Case Report

Juxta-Articular Osteoid Osteoma of the Knee: A Case Report

CPT Matti P Asuma*, MAJ Joseph W Galvin1, LTC George T. Leonard2, LTC Josef K Eichinger1, LTC Jason A. Grassbaugh1, and COL (ret) Edward D Arrington1

Orthopedic Surgery Service, Madigan Army Medical Center, USA
Department of Pathology, Madigan Army Medical Center, USA

Abstract

A 25-year old male active duty soldier presented with two years of persistent localized anteromedial right knee pain with an insidious onset and absence of trauma. Due to the severe pain, he was unable to perform his duties. Physical therapy, oral anti-inflammatory pain medication and activity modification failed to provide sustained relief. However, oral anti-inflammatory medications did provide temporary symptom resolution, especially at night. Examination revealed isolated tenderness over the medial femoral condyle and full range of motion. Radiographs of the knee were normal. Magnetic resonance imaging (MRI) demonstrated diffuse bony edema of the medial femoral condyle without evidence of chondral injury. A computed tomography (CT) scan revealed a 5-millimeter (mm) sclerotic lesion in the subchondral bone of the medial femoral condyle. The patient was presumptively diagnosed with an Osteoid osteoma. Treatment consisted on an intraoperative (CT)-guided localization and resection of the lesion through an open medial arthrotomy with an osteochondral autograft transfer procedure. Final pathology confirmed an osteoid osteoma with complete excision of the lesion. Postoperatively, the patient regained full function with complete pain resolution.

INTRODUCTION

Knee pain is a common complaint in young athletic adults and especially in our population equivalent: the active duty soldier. Specifically, anterior knee pain is estimated to affect 1 in 4 athletes, with 70% of athletes being between the ages of 16 and 25 [1]. In our active duty population, musculoskeletal injuries are common given the rigorous physical training regimen they perform on a regular basis. One study reported that 22% of musculoskeletal complaints in active duty soldiers originate in the knee and lower leg [2]. Recently, the incidence of knee pain in active duty soldiers was found to be 4.32 cases per 1,000 person-years [3]. Given the complex anatomy of the knee and broad differential, this presents a diagnostic challenge for the provider, especially in a healthy patient with no history of trauma.

Osteoid osteomas are benign bone tumors which produce mature osteoid. They comprise 10-15 % of all benign bone tumor [4-6], and most commonly occur in the femur and tibia of males (2:1, male: female) in the second decade of life. Typically, lesions are less than 1.5 centimeters (cm) in the greatest dimension. Night pain relieved by nonsteroidal anti-inflammatory drugs (NSAIDs) is a classic clinical symptom [4,6]. This is due to the high level of prostaglandin production by tumor cells [7]. Diagnosis of osteoid osteomas can be a challenge in an active patient with knee pain, especially if they are in an intra-articular [5] or juxta-articular location. A combination of advanced imaging (CT and MRI) with history and exam findings confirms the diagnosis. Historically, open excision was commonly performed; however, more contemporary management includes observation and symptom management with NSAIDs, percutaneous CT-guided excision, and percutaneous CT-guided radiofrequency ablation [8-10]. Rarely, osteoid osteomas arise in the subchondral bone adjacent to the articular cartilage of the distal femur or proximal tibia. In this scenario, arthroscopic and open procedures with osteochondral grafting have been employed with success in order to avoid the potential morbidity of damage to the articular cartilage with radiofrequency ablation [11-17]. We report a case of a diagnostically challenging juxta-articular osteoid osteoma of the medial femoral condyle treated with intraoperative computed...
tomography (CT)-guided localization, and open excision with osteochondral autograft transfer.

CASE PRESENTATION

A 25-year-old male active duty soldier presented with two years of persistent localized anteromedial right knee pain with an insidious onset and absence of trauma. Due to the severe pain, he was unable to perform his duties as a field officer. His right knee pain was tolerable early in the morning, but in the evening after training, the pain became severe and began to interfere with sleep. He presented to his primary care provider over one year after initial complaints, who obtained knee radiographs that were unremarkable, and recommended activity modifications with NSAIDs. Physical therapy, oral anti-inflammatory pain medication and activity modification failed to provide sustained relief, so he was referred to Orthopaedics. He rated his pain on the Visual Analog Scale (VAS) for pain as 10 out of 10, especially at night and 3/10 after NSAID use. His Knee injury and Osteoarthritis Outcome Score (KOOS) was 50.4. Examination revealed an antalgic gait, tenderness over the medial femoral condyle, normal knee range of motion and a normal ligamentous exam. Radiographs of the knee revealed no abnormalities; however, a non-contrast MRI revealed increased signal intensity of the medial femoral condyle adjacent to the articular surface on T2 and short tau inversion recovery (STIR) sequences, with no evidence of articular cartilage injury (Figure 1 A,B). A CT scan revealed a 5 millimeter (mm), peri-articular, well-circumscribed sclerotic lesion of the medial femoral condyle, within the subchondral bone (Figure 2A,B). Given the classic history of night pain only improved with NSAIDs, exam and imaging findings, the patient was diagnosed with an osteoid osteoma of the medial femoral condyle.

Potential options for treatment in this situation included continued observation and symptomatic treatment with NSAIDs, radiofrequency ablation, or arthroscopic versus open excision. Given the patient’s failure of non-operative treatment and persistent debilitating pain and dysfunction for close to 2 years, as evidenced by his VAS of 10 and KOOS of 50.4, he elected to proceed with operative management. Furthermore, due to the potential morbidity of radiofrequency ablation on the adjacent articular cartilage, a combined arthroscopic and open approach was chosen. The initial surgical plan was to perform a diagnostic arthroscopy. If the lesion was identifiable on arthroscopy, then an arthroscopic versus open autograft osteochondral transfer procedure would be performed without any need for CT-guided localization. However, if the lesion was not identifiable and accessible on arthroscopy, then our plan was to perform an open medial arthrotomy followed by intraoperative CT-guided localization. CT-guided localization was chosen over C-arm fluoroscopy because of the inability to identify the lesion on preoperative plain radiographs. We planned to use a 0.062 inch Kirschner wire (K-wire) combined with intraoperative CT imaging (O-arm) (Medtronic, Minneapolis, MN) in order to localize the lesion.

Knee arthroscopy failed to identify the lesion intra-articularly as there was no chondral disruption to reveal the location of the lesion and the lesion was too far medial to access after CT localization (Figure 3). Consequently, an open medial arthrotomy revealed an approximately 1x1cm faint, bluish discoloration at the junction of the medial femoral condyle cartilage and adjacent bone (Figure 4). To verify the lesion at this location, a smooth 0.062 inch K-wire was inserted into the middle of the suspected site. Intraoperative CT scan (O-arm), (Medtronic, Minneapolis, MN) was obtained and confirmed wire localization of the lesion. Beam hardening artifact created obscuration of initial CT scan localization.
images; therefore, we removed the K-wire and repeated the CT scan. We were then able to identify that the K-wire tract was in the middle of the lesion (Figure 5 A,B). The lesion was excised and grafted with a 10 mm osteochondral autograft transfer from the non-weight bearing portion of the lateral trochlea (Figure 6 A,B). Gross inspection of the excised bone lesion revealed a well-circumscribed bony nidus (Figure 7). Histologic analysis confirmed the presence of a central nidus clearly demarcated from the surrounding sclerotic bone, immediately adjacent and continuous with the articular cartilage (Figure 8A). On high power magnification, the nidus is composed of a random anastomosing network of fine trabecular bone and osteoid with patchy mineralization. The bony trabeculae are lined by a single layer of polygonal osteoblasts with small nuclei lacking atypia. Occasional multinucleated osteoclasts with prominent eosinophilic cytoplasm are also evident. Inter-trabecular spaces contain numerous fibroblasts and capillaries (Figure 8A,B).

Postoperatively, he was non-weight bearing in a hinged knee brace for 5 weeks and could perform range of motion as tolerated. He worked with physical therapy two times per week on active range of motion. At 3 months, the patient reported near complete resolution of his pain with return of function. His VAS Pain was 1 out of 10 at the end of the day, and 0 out of 10 with walking and activities, with a KOOS of 80.6. At 5 months is VAS pain was 0/10 and he was able to run 1 mile without discomfort. At 9 months post-operatively, his VAS pain remained at 0/10, with a KOOS of 91.1. He was able to run 8 miles with no pain and completed the Army Physical Fitness Test 2 mile run in 12 minutes and 54 seconds. At 1 year post-operatively, his VAS was 0/10, with a KOOS of 100 and he is currently undergoing Pre-Ranger selection school, which is arguably one of the most rigorous Army training schools in the military. At 14 months post-operatively, a non-contrast MRI of his right knee (Figure 9 A,B) was obtained which demonstrates a smooth medial femoral condyle articular surface with no chondral disruption and evidence of disorganized subchondral bone. At his most recent follow-up call 15 months after the operation, he has regained full range of motion of the knee joint and is completely asymptomatic. This patient provided informed consent for the submission of this case report publication.

DISCUSSION

The diagnosis of juxta-articular osteoid osteomas can be challenging, misdiagnosed and delayed for up to 1 to 10 years [5], especially in young adults like our patient described above. One study by Szendroi et al., in 2004 retrospectively looked at the diagnostic challenges of intra-articular osteoid osteomas. They found there was a significant delay in diagnosis in a group of patients with intra-articular osteoid osteomas (26.2 months) compared to a group with extra-articular osteoid osteomas (8.5 months). They concluded that the clinical symptoms and imaging findings of intra-articular osteoid osteomas varied significantly from the classic hallmark signs and symptoms with extra-articular osteoid osteomas [18]. Our patients’ osteoid osteoma was juxta-articular, and in close proximity to the knee joint which
made this a diagnostic challenge that took roughly 24 months from the onset of symptoms to definitive treatment. Therefore, providers should maintain a high suspicion for an intra-articular or juxta-articular osteoid osteoma in a young adult who presents with knee pain, no history of trauma and pain significantly worse at night.

The first line treatment option for symptomatic osteoid osteomas includes nonsurgical management with NSAIDs and observation. Kneisl and Simon found that in six patients with osteoid osteomas, the average time to symptom resolution and “burn out” of the lesion was 33-months [9]. CT-guided radiofrequency ablation has become the standard treatment for most osteoid osteomas. Most lesions treated with this technique are in the most common locations, femur and tibia. Locations such as the spinal elements and juxta-articular locations preclude use of this modality due to the potential morbidity of surrounding tissues such as the neural elements and articular cartilage [4,10]. The heat applied to the nidus via the radiofrequency probe has the potential to damage the directly adjacent articular cartilage. Therefore, arthroscopic and open techniques have been employed with success [11-17].

Adachi et al. reported a case of a juxta-articular osteoid osteoma of the lateral tibial plateau. The patient had a successful outcome with arthroscopic guided retrograde osteochondral autograft transfer procedure. The authors describe arthroscopic localization of the lesion supplemented with fluoroscopy to aid placement of a retrograde tibial pin into the center of the lesion. CT scan was not utilized [11]. Franceschi et al. reported their management of an intra-articular osteoid osteoma of the lateral tibial plateau. The authors describe first localizing the lesion with a K-wire using CT guidance in the radiology suite, and then transferring the patient to the operating room and performing retrograde drilling of the lesion over the top of the K-wire. The articular cartilage overlying the lesion was kept intact and the excision tract in the proximal tibia was bone grafted with autograft from the proximal tibia [12]. The lesion in our case was not amenable to this technique given its location on the “shoulder” of the medial femoral condyle. Franceschi et al., in 2008, successfully managed an osteoid osteoma of the patella with a similar localization in the CT radiology suite and arthroscopic assisted excision and bone grafting [13]. Abnousi et al., described a case of an intra-articular osteoid osteoma of the medial femoral condyle which was easily identified intra-articularly and managed with arthroscopic excision [14].

In our case, due to the normal appearing preoperative X-rays and the appearance of intact cartilage overlying the lesion on MRI, we were concerned that we would not be able to identify the bony nidus with arthroscopy. We knew that because the lesion was not identifiable on X-rays, that fluoroscopy would not allow us to precisely localize the center of the nidus. Therefore, we planned for using the intraoperative CT scanner (O-arm) (Medtronic, Minneapolis, MN) available at our institution. To our knowledge, this is the first known report of intraoperative CT localization and excision, as prior cases had localization performed in the radiology suite and then transferred to the operating room [12,13]. The capability of an intraoperative CT scan provided for a smooth procedure and confidence that we had excised the entire lesion. The use of an osteochondral autograft

**Figure 8** (Figure 8A) – (40x magnification) The central nidus (*) is clearly demarcated from the surrounding sclerotic bone (**) and focally erodes the abutting articular cartilage (AC). (Figure 8B) – (400x magnification) Reveals the nidus composed of a random anastomosing network of fine trabecular bone and osteoid with patchy mineralization (indicated by the arrow). The bony trabeculae are lined by a single layer of polygonal osteoblasts with small nuclei lacking atypia (indicated by the star). Occasional multinucleated osteoclasts with prominent eosinophilic cytoplasm are also evident. Inter-trabecular spaces contain numerous fibroblasts and capillaries.

**Figure 9** Post-operative non-contrast knee MRI which demonstrates smooth medial femoral condyle articular cartilage with disorganized subchondral bone on PD fat-saturation coronal (Figure 9A) and sagittal (Figure 9B) images.
procedure was successful and the patient has now regained full asymptomatic function of his right knee.

CONCLUSION

Juxta-articular osteoid osteomas present a diagnostic challenge in a young adult with atraumatic knee pain, prolonging the time to diagnosis compared to extra-articular osteoid osteomas. Although radiofrequency ablation remains a minimally invasive and successful management option for most osteoid osteomas, intraoperative CT-guided localization, open resection and osteochondral autograft transfer can provide for a successful outcome in those rare juxta-articular osteoid osteomas of the knee.

REFERENCES