Sonographic and Magnetic Resonance Imaging Examination of a Cyclops Lesion After Anterior Cruciate Ligament Reconstruction: A Case Report

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ABSTRACT

Objective: This case report describes magnetic resonance imaging (MRI) and diagnostic ultrasound (US) findings for a patient with arthrofibrosis related to a complication of anterior cruciate ligament (ACL) reconstruction.

Clinical Features: A 25-year old man presented with right knee pain and loss of extension 5 years after ACL reconstruction. MRI and sonographic examination revealed a soft tissue mass anterolateral to the ACL graft consistent with a cyclops lesion. The lesion was surgically resected and physical therapy was followed postoperatively.

Intervention and Outcome: The patient reported that full range of motion was restored 6 weeks after resection and a course of physical therapy. MRI is the modality of choice for diagnosis, but US may be useful in the diagnosis of this condition.

Conclusion: Cyclops lesions may complicate ACL reconstruction or acute ACL injuries. The patient may present with pain and loss of extension, which can be debilitating. MRI and US can be used to diagnose this condition in a timely manner, ensuring optimal clinical outcomes. (J Chiropr Med 2016;15:214-218)

Key Indexing Terms: *Ultrasonography; Magnetic resonance imaging*

INTRODUCTION

Cyclops lesions are proliferative fibrous nodules with neovascularity that may be a complication of anterior cruciate ligament (ACL) reconstructions or, rarely, acute ACL injury without reconstruction.¹⁻¹² The etiology of these nodules is multifactorial, including iatrogenic bone and cartilage drilling debris or anteriorly positioned graft, ACL stump remnants, partially torn anterior graft fibers, and graft hypertrophy from chronic impingement.^{1,2,4} Patients often present with medial joint line pain and loss of full extension of the knee,^{1,2,4-10} suggesting cyclops syndrome.¹ Magnetic resonance imaging (MRI) has been the modality of choice, with a high sensitivity, specificity, and accuracy of diagnosis.¹¹⁻¹³ Ultrasound (US) may be a helpful and possibly more cost-effective way to image arthrofibrosis because Doppler imaging can assess the

neovascularity not seen on MRI.¹⁴ This is an advantage because of the ability to differentiate postoperative knees with arthrofibrosis from those postoperative knees without complications.¹⁴

This lesion has been described in MRI literature, but no description of the lesion with diagnostic US has been previously reported. In this case, we describe MRI and sonographic examination of a 25-year-old man with a previous ACL reconstruction presenting with pain and loss of extension with arthroscopic confirmation of a cyclops lesion.

CLINICAL FEATURES

A 25-year-old man presented to the chiropractic teaching clinic with a feeling of pressure and instability in the right knee after fishing with waders. His pain was rated 4 out of 10 on a numeric pain scale, with 0 being no pain and 10 being the worst he had experienced. After fishing, as he went to remove his waders, he heard a “pop” with valgus stress and medial rotation of the femur. No unusual swelling was reported.

Five years earlier, the patient had undergone an ACL reconstruction of the right knee. His original ACL injury occurred during a beach volleyball game when another

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Fig. 1. Sagittal T1-weighted (A), sagittal T2 fat-saturated (B), and coronal T2 fat-saturated (C) magnetic resonance image demonstrating the typical heterogeneous soft tissue mass (arrow) anterolaterally within the intercondylar notch adjacent to anterior cruciate ligament graft (arrowheads), indicating a cyclops lesion.

player jumped on his back, causing hyperextension of the right knee. Arthroscopic examination shortly after the injury confirmed a full-thickness ACL tear associated with a grade 2 medial collateral ligament (MCL) tear and meniscal derangement. His reconstruction took place 3 months after the acute injury, and a contralateral patellar tendon-bone graft was used for the repair. The patient reported that the complications started 2-3 months after the surgery and included the right knee “giving way” under single-leg weight bearing, sporadic circumferential swelling with no specific onset, lack of full extension, and notable laxity with crepitus and clicking, especially with weight-bearing rotation of the tibia.

The McMurray test with valgus stress, lateral pivot shift, and laxity with forced extension were found positive, and the Lachman test was negative. The patient was able to perform all ranges of motion except end-range extension in his right knee. The extension range loss was 10°-15° and there was an audible clunk with forced extension. There was slight circumferential swelling compared with the unaffected knee. The unaffected knee also had a surgical scar overlying the patella where a tendon-bone graft was harvested.

MRI of the right knee without contrast was ordered. The MRI revealed a heterogeneous soft tissue mass anterolaterally within the intercondylar notch adjacent to ACL graft. This finding was consistent with a cyclops lesion (Fig 1). There was also variable high signal intensity on T2-weighted images present within the ACL graft, indicating the presence of a grade 1 sprain. The associated injuries that are commonly found with ACL tears were demonstrated as well, including meniscal and MCL derangement. There was a small amount of fluid present within the MCL, indicating a grade 3 sprain, and high signal intensity within the posterior horn of the

medial and lateral menisci consistent with mucoid degeneration. A small joint effusion and medial plica were also noted (images not shown). A targeted follow-up sonographic examination with a GE LOGIQ E9 system (GE Healthcare, Wauwatosa, WI) was performed for additional evaluation of the location and characteristics of the intra-articular mass using a high-frequency transducer (ML6-15) operating at 9 MHz. The same anterolateral soft tissue mass, noted at MRI, was localized within the intercondylar notch. The sonographic characteristics of the mass included a well-defined, somewhat heterogeneous, hypoechoic nodule, not attached to the cortex, with sparse peripheral hyperemia (neovascularity) demonstrated by Doppler imaging. The nodule was incompletely visualized but measured approximately 1.61 × 1.20 cm (Fig 2).

The patient was referred to an orthopedic surgeon. On arthroscopic examination, the cyclops lesion was confirmed with an intact ACL graft as well as a chronic complete tear of the MCL and minor meniscal derangement. The cyclops lesion was surgically resected, and the MCL was repaired with a semitendinosus allograft.

The patient followed a regimen of postoperative physical therapy. The physical therapy regimen included bracing for 1 week in full extension and bracing in an unlocked brace for full ambulation for weeks 1-4. This was followed by weight bearing to tolerance, with and without crutches; therapeutic exercises, including heel slides, quad strengthening, hamstring strengthening, and gastrocnemius and soleus stretches; plyometric exercises; proprioceptive training; and gradual return to sports-related activities. The patient reported obtaining all full ranges of motion and was able to return to full activities of daily living within 6 weeks after surgery. The patient gave informed consent for this case to be published.

Fig. 2. Sonographic characteristics including a well-defined, hypoechoic, somewhat heterogeneous nodule within the intercondylar notch, not attached to the cortex, indicating an incompletely visualized cyclops lesion (arrows) (A). There is sparse peripheral hyperemia (neovascularity) (B) adjacent to the cyclops lesion. The nodule measures approximately 1.61 cm $\times$ 1.20 cm (B).

DISCUSSION

To the best of our knowledge, this is the first sonographic description of a cyclops lesion. Cyclops syndrome was first described by Jackson and Schaefer in 1990.¹ They defined the syndrome as loss of extension or an audible click or clunk at terminal extension. The underlying cause was a fibrous nodule that was impinged by the roof of the intercondylar notch in ACL reconstruction.¹ This syndrome has been found in 2%² to as many as 35%⁴ of post-ACL reconstructions. The loss of extension may range from 0° to 30°. This loss of extension is found to be more disabling than a loss of flexion range of motion in the knee because of the low tolerance levels of high-performance athletes.¹⁻⁷ It is postulated that the occurrence and severity of cyclops formation depend on risk factors including tightness of the graft in extension, graft placement, intercondylar notch enlargement, short immobilization period postoperatively, early continuous passive motion, and postoperative rehabilitation.¹ However, 1 study found that physical therapy and graft placement were not related to the degree of severity of cyclops formation.³ Fujii et al⁹ found that a smaller cross-sectional area of the femoral intercondylar notch post-ACL reconstruction, as measured on MRI, was significant in the formation of cyclops lesions, confirming the importance of adequate notchplasty (surgical enlargement of the intercondylar notch) during ACL reconstruction.

The formation of the cyclops nodule usually occurs anterior to the tibial side of the ACL graft.¹⁻⁷ Different etiologies have been proposed, including bony and cartilaginous drilling debris, fibers of the ACL stump, broken graft fibers, and repetitive impingement of the graft by the roof of the intercondylar notch.⁴ The type of graft origin (patellar or hamstring tendon) was found to be

irrelevant to the cyclops formation.² A study by Muellner et al³ reported that the size and histologic characteristics of the nodule can affect the amount of lost extension. A nodule consisting of fibrous and granulation tissue (cyclopoid scar formation) with an average size of 8 mm $\times$ 6 mm was less likely to cause loss of extension compared with the cyclops lesions. The cyclops lesions consisted of new bone formation and neovascularity with an average size of 14 mm $\times$ 8 mm, which resulted in a mean loss of 19° of extension.³

The time frame for the cyclops evolution has been described in 2 studies. Cyclops nodules can occur within 2 weeks of an acute ACL rupture accompanied with loss of knee extension (~5% of cases).^{5,6,13} The etiology was postulated to be related to the broken fibers of the ruptured ACL and the inflammatory reparative process that ensued.^{5,6} Patients who were treated with ACL reconstruction surgery developed their cyclops lesions within 2 months to 3 years (average was 6 months) postoperatively.¹⁻⁷

The imaging characteristics of cyclops lesions have been documented by MRI. The well-circumscribed soft tissue nodule is typically found anterior to the ACL graft. The MRI is of low to isointense signal intensity in relation to skeletal muscle on both T1- and T2-weighted pulse sequences.⁸⁻¹² These MRI findings were consistent with those identified in our patient. The ACL graft fibers are typically seen as a low signal intensity except 4-8 months postoperatively, when the graft may appear iso- to hyperintense on fluid-sensitive imaging (T2, fat suppression) because of revascularization and synovialization.⁸ The origin of the graft tissue may affect the MR signal intensity as well. The hamstring tendon graft consists of multiple fibers of low signal intensity, but fluid can dissect between them, giving streaks of high signal intensity on

water-sensitive imaging. This finding would be abnormal in a patellar bone-tendon graft because it is a single bundle of fibers.⁸ The sensitivity, specificity, and accuracy of cyclops lesion findings on MRI were 85.0%, 84.6%, and 84.8%, respectively.¹¹

We performed US for additional evaluation of the location and characteristics of the intercondylar soft tissue nodule. The patient's sonographic findings provided additional diagnostic confirmation of the cyclops lesion. The sonographic findings of diffuse arthrofibrosis with extensive joint involvement were described by Boldt et al.¹⁴ Their findings included synovial membrane thickening and neovascularity of the synovial membrane and Hoffa fat pad subsequent to total knee arthroplasty.¹⁴ To our knowledge, the sonographic characteristics of focal arthrofibrosis related to cyclops lesion have not been documented before this report. Based on our case, US findings would consist of a soft tissue mass within the intercondylar notch that is of somewhat heterogeneous hypoechogenicity and demonstrates hyperemia on Doppler examination.

The treatment for cyclops lesions consists of arthroscopic resection of the nodule followed by postoperative physical therapy.¹⁻⁷ Arthroscopic evaluation confirmed that graft fibers typically run a different direction compared with the tissue of the cyclops lesion, making diagnostic differentiation easier for the orthopedic surgeon. This critical distinction reduces the risk of graft, rather than cyclops, resection.¹⁻⁶ After resection, most patients regain full extension and recurrence of the fibrous nodule is low (0%) when all causes of the cyclops lesion are removed.¹⁻⁷ Additional case series and case control studies might support the cost-effectiveness of sonographic evaluation, instead of MRI, for the diagnosis of this important postoperative complication, the cyclops lesion.

LIMITATIONS

Our case study is limited to this particular patient and the diagnosis and interventions cannot be generalized among the postoperative knee pain population. Additional sonographic studies need to be conducted to assess the value of ultrasonography in evaluation of the cyclops lesion.

CONCLUSIONS

We report the first sonographic description of the cyclops lesion, which can be a complication of ACL reconstruction and, rarely, acute partial- or full-thickness ACL tears. As demonstrated in this case, MRI examination showed a focal low to isointense signal nodule anterior to and at the tibial aspect of the ACL graft. Additional use of sonographic examination may be helpful in further evaluating these lesions.

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CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.M.C., A.M.Y., N.W.K.

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Practical Applications

- This is the first case report to describe the sonographic characteristics of a cyclops lesion after an ACL reconstruction.
- This lesion is a potential complication of ACL reconstruction, especially in a patient presenting with loss of knee extension.

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