—Case Reports—

Midterm Result of Arthroscopic Bicruciate Ligament Sutures for Multiligament Knee Injury in an Adolescent Patient

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Background: Treatment of multiligament knee injuries, especially in adolescent patients, is challenging for orthopedic surgeons. Repair of collateral ligaments and reconstruction of cruciate ligaments are usually performed, however, ligament reconstruction with transphyseal or physeal-sparing techniques may lead to physeal damage and growth disturbances in skeletally immature patients. We present a case report on performing bicruciate ligament sutures arthroscopically in an adolescent patient.

Patient and Methods: The patient was a 14-year-old boy, who was diagnosed with injuries to the anterior cruciate ligament, posterior cruciate ligament, and medial collateral ligament. Single-stage arthroscopic primary suturing of the anterior and posterior cruciate ligaments and open medial collateral ligament suturing were performed 7 days after the injury.

Results and Discussion: The patient returned to routine activities, including high-level competitive sports, at 8 months post-surgery, and currently, 8.5 years after surgery, remains without complications. Suture repair was able to minimize the size of the bone tunnels and to re-establish knee stability with native tissues. Therefore, the application of sutures may be a useful option for repairing multiligament knee injuries, particularly in adolescent patients. (J Nippon Med Sch 2017; 84: 301–303)

Key words: multiligament knee injury, adolescent patient, ligament suture, anterior cruciate ligament, posterior cruciate ligament

Introduction

Multiligament knee injuries are defined as a complete cruciate tear (grade III) plus a partial/complete collateral tear (grade II/III) or a partial/complete tear of the other cruciate (grade II/III) among the four major ligaments: anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL) and lateral collateral ligament[1].

Repair of collateral ligaments and reconstruction of cruciate ligaments are usually performed. However, in skeletally immature patients, ligament reconstruction with transphyseal or physeal-sparing techniques may lead to concerns regarding potential growth arrest and resulting angular deformities[2,3]. To avoid this, we used arthroscopic bicruciate ligament sutures for multiligament knee injury in an adolescent patient.

Case Report

A 14-year-old boy came to our institution with right knee pain after a valgus force on the knee while practicing Judo.

The knee was swollen and exhibited a critically limited range of motion (ROM). Knee laxity was confirmed by anterior, posterior and valgus stress tests. Open physes of the knee were radiographically detected, and ruptures of the ACL, PCL and MCL were confirmed by magnetic resonance imaging (**Fig. 1**). Therefore, we diagnosed the patient as type 1a based on the French Society of Orthopedic Surgery and Traumatology (SOFCOT) 2008 classification[4].

Surgical Procedures

The operation was performed 7 days post-injury. The medial knee was exposed, with the exposed superficial MCL (sMCL) showing rupture at the tibial attachment. The joint capsule and deep MCL were also torn. How-

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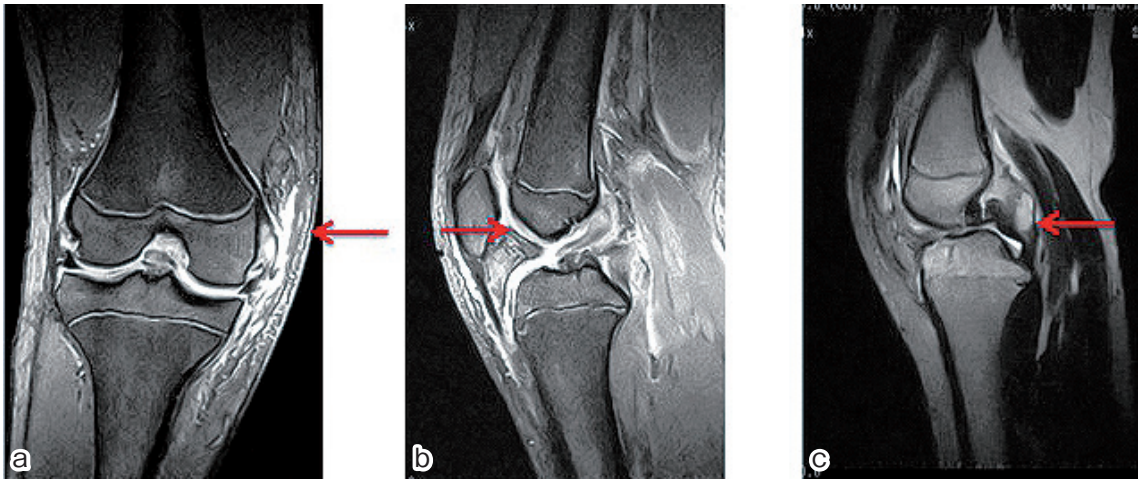

Fig. 1 MRI indicated the disruption of the MCL at the tibial side (a), the ACL at the tibial side (b) and the PCL at the femoral side (c).

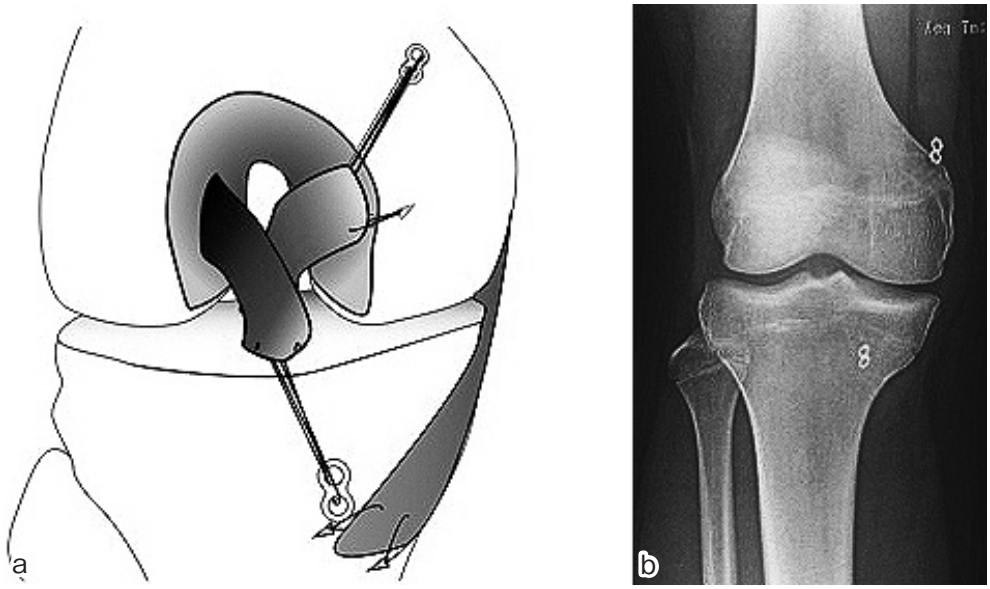

Fig. 2 This schematic drawing shows suture techniques for the MCL, ACL and PCL (a). Postoperative radiograph shows the fixation of the ACL and PCL with the plates (b).

ever, the posterior oblique ligament was not injured. We reduced the sMCL underneath the hamstrings and sutured it to the tibial insertion with two absorbable suture anchors (Smith & Nephew Inc., Memphis, TN, USA). Medial instability markedly improved.

Arthroscopic findings showed the intrasubstance tears of the ACL at the tibial side and the PCL at the femoral side. Both the medial and lateral menisci were intact. Two FiberWire (Arthrex Inc., Naples, FL, USA) sutures were used at the ruptured edges of the ACL and PCL and tied with a loop suture. We created 4.5-mm diameter bone tunnels in the tibia for the ACL and in the femur for the PCL (Acufex, Smith & Nephew Inc., Memphis, TN, USA) and tied the sutures with pre-cut titanium plates (DePuy Synthes, West Chester, PA, USA). We sutured the anterior portion of the residual PCL with a suture anchor (**Fig. 2**).

Postoperative Findings and Rehabilitation

After 2 weeks of outer fixation, ROM training from 20° to 100° was initiated, with a PCL knee brace involving a traction system (Nishinihon Rinsho Igaku Kenkyujo, Nalatsu, Oita, Japan)[5]. The patient was allowed to jog with the PCL brace (DonJoy, DJO Global, Vista, CA, USA) 5 months post-surgery. After the second-look arthroscopy 8 months post-surgery, the patient was allowed to practice Judo.

Recent Clinical Evaluations

At 8.5 years post-surgery, the patient participates in

unrestricted sports activities. The patient's knee ROM was 0°–145°, his Lysholm score was 95, with inconstant and slight pain post-training, and his Tegner score was 9. Grade I posterior drawer was detected; however, there was no rotational instability. No growth disturbance was evident.

Discussion

The treatment target in a multiligament injury is treating all disrupted structures (particularly grade III), otherwise excessive stress forces on the treated ligaments may result in re-rupture of the treated ligaments[1].

In terms of surgery timing, 3 weeks is considered as the demarcation between early and delayed surgery. For suture repair, early surgery is recommended because later repair is insufficient owing to scaring, retraction of ligament stumps, and granulation in the delayed period[2,6,7].

Reconstruction of cruciate ligaments is the standard surgical procedure. However, there remains some uncertainty pertaining to the detriments of bone tunnels in skeletally immature patients.

For these reasons, we used early suture repair of all disrupted ligaments. The benefits of suture repair included minimizing the size of the bone tunnels, avoiding harvest site discomfort, and re-establishing knee stability with native tissues. Therefore, we performed suturing in adolescent patients only if the surgery was performed within 3 weeks after the injury, the remnant existed, and the patients could follow our rehabilitation protocol.

A detrimental factor in early surgery is the difficulty of arthroscopic procedures owing to irrigation liquid leaks because of capsule tear. Moreover, fluid extravasation causes compartment syndrome and results in a risk of arthrofibrosis[1]. Therefore, in this case, the knee was closed after the MCL suture and arthroscopic procedure.

Grade I posterior drawer was evident, suggesting that the ROM training was too aggressive for the repaired PCL. However, the patient returned to his routine activities. This suggests that arthroscopic primary suturing is an option, particularly in skeletally immature patients with multiligament knee injuries.

Conclusion

Arthroscopic primary suturing for bicruciate ligaments was performed in an adolescent patient with multiligament knee injury. The patient could return to his routine activities without growth disturbance. Primary suturing is considered to be an option for multiligament knee injuries, particularly in skeletally immature patients.

Conflict of Interest: The authors declare no conflicts of interest.

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