

Pseudocyclops: two cases of ACL graft partial tears mimicking cyclops lesions on MRI

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Abstract Arthroscopic reconstruction of the anterior cruciate ligament (ACL) using autografts or allografts is a common surgical procedure, particularly in young athletes. Although the procedure has excellent success rates, complications such as mechanical impingement, graft rupture, and arthrofibrosis can occur, often necessitating additional surgery. Magnetic resonance (MR) imaging has become a valuable tool in evaluating complications after ACL reconstruction. We report two cases of ACL reconstruction complicated by arthroscopically proven partial graft tears. In both cases the torn anterior graft fibers were flipped into the intercondylar notch, mimicking anterior arthrofibrosis, i.e., a “cyclops lesion,” on MR imaging. Careful review of the direction of graft fibers on MR imaging in the “pseudocyclops” lesions can help differentiate these partial tears from the fibrosis of a true cyclops. The “pseudocyclops” lesion is a previously undescribed MR imaging sign of partial ACL graft tear. Larger studies are required to determine the sensitivity and specificity of the sign, as well as the clinical importance of these partial graft tears.

Keywords MR imaging · Knee · ACL reconstruction · ACL graft · Arthrofibrosis · Cyclops lesion

Introduction

Anterior cruciate ligament (ACL) reconstruction performed with allografts or autografts is a common orthopedic surgical procedure that is increasing in frequency in conjunction with

the greater number of young athletes and associated sports-related injuries [1, 2]. This procedure is designed to prevent knee instability and subsequent development of osteoarthritis [3, 4]. ACL reconstruction has a high success rate; however, the complication rate is approximately 10 % to 25 % [3, 4]. The most commonly encountered complications include mechanical impingement, graft failure, cystic degeneration, arthrofibrosis, infection, and donor site morbidity [3–5].

Magnetic resonance (MR) imaging is a useful tool for evaluating the postoperative knee, both to assess the ACL graft and detect other intraarticular pathology [3, 4, 6]. MR imaging has proved especially useful in evaluating localized anterior arthrofibrosis, the so-called “cyclops lesion,” which affects up to 10 % of patients after ACL reconstruction [5, 6]. The cyclops lesion is a focal nodule of fibrous tissue situated within the intercondylar notch, anterior to the ACL graft and tibial tunnel [7, 8]. The cyclops lesion is the second most common cause of terminal extension loss after graft impingement. It is reported to occur in 1 % to 10 % of ACL reconstructions, with up to 2 % of patients having clinical symptoms [3, 5, 8]. We report two arthroscopically confirmed cases of partial ACL graft tears with torn anterior graft fibers displaced into the intercondylar notch, mimicking a cyclops lesion on MR imaging. We describe the MR imaging findings that differentiate the “pseudocyclops” lesion of partial graft tears from the fibrosis of the cyclops lesion.

Case report

The first case is a 20-year-old female who tore her right knee ACL playing softball. She underwent ACL reconstruction with a four-strand hamstring autograft using the semitendinosus and gracilis tendons. Nine months later, the patient was doing well; her only complaint was mild fullness and tightness attributed to hamstring harvest, but no evidence

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of instability. Fourteen months after her initial surgery, the patient developed medial right knee pain. Physical examination demonstrated medial point tenderness, but the Lachman test was negative with a firm endpoint and no increased excursion.

Right knee MR imaging (Magnetom Verio 3 T, Siemens, Germany) demonstrated a longitudinal tear of the posterior horn of the medial meniscus and a partially torn ACL graft, with the torn anterior graft fibers displaced into the intercondylar notch. The flipped graft fibers demonstrated intermediate signal intensity on T1- and intermediate-weighted images, resembling a cyclops lesion (Fig. 1). However, upon careful review of the images, the displaced graft fibers were found to extend directly from the femoral tunnel, thereby differentiating the finding from a cyclops lesion.

The patient underwent arthroscopy, during which the partially torn and flipped ACL graft fibers were identified and debrided. No cyclops lesion was identified, and the remaining deeper portion of the ACL graft was found to be adequate. No revision was deemed necessary. The medial meniscal tear was also confirmed, and partial medial meniscectomy was

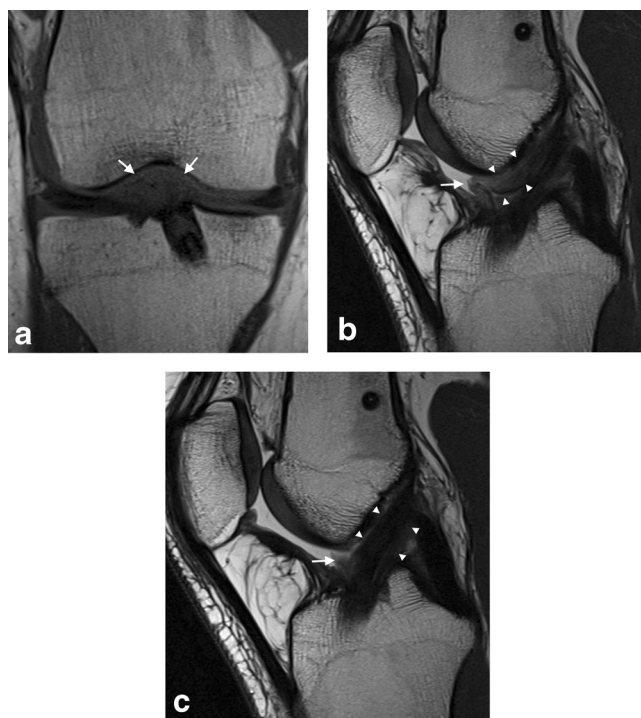


Fig. 1 A 20-year-old female with previous ACL reconstruction using a hamstring tendon autograft. **a** Coronal T1-weighted MR image (TR 650, TE 11) demonstrates an intermediate signal intensity nodule, i.e., “pseudocyclops” (arrow), in the anterior intercondylar notch. **b** Sagittal intermediate-weighted MR image (TR 5,100, TE 50) demonstrates the intermediate signal intensity nodule, “pseudocyclops” (arrow), in the anterior intercondylar notch with the displaced fibers from the graft extending directly from the femoral tunnel (arrowheads), differentiating the finding from a cyclops lesion. **c** Intermediate-weighted MR image (TR 4,690, TE 50) from 1 year later demonstrates an intact graft (arrowheads) and debrided torn ACL graft fibers (arrow)

performed. Follow-up MR imaging (Magnetom Verio 3 T, Siemens, Germany) for recurrent medial knee pain performed 12 months later demonstrated an intact ACL graft with no residual “pseudocyclops” or torn ACL graft fibers (Fig. 1).

The second case is a 50-year-old male who presented 12 years after a left knee ACL reconstruction with a patellar tendon autograft. The patient had developed medial knee pain, significant knee swelling, and loss of extension following a low-energy twisting injury. Nonsteroidal antiinflammatory drugs were administered with minimal improvement of symptoms. On physical examination, the patient had medial joint line tenderness, significant pain with forced extension, and crepitus during both flexion and extension. Results of Lachman, anterior drawer, posterior drawer, and varus and valgus stress testing were negative.

MR imaging (Magnetom Symphony 1.5 T, Siemens, Germany) demonstrated a bucket-handle tear of the medial meniscus with the posterior horn and body displaced into the intercondylar notch (not shown). There was abnormal soft tissue anterior to the ACL graft with linear fibers extending proximally into the femoral tunnel and distally into the tibial tunnel, representing a partial tear of the anterior graft fibers that were displaced into the intercondylar notch, resembling a cyclops lesion (Fig. 2). Additionally, abnormal intermediate signal within the anterior and distal portion of the graft was consistent with impingement.

Arthroscopy revealed partially torn ACL graft fibers that could be flipped in and out of the intercondylar notch (Fig. 3), as well as an enlarged ACL graft that impinged on the roof of the intercondylar notch during extension. No associated cyclops lesion was identified at arthroscopy. The torn graft fibers were debrided and the remaining intact graft fibers were believed to be adequate for knee stability. No revision was performed. The bucket-handle tear of the medial meniscus was also confirmed, requiring a partial medial meniscectomy. One month later, the patient was doing well, with near full extension and decreased pain.

Discussion

As the number of ACL injuries has increased in conjunction with the growing active population, ACL reconstruction surgery has become an increasingly common procedure [1, 2]. Worldwide, the number of female soccer players alone has increased by 23 million since 2008 [9]. The expansion of female soccer in particular accounts for an increased number of ACL reconstruction operations, as female soccer players are up to six times more likely to sustain ACL tears relative to their male counterparts [9, 10]. Although ACL reconstruction has a high success rate, unsatisfactory results such as continued instability, loss of extension, and pain occur in 10 % to 25 % of patients [3, 5, 11, 12]. The loss of as little

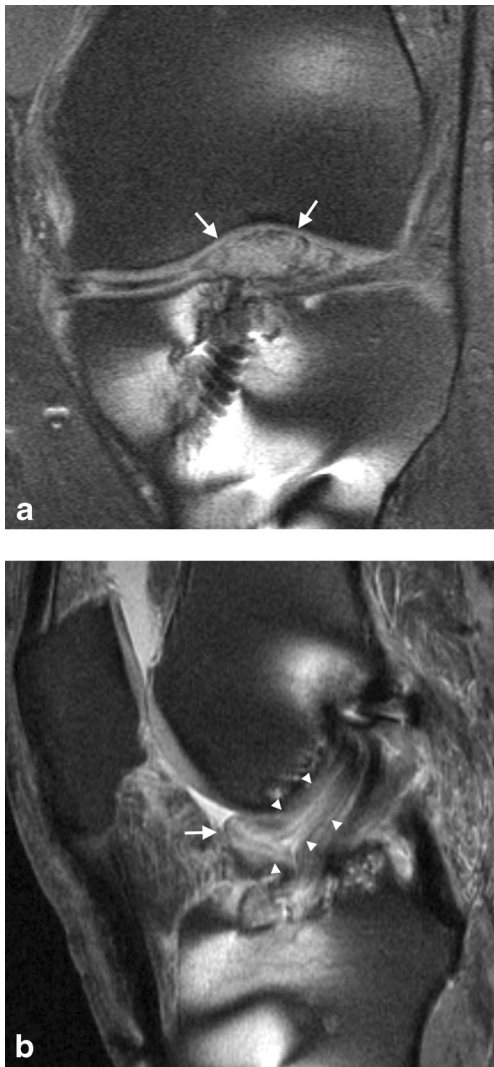


Fig. 2 A 50-year-old male with previous ACL reconstruction using a patellar tendon autograft. **a** Coronal and **b** sagittal PD-weighted fat-saturated MR images (TR 2,840, TE 14 and TR 4,590, TE 17, respectively) demonstrate the intermediate signal intensity nodule, i.e., “pseudocyclops” (arrow), in the anterior intercondylar notch with the displaced graft fibers extending directly from the femoral and tibial tunnels (arrowheads)

as 5 degrees of knee extension is not well tolerated and can often be more disabling than the preoperative instability [7].

Two of the most common complications of ACL reconstruction, both of which can result in loss of extension, include roof impingement and anterior arthrofibrosis (cyclops lesion) [7, 8, 13]. Roof impingement typically occurs when the tibial tunnel is too anteriorly placed, resulting in contact of the graft with the intercondylar roof during extension [3, 14]. This impingement can result in partial or complete rupture of the ACL graft fibers, which can potentially lead to formation of a cyclops lesion [3, 8, 15].

The cyclops lesion is a localized form of arthrofibrosis that arises within the intercondylar notch anterior to the tibial tunnel and ACL graft [3]. The fibroproliferative nodule is

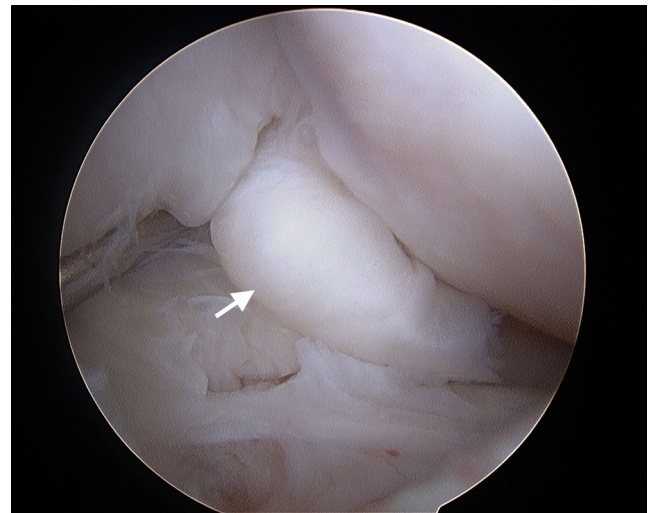


Fig. 3 Arthroscopic image from case 2 demonstrates a soft tissue nodule of coalesced torn graft fibers (arrow) contiguous with the ACL graft. The soft tissue nodule corresponds to the “pseudocyclops” in Fig. 2 and could be flipped in and out of the intercondylar notch

believed to form either as a result of residual debris around the tibial tunnel or secondary to microtrauma from graft impingement. The lesions typically range from 10 to 15 mm in size and can be adherent to the ACL graft [5]. Cyclops lesions typically present early with loss of extension. Most cases are established within 6 months after surgery [15], though they can occur or become symptomatic years after the initial surgery [16, 17]. Cyclops lesions are reported to occur in 1 % to 10 % of ACL reconstructions, with up to 2 % of patients having a symptomatic cyclops lesion [5, 8].

MR imaging is the preferred noninvasive method for assessing patients with symptomatic ACL graft reconstructions. MR imaging can reliably identify and distinguish among ACL graft complications such as roof impingement, abnormal tunnel location, graft tears, and cyclops lesions [3, 4, 6]. It can demonstrate ACL graft integrity with greater than 90 % sensitivity and specificity [18]. A cyclops lesion appears as an intercondylar nodule, anterior to the ACL graft and tibial tunnel, with mixed intermediate signal on T1-weighted, T2-weighted, and proton-density-weighted images [4, 19]. Muellner et al. described two distinct cyclops nodules with a similar appearance on MR imaging: true cyclops nodules and cyclopid scar [20]. True cyclops nodules show chondral and membranous ossification, and they are associated with loss of extension. The cyclopid scar contains only fibroproliferative tissue without ossification. The resulting softer nodule does not prevent extension [20, 21]. Neither true cyclops lesions nor the cyclopid scar contain elements of the tendinous graft on histologic specimens [20].

The cases reported here are instances of partial ACL graft tears with the torn anterior graft fibers flipped into the intercondylar notch creating a mass-like appearance that mimics a cyclops lesion on MR imaging. In both cases, the

torn ACL graft fibers can be seen extending from the tibial and/or femoral tunnels creating the “pseudocyclops” sign and differentiating the tears from true cyclops lesions. The MR imaging findings were confirmed to be partial graft tears and not cyclops lesions at arthroscopy and were treated with debridement. Both patients had stable knees before and after debridement, and graft revision was not required.

Following bundle preservation surgery, a remnant ACL bundle from the initial tear can be found anterior to the ACL graft. It often demonstrates intermediate signal intensity on MRI, resembling a cyclops lesion [5, 22]. However, in both of our cases, the ACL remnants had been debrided and could therefore not account for the MR imaging findings.

Our patients differed in sex, age, time from surgery, and type of graft used. The first patient was a young female athlete approximately 1 year post-ACL reconstruction with a hamstring autograft. The second patient was a middle-aged male 12 years after ACL reconstruction with a patellar tendon autograft. Our first patient had no acute injury or findings of impingement to account for the partially torn graft. Furthermore, the partial graft tear appeared to be asymptomatic, as the medial joint pain was attributed to the medial meniscal tear. Our second patient had both an acute injury and findings of impingement on MR imaging and arthroscopy, which could account for the partially torn graft. Our second patient also had loss of extension, which would be expected with the torn graft fibers displaced into the intercondylar notch. This symptom though could have been related to the displaced bucket-handle tear of the medial meniscus.

It has been suggested that larger grafts (≥ 10 mm in diameter) and smaller intercondylar notch size are risk factors for impingement and development of a cyclops lesion [7, 23]. This increased risk may be secondary to a higher incidence of unnoticed partial graft tears, which have been proposed as an inciting factor for formation of a cyclops lesion. Since hamstring tendon autografts have a greater number of bundles and are larger in size, we would expect a higher incidence of “pseudocyclops” lesions following reconstructions with this type of graft [24]. Our “pseudocyclops” cases, however, were seen in both patellar tendon and hamstring tendon autografts. Further studies are required to determine the risk factors associated with this type of partial graft tear.

In conclusion, a partially torn graft following ACL reconstruction with fibers lying in the anterior intercondylar notch may mimic focal anterior arthrofibrosis on MR images. It is our opinion that careful attention to the course of the torn graft fibers may help differentiate the “pseudocyclops” lesion from the cyclops lesion of arthrofibrosis. While the knees of our patients remained clinically stable despite the partial graft tears and arthroscopic debridement of the torn fibers was similar to the treatment for a cyclops lesion, it is our opinion that a partial graft tear may become significant and needs to be differentiated from focal arthrofibrosis. Larger studies are

required to determine the sensitivity and specificity of the sign as well as the clinical importance of identifying these partial graft tears.

Conflict of interest No conflict of interest.

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