

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(4): 380-384
© 2020 IJOS
www.orthopaper.com
Received: 07-07-2020
Accepted: 13-08-2020

Senthilnathan Arumugam
Professor of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu, India

Hameed Sabeer
MS Ortho - Postgraduate Student, Department of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu, India

Prabhakar Ramabadran
Lecturer, Department of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu, India

Vijayashankar Kaliyaperumal
Assistant Professor, Department of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu, India

Corresponding Author:
Hameed Sabeer
MS Ortho - Postgraduate Student, Department of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu, India

Our experience with the complications in anterior cruciate ligament reconstruction

Senthilnathan Arumugam, Hameed Sabeer, Prabhakar Ramabadran and Vijayashankar Kaliyaperumal

DOI: <https://doi.org/10.22271/ortho.2020.v6.i4f.2361>

Abstract

Aim and Objectives: To evaluate the complications encountered during ACL reconstruction. To quantify the complications and propose an appropriate solution.

Methodology: This is a retrospective study done at the department of orthopaedics of Rajah Muthiah Medical College and hospital. 67 cases of ACL reconstruction done in the last 5 years were taken into account for this study. In 35 (52.2%) cases, the patellar tendon bone graft was used for the reconstruction and in 32 (47.7%) cases the hamstrings graft was used.

Results: A total of 20 (28%) complications, both intraoperative and postoperative, were encountered, out of which 13 (19.4%) were intraoperative and 7 (10.4%) were postoperative.

Conclusion: The different complications in ACL reconstruction reiterates the need for an excellent surgical skill and a vigilant postoperative follow up.

Keywords: Complications, ACL reconstruction, management, solution.

Introduction

There has been an acute increase in the number of anterior cruciate ligament (ACL) injuries which could be attributed to an increased number in sports related activities with the advent of the modern era. An injury to ACL results in an unstable knee and the gold standard of management is surgical reconstruction. Even though advancements have been made in instrumentation and the finer techniques of fixation, complications do happen. It is believed that there has been a massive underreporting of complications due to the technical difficulties in recognizing and recording them. A sound knowledge of the complications and the ways to manage and prevent them is an absolute necessity to obtain optimal functional outcomes. This article will discuss about our experience in ACL reconstruction and its complications in the past 5 years.

Materials and Methods

This is a retrospective study done at the orthopaedic department of Rajah Muthiah Medical College and Hospital, Annamalai University in Chidambaram. In this study we revisited the files of 67 patients, retrospectively, who underwent ACL reconstruction in the last 5 years. We classified the complications into: intra-operative and post-operative. The term postoperative included up to and a maximum of 2 years following surgery. Although some authors have also included preoperative complications^[2], we are against the usage of this term. Planning before surgery is extremely essential for the final outcome, however faulty and hasty decisions cannot be classified as complications. So, we have not included preoperative complications in this article. Similarly, graft failure is a poor functional outcome and is not a complication of surgery. Subsequently, this will not be discussed in this article.

Results

A total of 20 (28%) complications were encountered in total of which 5 (10.4%) of them were postoperative. Majority of the intraoperative complications were resolved without any residual deficits.

Intra-operative complications

During harvesting the graft

Shortened hamstring graft because of pre-meditated Transection: 1/67 (1.4%) (Figure 1)

This results in a graft which is short in size and diameter which could eventually lead to failure of the graft. The ideal preventive measure would be the careful usage of the tendon stripper and avoiding cutting of the tendon expansions. Usually the stripper is blocked at the junction of the tendon and the expansion and a premature cut at this junction would result in a very short graft. The best management for this would be to isolate another graft from the ipsilateral quadriceps or bone patellar tendon either replacing or augmenting the index graft. Another alternative would be the use of an allograft, provided it is available and informed consent is obtained from the patient.



Fig 1: Shortened hamstring graft

Accidentally dropping the graft on the floor: 0/67

It results in graft contamination and an increased potential for infection. The ideal preventive measure would be by securing the graft throughout the surgery with sutures and non-crushing clamps. The ideal management would be harvesting another graft from the same side patellar tendon or the quadriceps replacing the index graft. Another option would be the use of an allograft provided they are ready and available and informed consent is obtained from the patient. However if neither could be done, the best way of sterilizing the graft would be by chlorhexidine or be mechanically agitating the graft with polymyxin B- bacitracin [3].

Fracture of the patella: 1/67 (1.4%) (Figure 2)

This will result in delaying the rehabilitation course for the patient. This can be prevented by bevelling the cut ends of the patella and using sharp osteotomes specifically designed for this purpose. Since there is a fracture of the patella the ideal management would be to fix the patella using periosteal sutures, cerclaging the patella or screws. The knee is locked in extension using a functional cast for 6 weeks if needed.

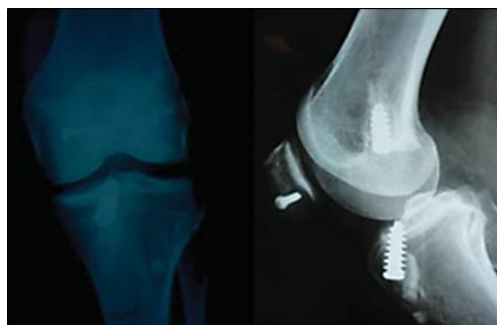


Fig 2: Fracture of the Patella

Injury to the infrapatellar division of saphenous nerve: 4/67 (5.9%) (Figure 3)

There would be impaired sensation in the area of distribution of the infrapatellar division of saphenous nerve. This could be prevented by using a horizontal incision (14.9%) instead of a vertical incision [4] (39.7%). There is no effective treatment for this complication and it is self-resolving. Return of sensation could take months and it depends on the grade of the injury (neuropraxia vs axonotmesis vs neurotmesis)



Fig 3: Injury to the infrapatellar division of saphenous nerve

Removal of excessive muscle tissue from the hamstring graft: 2/67 (3.5%)

It results in the formation of hematoma. While harvesting the graft using a stripper, it should be taken care to avoid stripping beyond the muscle-tendon junction. This increases the risk of muscle rupture and potential bleeding. It can be managed by using compressive stockings.

Complications of tunnel placement

Blow-out of the posterior wall during femoral tunnel drilling: 0/67

This results in unstable femoral fixation end eventually in failure of the graft. It can be prevented by exact placement of the guide wire and drilling carefully. If there is a doubt about the placement of the guide wire posteriorly, it is advised to drill for 2-3 mm and then the drill is withdrawn to evaluate the stump on the femoral condyle. The treatment is to create a new femoral tunnel by changing the angle of the drill. If the entry point of the new and the old tunnel is common, the new tunnel has a different orientation and is separate.

Non-anatomic position of tibial and femoral tunnels: 1/67 (1.4%) (Figure 4)

The clinical significance of this complication is a deficit in the range of motion of the knee with a potential risk of failure of the graft. It can be prevented by proper placement of the guide wire for both the femoral and tibial entry. The guide wire should be aimed at the center of the footprint of the ACL. The treatment is same as mentioned before by creating a new tunnel. If the index tunnel created does not interfere with the new one, it can be left alone. If it does interfere with the new one, we can use a screw of a larger size. An additional screw or a bone graft.

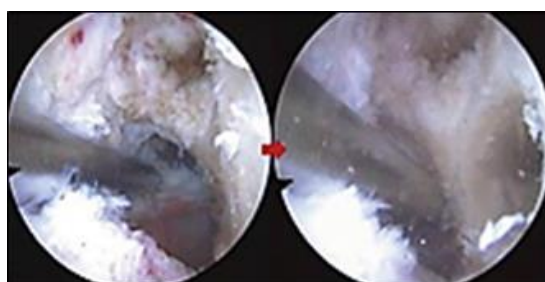


Fig 4: Arthroscopic picture of malpositioned femoral tunnel

Osteochondral lesion of the medial femoral condyle during drilling of the femoral tunnel via the antero-medial portal: 1/67 (1.4%) (Figure 5)

It causes significant effusion and painful knee. It can be prevented by drilling carefully and advancing the drill under direct supervision. The ideal management would be removal of any debris leaving behind the unaffected healthy cartilage. In case of smaller lesions (<1 cm), it can be left alone. In case of large lesions, microfractures must be suspected.

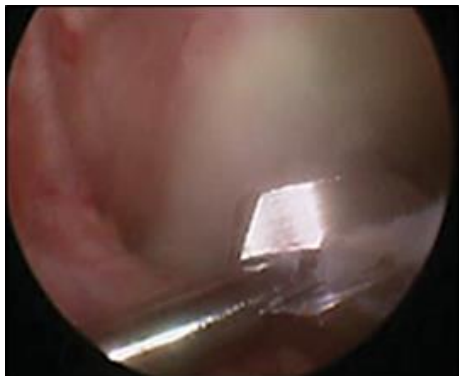


Fig 5: Osteochondral lesion of the medial femoral condyle

Complications during passage of graft

A thick graft compared to the diameter of the tunnel: 3/67 (4.4%)

The significance of this is that the graft will be unable to pass through the tibial tunnel and may result in graft rupture when the graft is pulled. This can be prevented by careful sizing of the graft and controlled drilling. Removal of soft tissue or any debris that could occlude the tunnel and can cause interference in graft passage. An alternative would be to increase the diameter of the tunnel using a drill or tunnel dilators.

A thin graft when compared to the diameter of the tunnel: 0/67

This may result in an unstable fixation of the graft and increases the potential for failure. Again, this can be prevented by careful sizing of the graft and controlled drilling. Use of a thicker screw or augmenting the initial fixation with an endobutton/staple can be done to treat this condition.

Complications during fixation of the graft

Inaccuracy in positioning the cross-pin: 1/67 (1.4%) (Figure 6)

This leads to insufficient fixation of the graft and potentiates graft failure. This can be prevented by verifying the cross-pin tunnel under direct supervision or by testing the 2 guide wires passed through the cross pin, whether they meet at the fixation point feeling for the metal-on-metal tactile sensation^[5]. The appropriate treatment is revision of the position of cross-pin or using any other method of fixation.

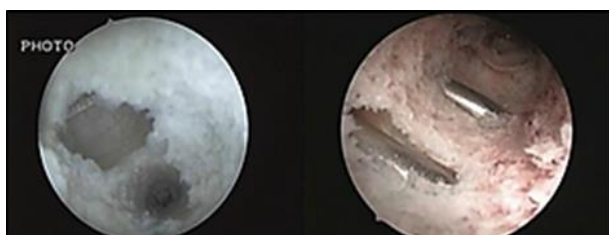


Fig 6: Inaccuracy in positioning the cross-pin

Screw breakage: 0/67

This, again, leads to an unstable fixation and potentiates failure of graft. It can be prevented by adequately tapping the tunnel. In the event of facing undue resistance while fixing the screw, a screw of a smaller diameter can be used. If the screw is already broken, remove the fragments entirely, evaluate the graft, re-tap the tunnel and use a screw of a smaller diameter.

If the screw is outside the tunnel: 0/67

This results in an unstable fixation. It can be prevented by using cannulated screws for fixing the graft. The position of the guide wire should be checked arthroscopically. If this is detected intraoperatively, the screw should be relocated. If it is detected postoperatively, a functional casting is done and the rehabilitation should be less aggressive.

Postoperative complications

Prominence of the tibial screw: 1/67 (1.4%) (Figure 7)

The patient presents with pain during kneeling. It can be prevented by making sure the tibial screw is well within the tunnel and avoiding bulky suturing or knots over the tunnel site. Removal of screw once the graft has completely healed is the appropriate treatment for this condition.



Fig 7: Prominence of the tibial screw which was removed

Breakage of implant or migration of screw after healing: 1/67 (1.4%)

This leads to significant chondral injury. There is an increased suspicion when the patient becomes symptomatic after an asymptomatic period. The ideal treatment would be to remove the implant arthroscopically^[6].

Extension loss-cyclops lesion: 1/67 (1.4%) (Figure 8)

This is a deficit in knee extension and can be prevented by starting extension exercises immediately post-surgery. The rehabilitation protocol must be aggressive and if it fails the cyclops lesion must be removed arthroscopically.

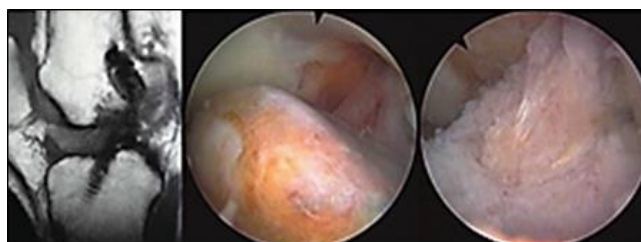


Fig 8: Cyclops lesion

Other complications not related to ACL

Arthrofibrosis of the joint: 1/67 (1.4%) (Figure 9)

It results in a deficit of knee flexion. It can be prevented by an aggressive rehabilitation program. If it does not resolve, the adhesions must be released arthroscopically.

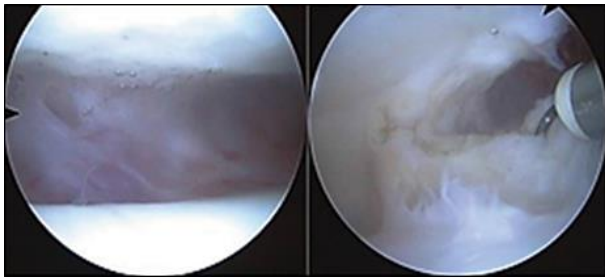


Fig 9: Arthroscopy image of arthrofibrosis of the joint

Infection: 3/67 (4.4%) (Figure 10)

It results in early knee arthritis. It can be prevented by preoperative and perioperative antibiotic coverage. Another alternative is to soak the graft in topical vancomycin to prevent infection. The gold standard of treatment includes cultures, arthroscopic lavage of the joint and synovectomy if necessary. In extremely resistant cases, the graft should be removed in 2 stages and ACL reconstruction is done under the cover of antibiotics [7].

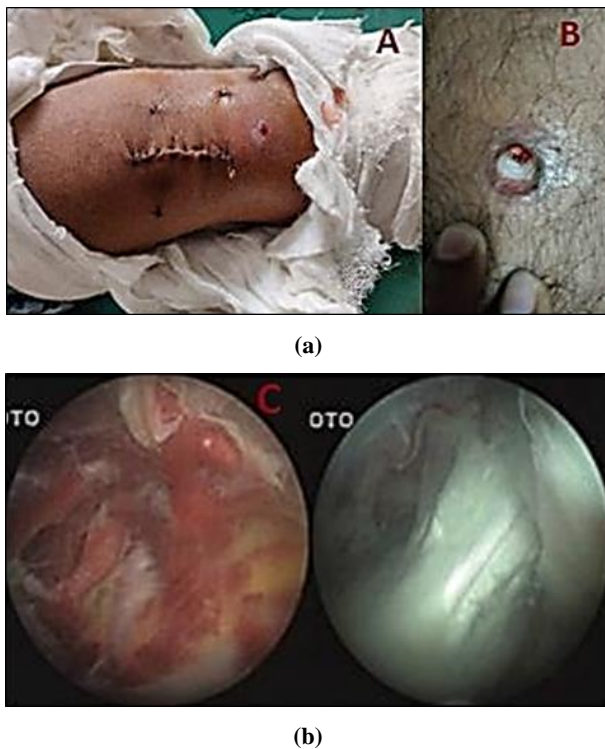


Fig 10: a) Superficial infection with result in, b) Exposure of tibial screw, c) Arthroscopy image of joint during lavage

Deep vein thrombosis leading to pulmonary embolism: 0/67

It is a devastating complication. It presents with pain in the calf, swelling, dysnoea and syncope. It can be prevented by compressive stockings and anticoagulation for a period of 1 month. Immediate referral to the intensive unit may be needed.

Discussion

The surgical reconstruction of the ACL is generally considered to be safe and can be performed under arthroscopic guidance with minimal complications. This article reviews the complications of ACL reconstruction, both intraoperative and postoperative. A similar retrospective study conducted by Stergios *et al.*, [8], but with a larger study group showed similar results. The major limiting drawback of this

study is that it is a retrospective one and a proportion of the complications might have been missed during follow-up. However, majority of the complications such as deficit in the range of motion, sensation loss, and prominence of screws that have been reported in our study have been easily identified in the follow-up.

The intra-operative complications are prone for speculation. For example, the anatomic positions of the tunnels may vary for different surgeons. All the ACL reconstructions in our study were done by the author. The advantage of this study is that it reflects the view point of a single experienced surgeon from one particular orthopaedic department and is therefore of great significant value for all budding ACL surgeons.

The most common post-operative complication encountered after ACL reconstruction with a patellar tendon graft was anterior knee pain attributed to the donor site morbidity while harvesting the graft. However a comparative study between the PTB and hamstring graft conducted by Mohtadi *et al.*, [9] on 330 cases of ACL reconstruction showed no significant difference in the rate of anterior knee pain or stiffness between the two groups which was in accordance with our study.

Another common complication post ACL reconstruction is Arthrofibrosis leading to deficit in the range of motion [10, 11, 12] resulting in higher rates of revision surgeries [13]. We encountered one case of arthrofibrosis which resulted in arthroscopic lavage and release of the adhesions.

With regards to the incidence of complications, it is quintessential that it is addressed appropriately by the surgeon. In our case study we did not experience any case of posterior femoral wall blowout during tunnel drilling, however we did encounter one case of non-anatomic position of the femoral tunnel which was done during the early period of the study. In the subsequent cases we followed the footprint technique for drilling as described by McGuire [14] by which we were able to place the femoral tunnel directly without misplacement or the need for radiographs. In cases where the graft was too thick to be passed into the graft sizer, the edges were trimmed to facilitate the passage of the graft. The most common technical difficulty encountered while using a hamstring graft was during the harvesting procedure. The harvested tendon was short in one case and it was attributed to a premature release of the aponeurotic bands and this occurred in the gracilis tendon. We had three cases of infection of which two cases resolved with antibiotics and one required arthroscopic lavage.

The intraoperative and postoperative complications of ACL reconstruction are not very infrequent and it can be prevented by careful preoperative planning, intraoperative technique and strict postoperative protocols. If the surgeon has enough experience, as in our study, most of the complications can be managed intraoperatively and it will not affect the final outcome. The surgeon must be well experienced in the different types of ACL reconstruction especially the patellar tendon and the hamstring graft and the various fixation techniques to identify the various complications and deal with them.

References

1. Lyman S, Koulouvaris P, Sherman S, Do H, Mandl LA, Marx RG. Epidemiology of anterior cruciate ligament reconstruction. *J Bone Joint Surg Am* 2009;91:2321-8.
2. Azar FM, Arthur ST. Complications of anterior cruciate ligament reconstruction. *Techniques in Knee Surgery* 2004;3(4):238-250.

3. Khan M, Rothrauff BB, Merali F, Musahl V, Peterson D, Ayeni OR. Management of the contaminated anterior cruciate ligament graft. *Arthroscopy* 2014;30(2):236-44.
4. Papastergiou SG, Voulgaropoulos H, Mikalef P, Ziogas E, Pappis G, Giannakopoulos I. Injuries to the infrapatellar branch(es) of the saphenous nerve in anterior cruciate ligament reconstruction with four-strand hamstring tendon autograft: Vertical versus horizontal incision for harvest. *Knee Surg Sports Traumatol Arthrosc* 2006;14(8):789-93.
5. Papastergiou SG, Koukoulis NE, Dimitriadis T, Pappis G, Parris CA. RigidFix Femoral Fixation: A Test for Detecting Inaccurate Cross Pin Positioning. *Arthroscopy* 2007;23(11):1247-3.
6. Papastergiou SG, Koukoulis NE, Ziogas E, Dimitriadis T, Voulgaropoulos H. Broken bioabsorbable femoral cross-pin as a cause of a chondral lesion after anterior cruciate ligament reconstruction. *BMJ Case Rep* 2009: bcr09.2008.0883.
7. Phegan M, Grayson JE, Vertullo CJ. No infections in 1300 anterior cruciate ligament reconstructions with vancomycin pre-soaking of hamstring grafts. *Knee Surg Sports Traumatol Arth.*
8. Papastergiou, Stergios, Koukoulis, Nikolaos, Dimitriadis, Theophilos, Kalivas, Efstathios, Papavasiliou A, Ziogas, Evangelos. Atlas of complications in anterior Cruciate Ligament Reconstruction. *Journal of Research and Practice on the Musculoskeletal System* 2018;02:136-143. 10.22540/JRPMS-02-136. *Rosc* 2016; 24(9):2729-35.
9. Mohtadi, Nicholas G, MD, MSc, FRCSC ^[1, 2]; Chan Denise S. MBT, MSc ^[1]. A Randomized Clinical Trial Comparing Patellar Tendon, Hamstring Tendon, and Double-Bundle ACL Reconstructions, *The Journal of Bone and Joint Surgery* 2019;101(11):949-960. doi: 10.2106/JBJS.18.01322
10. Cosgarea AJ, DeHaven KE, Lovelock JE. The surgical treatment of arthrofibrosis of the knee. *Am J Sports Med* 1994;22(2):184-191.
11. McMahon PJ, Dettling JR, Yocum LA, Glousman RE. The cyclops lesion: a cause of diminished knee extension after rupture of the anterior cruciate ligament. *Arthroscopy* 1999;15(7):757-761.
12. Valencia H, Gavín C. Infrapatellar heterotopic ossification after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2007;15(1):39-42
13. Hettrich CM, Dunn WR, Reinke EK, MOON Group, Spindler KP. The rate of subsequent surgery and predictors after anterior cruciate ligament reconstruction: two- and 6-year follow-up results from a multicenter cohort. *Am J Sports Med* 2013;41(7):1534-1540.
14. McGuire DA, Wolchok JW. The footprint: A method for checking femoral tunnel placement. *Arthroscopy* 1998;14:777- 778.