of the right knee and said he

had noticed symptoms worsening after increased walking and other activities. He reported mild swelling but no buckling, locking, or feeling of instability.

On physical examination, the medial aspect of the knee was warm and tender. Mild swelling and full passive motion were noted. Lachman, drawer, and pivot shift tests were negative. There was no varus or valgus instability.

After the patient's index ACL reconstruction, another arthroscopy of the knee had been performed, to débride and remove a loose body. Four years later, with knee pain increasing, magnetic resonance imaging (MRI) showed an intact ACL graft, mild tricompartmental arthritis, and a small cartilage flap along the lateral femoral condyle. The patient responded to physical therapy and was not treated surgically. Over the next 5 years, he was asymptomatic and able to perform activities of daily living and sports.

Past medical history was also significant for thyroid carcinoma and thyroidectomy.

At time of presentation, radiograph showed an expansile radiolucent lesion involving the entire proximal tibia and extending to the subchondral bone (Figure 1), and MRI showed a locally aggressive—



**Figure 1.** (A) Fifty-two-year-old man who presented with knee pain 13 years after arthroscopically assisted anterior cruciate ligament reconstruction was found to have a giant cell tumor of the proximal tibia surrounding the screw site. (B) Patient underwent removal of loose titanium screw, débridement, and polymethylmethacrylate cementing.

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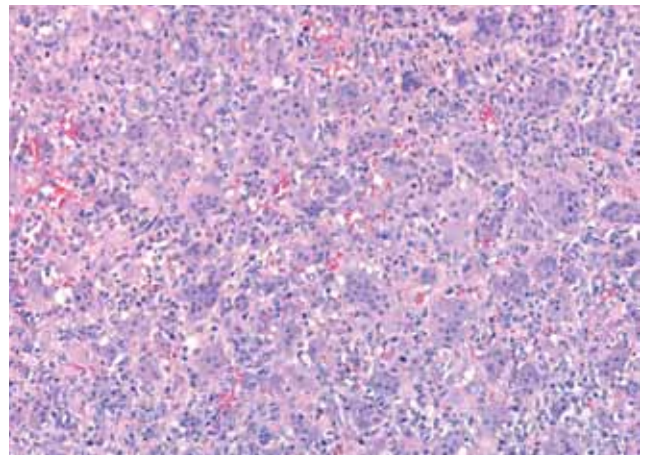
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**Figure 2.** Intraoperative specimen included giant cell tumor and removed hardware, which had been at same site in vivo.



**Figure 3.** Histology of giant cell tumor (hematoxylin-eosin, original magnification  $\times 200$ ).

appearing tumor in the marrow cavity of the proximal tibia extending to the articular surface of the central plateau. The ACL graft appeared present.

The patient was referred to a musculoskeletal oncologist. Computed tomography (CT) of the chest was negative. At surgery, arthroscopy confirmed that the lesion did not extend into the joint. Additional arthroscopic findings included an intact ACL graft and mild degenerative arthritis. After arthroscopy, the right proximal tibia was exposed, and through a cortical window the entire lesion was thoroughly curetted. The titanium screw, loose within the cavity, was removed (Figure 2). After the aggressive curettage, polymethylmethacrylate cementing was performed. After surgery, the patient began early knee range of motion and full weight-bearing in a brace with crutches.

Final pathology showed GCT of the proximal tibia with aneurysmal bone cyst changes (Figure 3). Radiographs 2 weeks after surgery showed a stable cortical crack and a well-filled lesion (Figure 4). There was no bony tenderness. Twelve weeks after surgery, the patient had no complaints and was able to hop on one leg. At most recent follow-up, radiographs showed a well-filled proximal tibial lesion (not changed significantly since prior radiograph) and no evidence of recurrence. The patient remained asymptomatic and was advised to return in 1 year for a follow-up with repeat radiograph.

## DISCUSSION

GCT accounts for roughly 20% of benign bone tumors,<sup>1</sup> and incidence is about 1 in 1 million per year.<sup>2</sup> ACL rupture is a common injury, and about 100,000 reconstructions are performed each year in the United States.<sup>3</sup> Despite the anatomical relationship between the tibial interference screw and the GCT in our patient's case, it is unlikely that the screw caused the GCT.

This case emphasizes that neoplasms should be considered in the differential diagnosis of lesions in

the femur or tibia after ACL reconstruction. In 1992, Dagher and colleagues<sup>4</sup> reported an aneurysmal bone cyst that developed 4 years after ACL reconstruction. They hypothesized that the etiology of the lesion was either the trauma that caused the ACL rupture or the femur damage that occurred during surgery. Other lesions, such as our patient's GCT, are more likely coincidental. In 2004, Caron and colleagues<sup>5</sup> reported a case of a distal femur leiomyosarcoma arising after ACL reconstruction, at the site of the metal interference screw. Theirs was the first reported case of malignancy at the site of prior ACL reconstruction.

A common cause of bone lesions after ACL reconstruction is bone tunnel enlargement or osteolysis. Bone tunnel enlargement results from biological and mechanical factors. Biological factors include graft incorporation time, immune response to allografts, cell necrosis due to toxic products (eg, ethylene oxide, metal) in the tunnel, and heat necrosis due to drilling. Mechanical factors include stress shielding of bone within the tunnel wall, graft tunnel motion, improper tunnel placement, and aggressive rehabilitation.<sup>6</sup> Given these factors, osteolysis is more commonly seen with hamstring grafts than with bone-patella-bone grafts.<sup>7</sup> Recent results have also implicated biological mediators such as interleukin 6, tumor necrosis factor  $\alpha$ , and nitric oxide in the development of bone tunnel enlargement.<sup>8</sup>

Time from surgery to discovery of a lesion is an important factor in the differential diagnosis. Bone tunnel enlargement has well-defined sclerotic margins and usually occurs within 1 year of surgery.<sup>5</sup> An MRI study of hamstring tendons found that fluid collections in the osseous tunnels are common after ACL reconstruction but usually resolve by 1 year.<sup>9</sup>

Material used for fixation and suture has been implicated as a cause of bony and soft-tissue lesions after ACL reconstruction. Martinek and Friederich<sup>10</sup> reported a case of an osteolytic lesion in the tibia after

use of a poly-D,L-lactide interference screw. Feldmann and Fanelli<sup>11</sup> reported a synovial cyst that originated in the femoral tunnel after bone–patella–bone reconstruction. They believed that the etiology of the cyst was a retained nonabsorbable suture in the femoral bone plug.

Much of the research on neoplastic risk after orthopedic hardware implantation has been conducted with patients who have undergone total joint arthroplasties. Examining a database of more than 30,000 total knee arthroplasties, Fryzek and colleagues<sup>12</sup> found the same overall incidence of cancer as in the general population. Examining an even larger database, of total hip arthroplasties, Signorello and colleagues<sup>13</sup> found no increased cancer rate and no subgroup increased risk for bone cancer.

As mentioned, it is important to include neoplasm in the differential diagnosis of bone lesions that occur after ACL reconstruction. The differential diagnosis for such lesions includes GCT, clear cell chondrosarcoma, chondroblastoma, intraosseous ganglion, eosinophilic granuloma, osteoblastoma, myeloma, lymphoma, metastasis, and infection. Primary bone lesions often occur in patients who are in the same age demographic as patients who undergo ACL reconstructions, and knee pain is common in both groups. Lewis and Reilly<sup>14</sup> reported on 36 patients with “sports tumors.” These patients were originally thought to have simple sports-related injuries but were ultimately diagnosed with a primary bone or soft-tissue tumor or tumor-like condition. Seven of the 36 lesions were GCTs.

In 2003, Muscolo and colleagues<sup>15</sup> reported on 25 patients who had a bone or soft-tissue knee tumor that originally had been diagnosed and treated as a sports injury. In 15 of the 25 cases, the missed diagnosis or the initial treatment affected which oncologic procedure was ultimately performed. All 4 of the stage I GCTs had progressed to stage III, and intra-articular resection was required. In none of these 25 cases had MRI been performed before the index procedure.

In 1983, Joyce and Mankin<sup>16</sup> reported on similar tumors mistaken for athletic injuries. Their conclusion, reiterated in 2003 by Springfield<sup>17</sup> (in a commentary on Muscolo and colleagues<sup>15</sup>), is that proper history-taking, physical examination, and plain radiographs are essential for the correct diagnosis of these lesions. Moreover, Springfield emphasized that, even with MRI, radiologists and orthopedists can miss neoplasms. MRI must be used judiciously, and its results must be correlated to the patient’s history and physical examination findings.

## CONCLUSIONS

The case reported here highlights the fact that neoplasms must be considered in the differential diagnosis of lesions that occur after ACL reconstruction. Bone tunnel osteolysis is a common cause of these lesions, but benign and malignant neoplasms have been found after ACL reconstruction.

## AUTHORS’ DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

## REFERENCES

1. Turcotte RE. Giant cell tumor of bone. *Orthop Clin North Am.* 2006;37(1):35-51.
2. Giant cell tumor of bone [patient information]. Chicago, IL: American Academy of Orthopaedic Surgeons; October 2004 (last reviewed & updated, October 2007). [http://orthoinfo.aaos.org/topic.cfm?topic=A00080&return\\_link=0](http://orthoinfo.aaos.org/topic.cfm?topic=A00080&return_link=0). Accessed April 4, 2010.
3. Canale ST, Beaty JH, eds. *Campbell's Operative Orthopaedics*. 11th ed. Philadelphia, PA: Mosby Elsevier; 2008.
4. Dagher AP, Magid D, Johnson CA, McCarthy EF Jr, Fishman EK. Aneurysmal bone cyst developing after anterior cruciate ligament tear and repair. *AJR Am J Roentgenol.* 1992;158(6):1289-1291.
5. Caron JJ, Pambuccian SE, Steen JT, Cheng EY. Leiomyosarcoma of the distal femur after anterior cruciate ligament reconstruction. *Clin Orthop.* 2004;(419):214-217.
6. Hoher J, Moller HD, Fu FH. Bone tunnel enlargement after anterior cruciate ligament reconstruction: fact or fiction? *Knee Surg Sports Traumatol Arthrosc.* 1998;6(4):231-240.
7. Wilson TC, Kantaras A, Atay A, Johnson DL. Tunnel enlargement after anterior cruciate ligament surgery. *Am J Sports Med.* 2004;32(2):543-549.
8. Zysk SP, Fraunberger P, Veihermann A, et al. Tunnel enlargement and changes in synovial fluid cytokine profile following anterior cruciate ligament reconstruction with patellar tendon and hamstring tendon autografts. *Knee Surg Sports Traumatol Arthrosc.* 2004;12(2):98-103.
9. Sanders TG, Tall MA, Mulloy JP, Leis HT. Fluid collections in the osseous tunnel during the first year after anterior cruciate ligament repair using an autologous hamstring graft: natural history and clinical correlation. *J Comput Assist Tomogr.* 2002;26(4):617-621.
10. Martinek V, Friederich NF. Tibial and pretibial cyst formation after anterior cruciate ligament reconstruction with bioabsorbable interference screw fixation. *Arthroscopy.* 1999;15(3):317-320.
11. Feldmann DD, Fanelli GC. Development of a synovial cyst following anterior cruciate ligament reconstruction. *Arthroscopy.* 2001;17(2):200-202.
12. Fryzek JP, Ye W, Signorello LB, et al. Incidence of cancer among patients with knee implants in Sweden, 1980–1994. *Cancer.* 2002;94(11):3057-3062.
13. Signorello LB, Ye W, Fryzek JP, et al. Nationwide study of cancer risk among hip replacement patients in Sweden. *J Natl Cancer Inst.* 2001;93(18):1405-1410.
14. Lewis MM, Reilly JF. Sports tumors. *Am J Sports Med.* 1987;15(4):362-365.
15. Muscolo DL, Ayerza MA, Makino A, Costa-Paz M, Aponte-Tinao LA. Tumors about the knee misdiagnosed as athletic injuries. *J Bone Joint Surg Am.* 2003;85(7):1209-1214.
16. Joyce MJ, Mankin HJ. Caveat arthroscopos: extra-articular lesions of bone simulating intra-articular pathology of the knee. *J Bone Joint Surg Am.* 1983;65(3):289-292.
17. Springfield D. In commentary on: Muscolo DL, Ayerza MA, Makino A, Costa-Paz M, Aponte-Tinao LA. Tumors about the knee misdiagnosed as athletic injuries. *J Bone Joint Surg Am.* 2003;85(7):1209-1214.