CASE REPORT

Long-term sequelae and management following anterior cruciate ligament injury

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SUMMARY

This article discusses a case in which a patient who sustained an anterior cruciate ligament (ACL) injury returned with anterior knee pain in the same knee approximately 20 years later. He underwent reconstruction at the time of the injury and had a revision reconstruction performed 10 years later. The case highlights the long-term consequences of ACL injury and subsequent reconstruction for the knee joint, as this patient has developed anterior knee pain during his mid-40s. Additionally, non-operative management of knee osteoarthritis is discussed.

BACKGROUND

Injury to the anterior cruciate ligament (ACL) is a common occurrence¹ that results in over 100 000 ACL reconstructions being performed annually in the USA.² ACL injuries are often associated with other injuries to the knee, including meniscal tears.³ The prevalence of meniscal damage increases as ACL deficiency becomes a chronic condition.³

In addition to meniscal pathology, articular cartilage damage has been described following ACL injury.^{4–5} The damage may develop in the unstable knee after the knee has become ACL deficient.⁵ This mechanism of chondral damage is supported by the Pond-Nuki model in canines, which created isolated ACL injuries and documented early osteoarthritic changes in the affected knee.⁶ Cartilage damage may also be caused by trauma at the time of injury.⁷ This chondral damage may be demonstrated by bone bruises on MRI seen following the ACL injury,⁸ though not all cartilage damage can be detected with MRI acutely after injury.⁷

Finally, knee injury has been linked to the development of subsequent arthritis,⁹ with ACL injured knees having a higher rate of moderate-to-severe radiological changes compared with contralateral uninjured knees.¹⁰ Reconstruction of the ACL may result in decreased development of osteoarthritis,¹⁰ though reports are conflicting.¹¹ In fact, Daniel *et al*¹¹ actually found that ACL-reconstructed knees had an increased incidence of arthrosis. Furthermore, patients who require a revision ACL reconstruction tend to have worse joint disease than those who only needed a primary reconstruction, with revision patients having increased rates of osteoarthritis and poorer cartilage status.¹²

subsequent revision ACL reconstruction. The primary procedure was performed approximately 20 years ago, reportedly with a bone-patellar tendon-bone autograft from his ipsilateral patellar ligament. The revision was performed 10 years later with allograft augmentation of the lax existing ACL reconstruction. Both of these procedures were performed in a different state and medical records were unable to be obtained. Additionally, he reported having had three right knee arthroscopies to debride meniscal tears in that time period. His primary symptom was increasing knee pain over the anterior aspect of the knee during the past several months. He noted that there was also swelling that increased throughout the day. The pain was particularly bad when using stairs or kneeling to play with his young children. He denied sensations of his knee catching or locking. He had no significant medical history and was an otherwise healthy man, with a body mass index (BMI) calculated at 30.

When he entered the room he walked with a mild antalgic gait, favouring his right leg. Mechanical axis of both lower extremities was symmetrical with alignment at 0° as was the Q angle at 10°, which was measured on X-ray. Examination was performed of the affected right knee as well as the contralateral left knee. His right knee was minimally swollen and not erythematous, with well-healed scars from the previous surgeries. He had tenderness, particularly evident along the anterior, and somewhat on the medial, aspect of his knee, with minimal swelling and no warmth to palpation. His active and passive range of motion was extension to 10° and flexion to 125°. He had 2+ dorsalis pedis and posterior tibial pulses bilaterally. He had sensation intact throughout his feet and lower legs as well as full strength bilaterally. His right Lachman was 2A. The anterior and positive drawer tests were negative. Valgus and Varus stresses demonstrated no laxity. Lateral and medial McMurray tests were negative.

An X-ray series of his right knee was performed (figures 1 and 2). Osteophytes, subchondral sclerosis and joint space narrowing were seen in the patellofemoral joint as well as some minimal joint space narrowing in the medial compartment. Additionally, an MRI of his right knee was obtained (figures 3 and 4), which demonstrated an intact ACL graft and areas of full thickness cartilage loss in the patellofemoral and medial compartments.

CASE PRESENTATION

The patient, a 46-year-old Caucasian man new to the area, presented with chronic right knee pain. His surgical history includes an ACL reconstruction and

DIFFERENTIAL DIAGNOSIS

The final diagnosis was chondromalacia of the patellofemoral compartment, as well as the medial compartment, with early stages of osteoarthritis. Our

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Figure 1 Right knee standing anteroposterior X-ray of the knee. Note the hardware from anterior cruciate ligament reconstructions and mild medial compartment joint space narrowing.

differential diagnosis also initially included a recurrent ACL injury, recurrent meniscal tear, other ligamentous injury of the knee, infection and fracture. These other possibilities were deemed to be less likely based on physical examination and imaging.

OUTCOME AND FOLLOW-UP

The patient is being managed with conservative treatment for his knee pain. This plan includes non-steroidal anti-inflammatory drugs (NSAIDs) and heat or ice for comfort. Additionally, intra-articular injections of triamcinolone acetate and viscosupplementation will be used to aid in the conservative treatment approach. Finally, with a BMI of 30, the patient is obese. Thus, weight loss will be encouraged and may lead to a reduction in symptoms.

Figure 2 Right knee lateral X-ray of the knee. Osteophytes, subchondral sclerosis and joint space narrowing of the patellofemoral joint are apparent.

Figure 3 Right knee coronal MRI demonstrating the 10×10 mm area of full thickness cartilage loss involving the medial femoral condyle. There is also some mild thinning of the adjacent cartilage on the medial tibial plateau. The full thickness lesions represent an Outerbridge grade 4 lesion and the tibial plateau lesion is grade 3.

DISCUSSION

ACL injuries are common.¹ Therefore, appropriate long-term treatment of ACL injuries and the subsequent postoperative management is important to understand, in addition to the recognition of the long-term prognosis following these events.

In patients who have sustained an ACL injury, reconstruction is often performed to treat functional instability of the knee.¹³ Although reconstruction may return patients to previous activities, it does not necessarily prevent development of chronic knee pathology.¹¹ When compared with the contralateral uninjured knee, development of osteoarthritis in the affected knee can occur at a significantly greater rate following ACL injury.¹⁰ Additionally, the patellofemoral pathology the patient exhibits is a frequent finding in patients following ACL reconstruction,¹⁴

Figure 4 Right knee axial MRI demonstrating the 7 mm area of full thickness cartilage loss involving the lateral facet of the patella. This lesion is full thickness, which is an Outerbridge grade 4.

though it is likely an overlooked source of symptoms in patients following ACL reconstruction.¹⁵ Bone-patellar tendon-bone autograft is a common ACL graft selection that has been proposed as a source of patellofemoral pathology and anterior knee pain. However, there does not appear to be a difference in the development of patellofemoral osteoarthritis between patients who were treated with a bone-patellar tendon-bone graft versus a hamstring graft.^{16 17} Additionally, review of the literature does not seem to find a link between anterior knee pain and use of bone-patellar tendon-bone autograft.¹⁸ Nonetheless, patellofemoral osteoarthritis has recently been linked to the development of anterior knee pain.¹⁷

Current strategies in ACL reconstruction aim to better address any continued laxity that could lead to long-term consequences for the knee.¹⁹ Conventional positioning of the ACL graft has been shown to consistently malposition the tibial and also the femoral tunnels.²⁰ The result is that conventional positioning has been demonstrated to not re-establish normal knee kinematics or joint loading,²¹ while anatomic reconstruction techniques have been found to achieve superior improvements to knee laxity.¹⁹ However, the clinical significance of these improvements is uncertain.¹⁹ While it is theorised that these techniques to enhance stability of the knee would improve long-term degenerative changes,^{19 22} the effect of ACL reconstruction on the development of knee osteoarthritis is controversial.^{10 11 23 24} Currently, the indication for ACL reconstruction is to address knee laxity by restoring ligamentous knee stability,^{25 26} not to prevent degenerative joint disease.

Treatment of osteoarthritis in younger patients can be difficult. Physicians treat these patients with non-operative treatment until these methods are no longer effective. Knee osteoarthritis can also be managed via total knee arthroplasty. However, in younger patients there is a significant chance that the patient with live longer than the replacement will function, thus necessitating revision of the implant. In addition to the longer expected lifespan of younger patients, they tend to be more active, further wearing out their joint replacement and making revision surgery more likely.²⁷

Non-operative treatment of osteoarthritis has multiple options. First, exercise is recommended as an important component in the treatment of osteoarthritis.²⁸ Acetaminophen and NSAIDs can also be used to control osteoarthritis symptoms, with NSAIDs appearing to be more effective.²⁹ Additionally, intra-articular injection of corticosteroids³⁰ and hyaluronic

acid³¹ have been shown to be helpful in the treatment of osteoarthritis. Moreover, studies evaluating hyaluronic acid injections for early osteoarthritis suggest it is effective in younger people, such as our patient.³²

Finally, obesity can be an important factor in knee pain. To this point, obese patients with osteoarthritis have been reported to have higher pain scores.³³ Additionally, patients with osteoarthritis who are obese show significantly less improvement in pain following physical therapy regimens.³³

Contributors Dr Sidney Martin managed the care of the patient.

Competing interests None.

Patient consent Obtained.

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Learning points

- In an anterior cruciate ligament (ACL) injured knee, there may be significant damage not only to the ACL, but also to cartilage and meniscus at the time of the initial injury.
- ACL reconstruction is currently indicated for knee instability and its effect on the development of osteoarthritis is controversial.
- ACL injury can lead to chronic knee pathology for these patients, including meniscal tears and early onset chondromalacia and osteoarthritis.
- These patients are often relatively young when they develop knee osteoarthritis and effective treatment can be difficult.
- Patellofemoral pathology is an underappreciated consequence following ACL injury and reconstruction and may be linked to anterior knee pain in these patients.

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