

# **SURGICAL COMPLICATIONS IN ORTHOPEDICS AND SOLUTIONS FOR THE PREVENTION OF COMPLICATIONS**

**Editor**

**Asst. Prof. M.D. Murat SAYLIK**



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## **Surgical Complications in Orthopedics and Solutions for the Prevention of Complications**

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## CHAPTER VIII

# COMPLICATIONS OF SURGICAL TREATMENT IN ISOLATED ANTERIOR CRUCIATE LIGAMENT INJURY

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**A**n anterior cruciate ligament (ACL) injury is seen in the active young-middle age group in almost every society, causing temporary loss of labor force and causing economic burden (1). The patient's complaints show the damage to the ACL to a great extent with careful physical examination findings and magnetic resonance (MR) visualization. While MR gives reliable results, especially in the diagnosis of acute ACL ruptures, MR images may not provide reliable results due to the development of synovial scar tissue proliferation in chronic ACL tears (2). The degree of damage to the ligament should be evaluated arthroscopically before ACL reconstruction.

In young patients and athletes with a complete ACL injury, ACL reconstruction has been the method used for many years for knee stability and functional improvement (3). There is no consensus on the best time for post-traumatic ACL reconstruction. After the regression of acute hemarthrosis and the reduction of edema in the tissues, the surgical application is recommended. Professional athletes may insist on early surgery because they want to return to the sport early. However, it has been reported that recurrence of ACL injury after early ACL reconstruction increased by 30%, arthrofibrosis increased by 22%, and range of motion was seen by 37% (4,5,6).

It has been reported that the physical condition of the knee during surgery is more important in the success of ACL surgery than in the time after trauma. Before ACL reconstruction, it is desirable that the quadriceps strength and control are good, the EHA is close to complete, and the swelling and inflammation in the knee are over (7).

In order to reduce the complications after ACL reconstruction, an appropriate rehabilitation method should be applied during the postoperative period and in the operation time suitable for the physical structure of the patient. The most commonly reported complication is graft failure (8). According to the complication rates that can be seen after knee surgery applications, the complication rate after ACL surgery is quite high. For example, while the postoperative complication rate for the meniscus was 1.5%, this rate was reported as 9% after ACL surgery (9).

Before ACL surgery, the level of injury, bone and soft tissue damage, hematoma, and other intra-articular pathologies (meniscus, posterior cruciate ligament, lateral ligaments, and cartilage) should be evaluated in detail. The presence of these pathologies causes limitation of movement in the knee after surgery. Especially due to the surgical treatment of pathologies in addition to an ACL injury, the operation time and the immobilization time are prolonged, thus prolonging the time of regaining joint movement (10).

When rehabilitation after ACL surgery is inadequately applied, the quadriceps weaken and the hamstrings remain relatively stronger, causing flexion contracture in the knee. In this case, the patient cannot stretch the patellar tendon sufficiently which causes patella inferia. In order to prevent this, early initiation of straight leg lifting and quadriceps stretching exercises prevent patellar tendon contracture and patella inference. The first goal is to ensure the extension. Patellar mobilization should be continued by the patient at regular intervals.

The complication rate in ACL reconstruction has been reported to be between 1.34% and 9% (8.9). Knowing the possible complications allows the surgeon to minimize the risk of complications by considering the risks.

### **1. Cyclops Lesion**

It is the development of proliferative fibrous tissue in the intercondylar region that causes excretion limitation after ACL reconstruction. Anterior knee pain is diagnosed by the limitation of extension in the knee and a sound is heard when the knee is forced to an extension. It usually occurs because the tunnel debris cannot be adequately cleaned from inside the joint (11). Although medical treatment and physical therapy are the first treatment methods, arthroscopic debridement can be applied to patients who cannot get results from physical therapy.

## 2. Complications resulting from the surgical application

The most common cause of limitation in the range of motion of the knee after ACL reconstruction is the wrong placement of the graft. Placement of the femoral graft in the anterior according to the anatomical footprint leads to flexion limitation. Placement of the tibial graft in the anterior causes pain due to compression in the femoral intercondylar notch, extension shortage, and graft failure. Placement of the tibial graft to the posterior causes the graft to be located on a closer position to the vertical. This causes the loss of rotational stability, the impingement of ACL with posterior cruciate ligaments and early graft failure (12,13). The optimal knee angle during graft detection is 30-degree flexion and it has been reported that it provides more appropriate detection for rotational biomechanics of the knee (14).

Other complications related to the graft are the inability to remove the graft in full size and the formation of a hematoma in the area where the graft is taken. The meticulous surgical application can minimize these complications. In patients with persistent hematoma, after the drain is removed, the presence of infection should be considered, a culture should be taken from the hematoma site and appropriate antibiotic therapy should be initiated.

## 3. Infection

Although infection after ACL reconstruction is rare, it is the most important complication that can be seen in the early period. Infection in the knee joint after ACL surgery can be seen in 0.14-1.71% (15).

In a review investigating infections after ACL reconstruction, the frequency of septic arthritis was 0.5% at 53.6 months of follow-up and all of these patients received prophylactic antibiotics. In 78% of the patients, there was a reproduction in culture and the most common causative agent was staphylococcus epidermidis. It has been determined that hamstring grafts were used in 55% of these patients. It has been reported that if the suture material in the hamstring tendon graft is left in too many joints, inflammation will develop and the drainage that will occur may cause infection (16). In terms of infection, allograft preference is more reliable. The infection rate was reported to be 0.24%/0.59% in patients who underwent allograft in ACL reconstruction compared to patients who underwent autograft (17).

After ACL reconstruction, the degree of infection varies from superficial wound infection to septic arthritis and often the causative pathogen is



bacteria. Septic arthritis is a complication that is difficult to treat as it causes serious problems with sudden and progressive pain, swelling, and fever. The determinant of the treatment is the detection of the microorganism and the severity of sepsis (15). Pain and swelling exacerbated after ACL reconstruction should be monitored for infection. If the C-reactive protein (CRP) value is not within the normal value of 0-5 in the first 2 weeks, an infection should be suspected (18). The general treatment approach is arthroscopic debridement with a specific antibiotic appropriate to the culture antibiogram result. During debridement, the graft should be protected as much as possible, but in resistant infections, the graft can be sacrificed for the health of the knee joint and the patient. While arthroscopic debridement is generally successful in acute infections, open debridement has been suggested in chronic infections. In patients where the graft was debrided due to infection, a revision of ACL was recommended 6-9 months after the infection completely disappeared (19).

In a study conducted for the most undesirable infection complication of ACL surgery, the graft was subjected to vancomycin solution without placing it in the knee and it was reported that no infection was found (20).

#### **4. Arthrofibrosis**

Painful limitation of movement that may develop after surgery in or around the joint is called arthrofibrosis. Limitation of movement, pain, and stiffness with effusion in the joint are known symptoms of arthrofibrosis (21). The prevalence of arthrofibrosis after ACL reconstruction has been reported to be between 2% and 35% (22). If arthrofibrosis is not noticed early after ACL surgery, the rehabilitation process is very much prolonged, and persistent pain or patient invulnerability due to limitation of movement may develop.

The arthrofibrosis classification (5), developed by Shelborn in 1996 according to the range of motion, was revised by Scott and Shelborn in 2018 (23).

Extension limitation has been reported to be caused by adhesion scar tissue and cyclops syndrome in the posterior capsule, while flexion limitation is caused by shortening of the quadriceps muscle, peripatellar scar tissue, medial-lateral ligament, and capsular stiffness (23).

There are two primary and secondary forms of arthrofibrosis. In primary arthrofibrosis, there is active proliferative massive and generalized fibrosis. In the primary form, an inflammatory reaction is observed, which causes resistant



chronic synovitis. Secondary arthrofibrosis is local and benign. There are reasons such as limitation of joint movement before surgery, patellar tendon graft use, inadequate postoperative rehabilitation, additional intra-articular pathologies, wrong position of the graft, patella inferia, infrapatellar contracture syndrome, cyclops syndrome that can cause arthrofibrosis in the secondary form (23). However, a study reported that graft type, additional meniscus damage, and patient age were not linked to the development of arthrofibrosis, while female sex increased the risk of arthrofibrosis by 2.5 times. It has been reported that it may be linked to inappropriate postoperative rehabilitation due to poor tolerance of pain in women (22). While surgical application in the first week after ACL injury is thought to cause arthrofibrosis, it has recently been reported that the degree of inflammation in the knee is more valuable in determining the risk of arthrofibrosis (5,24).

The first treatment of arthrofibrosis is medical treatment and physical therapy. In cases where physical therapy is insufficient, manipulation under anesthesia, arthroscopic loosening of intraarticular adhesions or open arthrolysis can be performed.

## **5. Deep Vein Thrombosis and Embolism**

The frequency of venous thromboembolism (VTE) after ACL reconstruction has been reported to be between 0.2% and 14% (25,26). Clinical suspicion, diagnostic methods, demographic structure, surgical techniques, and thromboprophylaxis applications are thought to be effective in reporting these very different results. When ACL reconstruction is applied without low molecular weight heparin; The DVT rate was reported as 9.7%, the frequency of symptomatic DVT as 2.1%, and the pulmonary embolism rate as 0.1% (25). In patients who underwent heparin, DVT rate was reported as 0.55% and pulmonary embolism rate as 0.12% (8).

Risk factors for VTE are smoking, use of oral contraceptives, being over 30 years of age, being female, having a body mass index more than 30 kg/m, having chronic venous insufficiency, complex surgical application, tourniquet use for more than two hours and prolonged immobilization. Routine thromboprophylaxis is not recommended for patients who have undergone isolated ACL reconstruction and do not have VTE risk factors (25, 27). However, thromboprophylaxis will be appropriate in patients with risk factors with a previous history of DVT. Recurrent ACL damage may develop in 20% of patients after ACL reconstruction (28).

## 6. Vascular and Nerve Damage

Vascular complications after ACL reconstruction may cause serious legal problems and morbidity. Severe pain after surgery, hemarthrosis, and swelling in the popliteal region with pulsation are the first clinical signs. Pseudoaneurysm can occur due to drill sheaver or detection materials. The most commonly damaged arteries are; inferior-superior lateral genicular arteries, posterior tibial arteries, and popliteal arteries. It is not always safe to take pulsation in palpation of peripheral pulses or to see it intact with Doppler USG. Angiography is much more valuable in diagnosis. Depending on the degree of vascular damage, exploration or vascular repair can be performed (25).

Neurological complications that may develop in ACL reconstruction are often seen with sensory losses. Clinical findings include hypoesthesia, dysesthesia, neuroma, reflex sympathetic dystrophy, and pain. When the hamstring tendon graft is removed, the sartorial terminal and infrapatellar branch of the saphenous nerve may be injured (29). Sartorial branch injury can occur with proximal compression of the tendon scraper when the gracilis tendon graft is removed and can be seen in 23% (29). Infrapatellar branch damage can be seen during the skin incision applied to remove the hamstring tendon graft. This is the most commonly reported complication when taking a hamstring tendon graft and has been reported in 12%-84% (30,31). It has been reported that horizontal or oblique application of the skin incision can avoid iatrogenic infrapatellar branch damage (32). It has been reported that hypoesthesia and sensory loss are more common in patients with vertical skin incisions (33).

## 7. Femoral and Tibial Tunnel Complications

Failure to open the tunnels to anatomical footprints and femoral/tibial tunnels opened in an inappropriate position may cause graft failure and cause the failure of ACL reconstruction (34). Especially in the ACL reconstruction performed with the transtibial technique, opening the tibial tunnel in the wrong direction will cause the femoral tunnel to be misdirected. Opening the femoral tunnel to the posterior or opening the tunnel wide will cause a fracture in the posterior cortex and graft failure. When opening the femoral tunnel, the knee can be kept in flexion more than 90 degrees, and the posterior cortex and tunnel distance can be protected at a safe boundary to prevent the bursting of the femoral tunnel (blowout) (35). Tunnel expansion after ACL reconstruction can be seen in 68% of cases due to biological and mechanical factors. Biorelaxation;

swelling in the graft, and the presence of synovial fluid in the bone tunnel can occur due to increased cytokine levels. Mechanical loosening; movement of the graft in the tunnel, and tunnel/graft direction mismatch may develop due to early rehabilitation with the use of incorrect detection material (36). It has been reported that tunnel expansion will not have a negative effect on clinical outcomes, but fracture risk may be seen by joining the tunnels during revision (36).

## **8. Graft Complications**

The most common complication of hamstring tendon graft, which is the most commonly used in ACL reconstruction, is the removal of the tendon as shorter than the standard. When semitendinous and gracilis tendon grafts are removed, tendon grafts may not be taken in sufficient length due to premature abrasion or anatomical variation in the tendons. In order not to strip the tendon grafts prematurely and not to escape to the proximal gland, it is very important that anesthesia provides sufficient muscle relaxation to the patient during the graft removal process. Tendons should be thoroughly removed from the surrounding soft tissues, the area should be wetted to provide lubrication, tendon scrapers should be kept parallel to the tendon, and the graft should be removed when the tendons are in sufficient tension and the knee is in flexion of about 45 degrees. If there is not enough graft length and thickness, graft removal from the opposite knee and bone-patellar tendon-bone graft removal options may be considered.

Complications of bone-patellar tendon-bone graft can be seen as patella fracture, patellar tendinitis, patellar tendon rupture, patella inferia syndrome, arthrofibrosis, anterior knee pain, and difficulty sitting above the knee (37). Patellar fracture risk should be avoided with an appropriate mini-saw, also incisions should not exceed graft block limits and graft should be removed in the form of trapezoids (38).

## **9. Complications resulted from Detection Materials**

The most preferred fixing material for ACL reconstruction tendon graft detection is biodegradable screws. But since these screws are destroyed after a while, the pieces that fall into the joint can cause locking and cartilage damage in the joint. These biodegradable screws can cause osteolysis inside the tunnel, causing tunnel dilation, allergy or foreign body reactions, effusion in the joint, abscess, and encapsulation around the screw. When applying the screw, it may break, or screw migration may occur in the long term (39).

In the endobutton detection of the graft passed through the femoral tunnel, the tibial graft should be determined after making sure that the implant fits the lateral cortex completely. The most common complication with cross-screws is that the nails cannot detect the graft inside the tunnel.

## 10. Conclusion

In young patients and athletes with a complete ACL injury, ACL reconstruction has been the method used for many years for knee stability and functional improvement. According to the complication rates that can be seen after knee surgery applications, the complication rate after ACL surgery is quite high. The complication rate in ACL reconstruction has been reported to be between 1.34% and 9% . Knowing the possible complications allows the surgeon to minimize the risk of complications by considering the risks.

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4	Coronavirus Disease : (COVID-19)	Siriken, Belgin , Guler, Ayhan	University of Munich <a href="https://opac.ub.uni-muenchen.de/TouchPoint/search.do?methodToCall=submit&amp;searchCategories%5B0%5D=1&amp;searchHistory=&amp;CSid=8334N3167Sc7e559250a351db96abf32e7d75b44252b3778&amp;refine=true&amp;refineField=1&amp;tab=tab1&amp;View=sunrise&amp;refineHitListName=2_&amp;refineQuery=%22Livre+de+Lyon%22&amp;submitSearch=Suchen&amp;refineType=new">https://opac.ub.uni-muenchen.de/TouchPoint/search.do?methodToCall=submit&amp;searchCategories%5B0%5D=1&amp;searchHistory=&amp;CSid=8334N3167Sc7e559250a351db96abf32e7d75b44252b3778&amp;refine=true&amp;refineField=1&amp;tab=tab1&amp;View=sunrise&amp;refineHitListName=2_&amp;refineQuery=%22Livre+de+Lyon%22&amp;submitSearch=Suchen&amp;refineType=new</a>
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