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Revision Lateral Collateral Ligament and Anterolateral Ligament Reconstruction with Internal Brace Augmentation in a Patient with Elevated BMI and A KD 4 Multiligament Knee Injury

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Abstract

The following case report is of a 36 year old female with a BMI of 43 with a Schenck Knee Dislocation (KD) 4 ligament us knee injury who underwent anterior cruciate ligament (ACL), posterior cruciate ligament (PCL) and posterolateral corner (PLC) reconstruction with allograft that subsequently required revision lateral collateral ligament (LCL) and lateral capsule reconstruction with internal brace augmentation to treat persistent varus instability.

Keywords: Multiligament; Knee; Injury; Internal; Brace; Dislocation

Introduction

Multiligament knee injuries are complex problems that are often complicated by vascular and neurologic injury. This injury is further complicated when the patient has a Body Mass Index (BMI) > 40. Increased BMI has been shown to worsen the outcomes of patients with multiligament knee injuries.\ Ridley et al found that there was an increase of 9.2% of complications for every 1 unit increase in BMI.1 When encountered with a patient with an elevated BMI and a multiligament knee injury, additional measures to augment the reconstruction may be necessary to achieve optimal stability. The internal brace technique is the use of braided ultrahigh-molecular-weight polyethylene/polyester suture tape to augment ligament strength. The authors have obtained the patient's informed written consent for print and electronic publication of this case report.

Case Report

This patient is a 36-year-old female with a BMI of 43 who sustained a left knee injury when jumping on a trampoline 6 months prior to presentation.. At time of the initial injury, she went to the Emergency Room and was found to have a non-displaced medial tibial plateau fracture and a foot drop (Figure 1). By the time she presented to our institution, she had tried a course of physical therapy with a knee brace and required use of a Ankle Foot Orthosis (AFO).

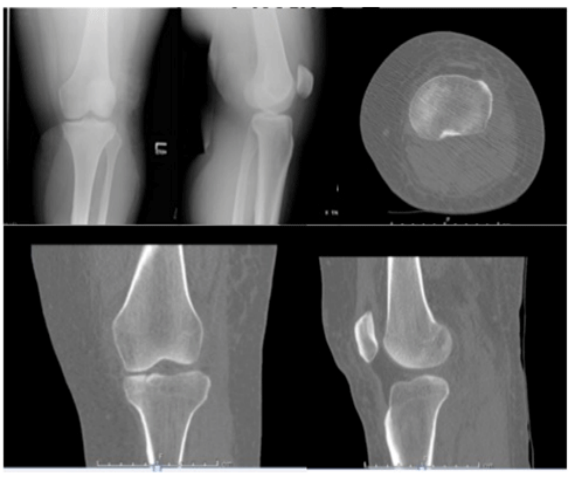

Figure 1: AP and lateral X-Ray along with CT scan images with minimally displaced medial plateau fracture

Examination of her left knee had 10 degrees of hyperextension consistent with increased recurvatum and a posterolateral corner injury. Her dial test had increased external rotation of 15 degrees at 30 and 90 degrees of knee flexion when compared to contra lateral leg. She had 3+ laxity with varus stress testing at 30 degrees of flexion and 2+ laxity with varus stress testing at full extension. She had a 3+ posterior drawer test with a soft endpoint and a positive anterior drawer test. Her Lachman's test was positive. She had 2+ laxity with valgus stress testing at 30 degrees of flexion. She did not have any significant laxity with valgus stress testing in full extension. Slocum test was negative for evidence of anteromedial rotary instability. Her range of motion (ROM) was -10 to 120 degrees. She had no sensation in the deep peroneal and superficial peroneal nerve distributions of her foot. Her sensation was intact in the tibial, saphenous, and sural nerve distributions of her foot. She was unable to dorsiflex her great toe or her ankle.

X-rays of her left knee showed a well-preserved joint line. There was a Stieda-Pellegrini lesion with heterotopic ossification off the medial collateral ligament (MCL) origin of the medial femoral condyle. Long leg films showed appropriate alignment of the mechanical axis. Her MRI showed a complete rupture of the ACL, PCL, PLC and evidence of high-grade sprain of the proximal MCL. An EMG/NCS study had findings consistent with peroneal nerve palsy.

Given her KD 4 injury, it was determined that she would be a candidate for reconstruction of her injured ligaments. Fluoroscopic evaluation and measurements under anesthesia were used to determine which ligaments to reconstruct. Based on comparison to the contra lateral knee, it was determined that she would need reconstruction of the ACL, PCL, LCL/PLC, and ALL (Figure 2). While there was clear radiographic evidence of a history of MCL injury, fluoroscopic evaluation demonstrated no evidence of residual valgus or posteromedial instability. Therefore no reconstruction was performed on the medial knee structures. During the arthroscopic portion of the case, the patient was found to have a lateral meniscus tear that was debrided. She also had a cartilage lesion on the lateral femoral condyle (LFC) that required chondroplasty. Of note, this lesion was not on the weight bearing portion of the LFC and was thought to be secondary to the hyperextension injury. Her PCL reconstruction was done arthroscopically using double bundle technique with 8mm allograft for each limb utilizing an outside-in technique. The tibial fixation for both the anterolateral (AL) and posteromedial (PM) bundles was tightened at 90 and 45 degrees respectively using an interference screw and a suture anchor. The ACL reconstruction was performed with a 10mm allograft. Next, a peroneal nerve exploration was done that found the nerve to be edematous but intact. Then attention was focused on the PLC and LCL that were found to be patulous from the injury. The popliteus was reconstructed with achilles allograft with LaPrade

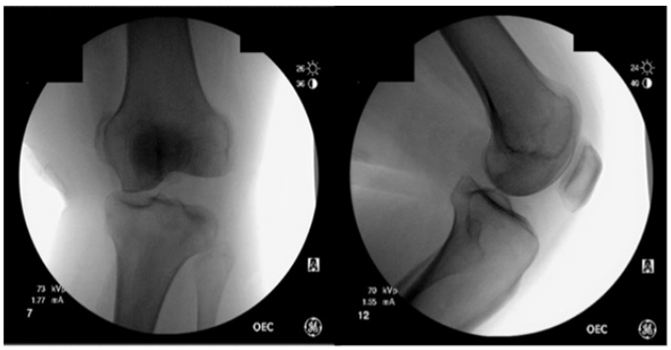

Figure 2: Intra-operative fluoroscopic exam revealing LCL and PLC laxity

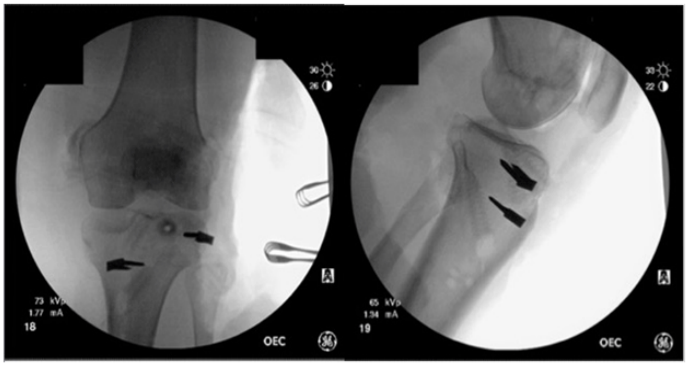

Figure 3: Post-operative imaging after ACL, PCL, LCL/PLC, and ALL reconstruction

technique.2 A separate achilles tendon bifid graft was used for LCL and ALL reconstruction. The graft was fixed to the femur with an interference screw and then the LCL limb was tunneled deep to the iliotibial band (ITB) and the tunneled through the fibular head. The LCL graft was fixed with a slight valgus stress at 20 degrees of flexion. The popliteus and popliteal fibular grafts were then tightened at 45 degrees of flexion and neutral rotation as described by LaPrade.2 The ALL portion of the LCL bifid graft was tunneled deep to the ITB midway between Gerdy's tubercle and anterolateral aspect of the tibial plateau and was fixed with a staple with the knee in near full extension and slight valgus (Figure 3).

After the operation, she was made non weight bearing for the first 8 weeks with a knee brace. This period of non weight bearing was 2 weeks longer than our standard 6 weeks given the patient's BMI. Unfortunately, when the patient returned for her 2 month postoperative visit she had varus laxity on her left knee despite strict non weight bearing. On physical examination, her ROM was 0 to 70 degrees. She had 1+ laxity to varus stress at full extension and 2+ varus laxity at 30 degrees. Valgus stress testing was negative. She had a negative Lachman, negative anterior drawer and negative posterior drawer. She continued to have decreased sensation in the distribution of the peroneal nerve and inability to extend her ankle or great toe but she was able to plantarflex digits and ankle.

Given her continued laxity with varus stress there was fear of further progression with advanced weight bearing therefore, it was decided to undergo a LCL and ALL reconstruction augmentation with internal brace fixation. The fluoroscopic exam revealed persistent lateral incompetence (Figure 4). During the procedure, we used two #2 Fiber Tape as an internal brace. These Fiber Tapes were fixed on the femur just proximal and posterior to the previous LCL tunnel. Next the 2 limbs were placed in the tibia making sure not to disrupt the previous tunnels from the ACL and PCL reconstructions. The two limbs of each Fiber Tape were fixed on the tibia with a button and backed up over a washer and post. The first set of sutures was tied at full extension and the second set was tied in 10 degrees of flexion (Figure 5). The goal of the surgery was to allow for further healing of the laterally reconstructed graft tissue under the appropriate amount of tension while allowing full mobilization. She was made weight bearing as tolerated with a hinged knee brace and began physical therapy treatment immediately following surgery.

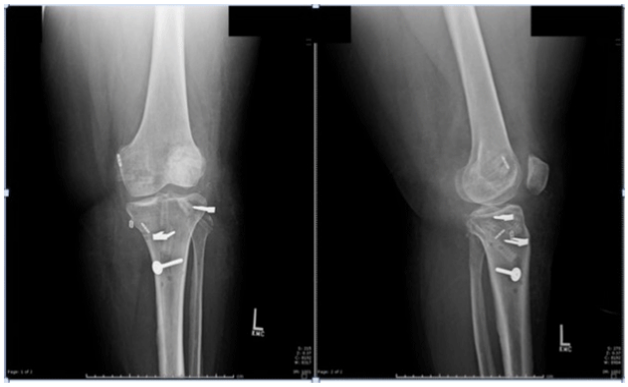

Figure 4: Examination under fluoroscopy revealing lateral knee laxity

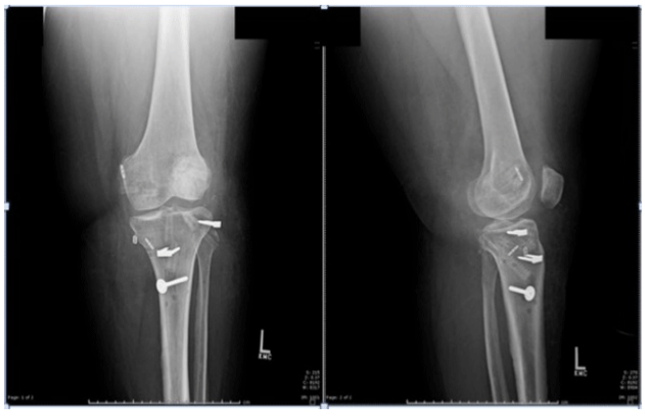

Figure 5: Final Post-Operative images after revision LCL and ALL reconstruction

At her one year postoperative visit, her knee range of motion was 0 to 125 degrees. She had stability to varus testing at 30 degrees of flexion and full extension of the knee. Her posterior drawer examination had 1+ laxity with a firm endpoint. She continued to have decreased sensation in the deep peroneal and superficial peroneal nerve distributions of her foot with inability to dorsiflex her great toe or her ankle. Her sensation was intact in the tibial, saphenous, and sural nerve distributions of her foot. Her Multiligament – Quality of Life (ML-QOL) score for the physical impairment (PI) was 57.9, emotional impairment (EI) was 38.3, activity limitation (AL) was 41.6, and societal involvement (SI) was 12.5. Her International Knee Documentation Committee (IKDC) score was 52.8 and her Lysholm score was 38.

Discussion

This case report highlights the difficult management of a multiligament knee injury in a patient with BMI >40. A revision LCL/ALL procedure was required given her continued instability to varus stress after a previous PLC/LCL/ALL reconstruction using LaPrade technique with concomitant ACL/PCL single stage reconstruction. It has been reported that 10% of posterolateral corner reconstructions require revision and increased BMI is a well documented risk factor for surgical complications and inferior clinical outcomes.1,4,5

The typical post operative protocol following LCL/PLC with or without PCL reconstruction includes a total of 12 weeks of protected weight bearing with crutches and a hinged knee brace, with the first 6 weeks being strict non weight bearing followed by a gradual advancement to weight bearing as tolerated over the next 6 weeks.6 However, in a patient with elevated BMI we extend the strict non weight bearing period and protected weight bearing period to decrease graft strain and avoid residual graft laxity. Unfortunately, this patient had continued laxity at her two month post operative visit.

It is believed that the internal brace construct acts as a secondary stabilizer to augment a reconstruction. This has been frequently used in the Brostrom procedure of the lateral ankle and achilles tendon repairs.7,8 This supplementation to ligament reconstruction provided a reinforced construct, which allowed the patient to immediately weight bear after her revision ligament knee surgery.

This is the first report in the literature for the use of an internal brace construct for revision LCL reconstruction in a patient with a BMI >40. At one year post surgery, her cumulative ML-QOL score of 150.3 was worse than the mean ML-QOL for revision knee ligament surgery of 122.9 which signifies a worse outcome. This was based on previous work by Yi et al that assessed 31 patients who underwent multi-ligament knee reconstruction.9 Her IKDC score of 52.8 was comparable to that found in the Stannard et al where the IKDC was 56.1 in multiligament reconstruction after revision of failures. However, the Lysholm score of 38 for our patient was lower than the 89.6 found in Stannard et al.10

Our patient likely performed worse on the outcome scores given her BMI >40 and her higher level of injury resulting in a KD 4 injury. Our patient's outcome is consistent with previous work by Yi et al, that found revision surgery and increased Schenck classification to be associated with worse ML-QOL outcome scores.9 Despite her outcome scores, it should be noted that our patient was able to have a have a stable knee at one year postoperative visit and was able to weight bear immediately after the supplementation of internal brace for a revision LCL and ALL reconstruction. She is able to work out and enjoy her activities of daily living (Video).

Further research with increased number of patients and long-term outcomes are needed to help refine the appropriate indications and patient counseling for internal brace augmentation to LCL/ALL reconstructions in order to optimize patient outcomes particularly when the BMI is > 40.

Video: The patient 9 months post operatively participating in therapy

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