CASE REPORT

Simultaneous ACL–PCL reconstructions with high tibial osteotomy: salvage for an unstable arthritic knee

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SUMMARY

We present a case of a 28-year-old man with a severe osteoarthritic varus knee after a neglected multiligamentous injury sustained 10 years prior. Simultaneous anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) reconstructions with high tibial osteotomy (HTO) were performed at a single stage. Five years after surgery, there were no signs of effusion and no instability, and the patient could easily kneel down without any discomfort. We think that salvage procedures and biological reconstructions would be the primary choice of surgical treatment in young patients to delay arthroplasty, and it is possible to perform simultaneous reconstructions of ACL and PCL with HTO in a single stage.

BACKGROUND

We present a case of a 28-year-old man with a severely unstable osteoarthritic varus knee due to a neglected multiligamentous injury sustained 10 before. We performed simultaneous reconstructions of anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) with high tibial osteotomy (HTO) in a single stage.

Early onset osteoarthritis due to chronic multiple ligamentous insufficiency of the knee joint is a challenging problem in orthopaedics. It is now well-known that the neglected treatment of knee dislocation and ligament tears can lead to osteoarthritis, therefore surgical reconstruction of the ligaments is advised.¹ Treatment choices for knee osteoarthritis may vary from conservative to surgical procedures such as arthroscopic debridement, proximal tibial or distal femoral osteotomy, inlay resurfacing, unicompartmental or total joint arthroplasty and, in some cases, arthrodesis.² In older ages, knee arthroplasty would be suitable for treatment, but joint arthroplasty is not always suitable in young patients due to high revision rates. We also had an option other than arthroplasty—arthrodesis—however, this was not preferred due to the full range of motion of the knee joint in this case.

Although biological arthroplasty concepts such as covering the arthritic knee with embedded cells or cell-free scaffolds have been gaining popularity in recent years, we did not consider them in this complicated single stage surgery, preferring to observe the results of our surgery and perform other biological reconstruction or injection methods for further stages.

CASE PRESENTATION

A 28-year-old man was admitted to our department with knee pain, deformity, recurrent swelling and instability. He had suffered a traffic accident 10 years previously. The initial treatment had been performed earlier at another centre. We received a report indicating that the patient had suffered knee dislocation and a right femur shaft fracture. Closed reduction and immobilisation had been performed for the left knee dislocation because the patient was in an intensive care unit for about 10 weeks with life-threatening injuries. We learned that patient had undergone cast immobilisation for 6 weeks followed by 4 months with a knee brace. The contralateral right femur fracture had been fixed with intramedullary nailing. The degree of deformity and swelling recurrences increased progressively and the patient had been in extreme pain for the past 2 years. The severity of his symptoms prevented him from working at his job as a waiter.

INVESTIGATIONS

Physical examination revealed varus deformity with minimal posterior subluxation of the tibia while range of motion of the knee was full. The medial and patellofemoral joint lines were painful during palpation. Lachman and anterior drawer tests were 3+ and posterior drawer test was 1+. According to dial and external rotation recurvatum tests, posterolateral corner injury was not detected. A single leg hop was 40% on the contralateral side. Lysholm score was 41 and the International Knee Documentation Committee score (IKDC) was 31. Weight-bearing X-rays, orthorontgenogram and MRI were performed (figure 1A, B). A total of 14° of varus deformity was measured at the weightbearing orthorontgenogram. On the X-rays and MRI, cartilage damage was grade 4 at the medial compartment, grade 2 at the retropatellar area, grade 3 at the trochlea and grade 1 at the lateral compartment of the knee. There was a degenerative tear of the medial meniscus while the lateral meniscus was intact.

TREATMENT

Proximal tibial medial opening-wedge osteotomy with autogenous tricortical bone grafting and simultaneous arthroscopic anterior and posterior cruciate ligament (ACL–PCL) reconstructions with ipsi–contralateral hamstring tendon autografts were performed.

Under spinal anaesthesia and using a tourniquet, the knee was evaluated with arthroscopy. Unstable

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Figure 1 (A) Preoperative weightbearing X-rays and orthorontgenogram: a 14° varus deformity was measured at the weightbearing orthorontgenogram of the left knee. Right femur fracture had been fixed with intramedullary nailing 10 years earlier. (B) MRI of the knee: severe cartilage damage with degenerated tear of the medial meniscus with an intact lateral meniscus.

chondral surfaces and the degenerative torn medial meniscus were debrided with punch and motorised shaver, and the loose bodies were excised. During the arthroscopy, we did not observe positive drive-through test for the posterolateral corner. Then a high tibial osteotomy (HTO) was performed with an Arthrex 15 mm wedge Puddu plate (Arthrex Inc, Naples, Florida, USA) followed by arthroscopic ACL and PCL reconstructions with hamstring autografts. The osteotomy site was grafted with autogenous tricortical bone.

Surgical procedures were performed in the following order: (1) Harvesting hamstring graft from the contralateral leg; (2) Harvesting hamstring graft from the ipsilateral leg; (3) Performing HTO and plating (fixing with one proximal posterior and two distal screws); (4) Drilling ACL tunnels; (5) Drilling PCL tunnels; (6) Inserting the proximal anterior screw.

In order to overcome tunnel superposition, the proximal anterior screw of the HTO plate was inserted at the end, by positioning it under fluoroscopic control in such a way as to prevent superposition of the screw through the ACL or PCL tibial tunnels. Two obturators were inserted through both tibial tunnels and then the hole for the proximal anterior screw of the HTO plate was drilled between the tunnels without overcrossing them (figure 2A, B).

Figure 2 (A) The proximal anterior hole of the Puddu plate was secured with a drill under fluoroscopic control to overcome tunnel superposition and (B) fixed osteotomy and ACL—PCL autografts. ACL, anterior cruciate ligament; PCL, posterior cruciate ligament.

OUTCOME AND FOLLOW-UP

Standard cruciate ligament rehabilitation protocol was applied with only a difference at partial weight bearing for 8 weeks. Range of motion exercises were started postoperatively and full range of motion was gained in 6 weeks. Open chain strength exercises were started after 4 weeks and full weight bearing was allowed after 8 weeks. The brace was used for 4 weeks. No instability was detected in final Lachman, anterior and posterior drawer tests. The plate was removed 2 years after the initial surgery due to implant irritation at Pes Anserinus. At 5-year follow-up, the patient still had no effusion, swelling or instability. He rarely reported of anterior knee pain, even after hard work. His range of motion had no limitation and he could easily kneel down. Neutral alignment was detected. The Lysholm score improved to 86 and the IKCD score improve to 73; a single leg hop was 90% on the contralateral side (figure 3A, B).

DISCUSSION

To the best of our knowledge, this is the first case report about simultaneous reconstruction of ACL and PCL with HTO in the English literature. The target of the surgical plan was to improve stability and correct the alignment while delaying the need for knee arthroplasty.

Knee dislocations are rare but devastating injuries and, typically, at least two ligaments are ruptured. Concomitant meniscus ruptures, cartilage injuries and intra-articular fractures may accompany this type of injury. The optimal treatment for

Figure 3 (A) Weightbearing X-rays and orthonortgenogram at 5 years. Corrected varus alignment with more patellofemoral osteoarthritis. (B) The patient can still kneel without severe pain.

multiligamentous knee injuries is still controversial. There yet remains a dilemma between immobilisation versus surgery, early surgery versus delayed surgery, repair surgery versus reconstruction surgery and the use of allograft or autograft.³

While the results of conservative treatment with a cast and prolonged immobilisation were presented by Taylor *et al*⁴ in the 1970s, recent articles have given superior results using surgical treatment and, for most of the authors, surgery is the golden standard.³ However, in the case of patients with head injuries, polytrauma or coexisting medical problems, conservative management might be advisable.⁵ In our case, the knee dislocation was initially managed with closed reduction and cast immobilisation due to other life-threatening injuries.

It is now well known that ACL and PCL tears may both lead to osteoarthritis because of instability.⁶ Recent articles have supported superior results with one stage ACL and PCL reconstructions using single bundle techniques. Mariani *et al* compared the results of cruciates repaired and reconstructed, and ACL reconstructed, and PCL repaired groups. Although all groups had similar knee scores (IKDC, Lysholm), the ACL and PCL reconstructed groups both had an increased rate of returning to sports whereas the repaired group had increased rates of posterior sag and lower rates of regaining preinjury level.⁷ One of the major problems in our case was severe instability and, to overcome this problem, both ACL and PCL reconstructions were preferred.

ACL tears may lead to further meniscal tears, which would worsen medial osteoarthritis and varus alignment. When ACL deficiency is combined with a varus alignment, the risk of progression to osteoarthritis increases. Reconstructing the ACL alone has an increased risk of failure.^{6, 8} As a salvage procedure, especially for young and active patients, combined HTO and ACL reconstruction is recommended. Open or closed wedge HTO for varus knees off loads the medial compartment and it is performed to realign varus angulated knees. In a recent article by Zaffagnini *et al*, the results of single bundle ACL reconstruction and concomitant closing wedge lateral HTO of 32 patients with a mean age of 40.1 were presented. They concluded that their salvage procedure improves the function, reduces the pain and avoids early prosthetic resurfacing.⁹

Previously, knee arthrodesis was preferred for post-traumatic arthritis of young patients, but in recent years it has been generally indicated for pain and instability of the knee in young patients after tumour resection, postpoliomyelitis syndrome or Charcot gonarthrosis.¹⁰

Another option for young patients with osteoarthritis is total knee arthroplasty. In a multicentre study by Parvizi *et al*,¹¹ it was concluded that about 1/3 of young patients reported

residual symptoms such as pain, stiffness, grinding, swelling and limitations in daily life activities (getting in or out of a car or chair, climbing stairs) even after modern arthroplasty techniques. Delaying the need for arthroplasty for young patients with salvage procedures is beneficial when considering the early failures and high rates of revision.¹²

Arthroplasty for young patients with heavy jobs requiring standing and walking all day would carry the risk of early revision. Our patient's main problems were instability and pain. In young patients, biological salvage procedures may be useful to eliminate the symptoms for some years and delay arthroplasty. These procedures may be performed in staged surgeries; however, solving all problems in one stage with a well-planned surgery would be preferable in young patients, with advantages of less loss of labour. Single stage HTO combined with ACL reconstruction is a good option for middle-aged patients with unstable arthritic knees. In this case report, we have explained that adding PCL reconstruction to combined ACL and HTO surgery did not add any significant complication.

A limitation of this presentation is that it is a single case report and thus does not generate a treatment algorithm for unstable arthritic knees in young patients. However, we wanted to demonstrate the possibility of single stage surgery for a complicated knee.

Learning points

- ▶ Neglected multiple ligamentous injury of the knee results in severe cartilage damage, deformity and instability.
- ▶ Salvage procedures and biological reconstructions would be the primary choice of surgical treatment in young patients to delay arthroplasty.
- ▶ It is possible to perform simultaneous reconstructions of anterior cruciate ligament and posterior cruciate ligament with high tibial osteotomy in a single stage.

Contributors TB was responsible for surgical treatment and follow-up of the patient. MD was responsible for scoring and editing. EC was responsible for follow-up and editing.

Competing interests None declared.

Patient consent Obtained.

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