A Newer Technique of Extended Cortical Fixation to Salvage Intratunnel Blowout during Revision Anterior Cruciate Ligament Reconstruction – A Case Report

Madan Mohan Sahoo¹, Udit Sourav Sahoo¹, Susanta Kumar Sena¹

Learning Point of the Article:
Intra-tunnel blowout during revision ACL reconstruction can be managed with a suture disc as a readily available, cost-effective alternative to extended cortical suspension buttons in a less invasive manner.

Abstract
Introduction: Posterior femur wall blowout and consequent loss of femoral graft fixation are commonly encountered distally at the aperture of the tunnel facing into the joint during anterior cruciate ligament (ACL) reconstruction. However, intratunnel blowout of femoral tunnel at its outer cortical opening during a revision ACL reconstruction is very rare. It compromises the mechanical strength of the cortical bone at the tunnel opening on lateral cortex, making it weaker for providing stability to endobutton. We report this very rare event of intratunnel blowout of femoral tunnel at its proximal opening on the lateral femoral cortex during a revision ACL reconstruction, where the patient was treated with a modification in the suspensory fixation technique using a suture disc.

Case Report: Two years following a primary ACL reconstruction, our patient presented with a lax knee. Radiography and magnetic resonance imaging images showed malpositioning of femoral endobutton, lax, and degenerated autograft. During revision, we encountered intratunnel blowout at outer opening on lateral femoral cortex. It was rescued with a modification in the suspensory fixation technique by tying the endobutton with a suture-disc, placed directly over the proximal opening of femoral tunnel on lateral cortex.

Conclusion: Our case report highlights, this rare critical surgical event during revision ACL reconstruction managed successfully with a suture disc, which is cost-effective, readily available and using the same prepared graft within a lesser operative time. Functional outcome was excellent and usage of a suture disc.

Keywords: Anterior cruciate ligament reconstruction, intratunnel blowout, Revision ACL reconstruction.

Introduction
Arthroscopic anterior cruciate ligament (ACL) reconstruction is a very common procedure performed globally among young, active, and athletic patients. Success rate of restoring knee stability ranges from 85% to 95% in the primary setting [1, 2, 3]. Many series of failure of primary ACL reconstructions are being increasingly reported with time, which can be expected to occur with the hike in number of primary reconstructions. Failures are grouped into three categories: Biological failure, traumatic failure and the most common, surgical technique failure [4]. Improper tunnel placement is the most common error in surgical technique, identified in 70–80% of failed ACL reconstructions [5]. Malpositioning of the femoral tunnel is a common source of these technical failures. If a femoral tunnel is placed too posteriorly, it may result in “blowout” or cortical violation of the posterior wall [6, 7]. This error can go unrecognized intraoperatively and may be a potential source of failure. This case report presents a rare occurrence of intratunnel posterior wall blowout of femoral tunnel at its proximal opening which was diagnosed intraoperatively and salvaged successfully with a novel method of modification in suspensory fixation technique.

Author’s Photo Gallery

1Department of Orthopedic Surgery, SCB Medical College and Hospital, Cuttack, Odisha, India.
Address of Correspondence:
Dr. Udit Sourav Sahoo,
Department of Orthopedic Surgery, SCB Medical College and Hospital, Cuttack, Odisha, India.
E-mail: uditsoursavshoo@gmail.com

Access this article online
Website: www.jocr.co.in
DOI: 10.13107/jocr.2020.v10.i08.1858

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/3.0) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Case Report

A 30-year-old male, recreational badminton player, having a body mass index of 29.6 /m2 kg was referred to our tertiary care center for evaluation and treatment of pain and instability of the right knee joint. Patient had a history of arthroscopic ACL reconstruction 2 years ago with ipsilateral hamstrings tendon graft by “all-inside” technique. However, the patient continued to have instability of knee in the form of giving way feel while walking on uneven ground and climbing stairs postoperatively which continued throughout the past 2 years. On clinical examination, Lachman test was Grade 3 and anterior drawer was positive. Pivot shift, McMurray, dial test, and varus/valgus stress tests were negative. Range of knee movements were within normal limits.

Pre-operative radiograph showed two endobuttons, one each on femoral and tibial bones. Endobutton on the femoral side was seen to be posteriorly, inferiorly, and medially positioned in anteroposterior and lateral view radiographs (Fig. 1). Magnetic resonance imaging (MRI) confirmed the above findings and showed the reconstructed graft to be lax and degenerated. Discontinuity of graft fibers was apparent in both T1 and T2 images (Fig. 2). Complete blood count, erythrocyte sedimentation rate, and C-reactive protein were within normal limits.

We planned to do a revision single bundle anatomic ACL reconstruction arthroscopically with peroneus longus autograft after shaving off the ACL graft remnants of primary surgery and retrieving the endobuttons.

Under anesthesia in the operating room, re-examination confirmed our clinical findings of positive Lachman and anterior drawer tests. Diagnostic arthroscopy showed torn ACL graft remnants with only a few continuous fibers. Non-absorbable sutures were also seen in the reconstructed ACL graft substance at the femoral end, suggesting failure of fixation and graft backing out into the joint space. Laxity and loss of tension were evident on probing the graft. Graft remnants were shaved and sutures removed after cutting with arthroscopic knife. The tibial endobutton was approached and removed from outer aspect along with its sutures with gentle traction. Peroneus longs graft was harvested and prepared with an adjustable loop device (Ultrabutton, Smith, and nephew). With knee hyperflexed, offset femoral drill guide was used to insert femoral guidewire at the junction of posterior intercondylar ridge and bifurcate ridge. After reaming, the tunnel was inspected for any cortical breach posteriorly or laterally through anteromedial portal. Tibial tunnel was prepared as per the standard procedure. Femoral tunnel shuttling suture was retrieved through tibial tunnel and prepared graft was passed. When it was felt that endobutton had been flipped, graft was pulled back through tibial tunnel until seating of the button securely against femoral cortex. All the steps were executed successfully as per planning until this stage. Then, knee joint was taken through a number of cycles of flexion-extension in 0°–135° range, while traction was being maintained on the graft at tibial end. After around 20 cycles, a sudden loss of resistance was felt. Nearly one-third of the graft had come out through tibial tunnel and on arthroscopic view; endobutton was seen to have backed out into the joint. We again examined the femoral tunnel toward its inner opening through anteromedial portal and posterior cortical rim was found to be intact. Mechanical strength of the cortex was felt to be adequate on probing at this level. Intraoperative fluoroscopic imaging also did not show any posterior wall fracture. To know the condition of outer opening of femoral tunnel, the condyle was exposed with a lateral longitudinal incision over the knee. We noted collapse of the cortical bone toward posterior aspect of the opening of the
tunnel with compromised mechanical strength, through which the endobutton was backing out into the tunnel (Fig. 3). We did not have any specialized extended cortical suspension buttons (XtendoButton; Smith and Nephew) with us, and decided to use a suture disc in a similar manner. The ultrabutton was passed through one of the holes in suture disc (Fig. 4) and the green colored suture was looped across the suture disc which was placed directly over the lateral cortex. Graft was passed, finger loop was pulled for initial loop reduction and then tail bridge was pulled for final loop reduction. After cycling the knee 10 times, interference screw was inserted retrograde into the tibial tunnel while holding maximum manual tension on the graft with knee in 20° flexion. Graft was confirmed to be in anatomical position with appropriate tension on probing.

Knee extension brace was given postoperatively. Static exercises began on 2nd post-operative day. Range of movement exercises started on 4th post-operative day. Partial weight bearing continued through 3rd post-operative week and full weight bearing with crutches through 7th post-operative week. By the end of 10th week, full flexion and painless unaided walking was possible. Recreational sports were allowed at the end of 5th month. At 2 years follow-up, knee was stable, painless. X-ray radiographs and computed tomography (CT) scan images showed the fixation devices in their usual position with proper tunnel placement.

Discussion

Suspensory fixation on femoral side is commonly used for ACL reconstruction with soft-tissue graft. For this fixation to be utilized, it is considered imperative that the lateral femoral cortex is intact. Anatomic femoral tunnel techniques through the anteromedial portal approach are susceptible to an increased incidence of posterior femur wall blowout and consequent loss of femoral graft fixation compared to transtibial approach [8]. Blowout can occur at three different levels: (1) Distally at the aperture of the tunnel facing into the joint, (2) within the tunnel just proximal to the aperture, and (3) more proximally at the outer opening of the tunnel on lateral femur cortex [9, 10, 11, 12], the third one being the rarest variety. If the knee is not maintained at around 90° flexion throughout the femoral tunnel drilling process, then possibility of intratunnel blowout increases at a more proximal level [12]. In some situations of revision ACL reconstructions, the previously placed femoral tunnel may be found to have weakened the femoral cortex due to osteolysis and risk of cortical breach is further increased. In pre-operative T2-MRI axial sections of our case, the old femoral tunnel of the primary surgery was visibly enlarged toward the lateral femoral cortex probably due to osteolysis which might have weakened the mechanical strength and caused eventual collapse of the cortical bone of the new tunnel at its outer opening (Fig. 5). If these cortical blowouts are not promptly recognized and appropriately treated, the graft is at risk of premature failure [12, 13]. Thus, in these situations, diagnosing this complication intraoperatively and knowing strategies for alternative or salvage fixation are of paramount importance.

Many surgeons would attempt bone tunnel re-drilling and some other method of fixations as salvage measures. These measures are likely to increase the duration of surgery, cost, and morbidity to the patient. To escape from such incidences, some surgeons deliberately drill the femoral tunnel more forward which then may cause impingements due to inappropriate location of autograft. Extended cortical fixation methods have come up as better alternatives in such conditions, since we could utilize the same tunnel, provided some of the mechanical strength of lateral cortex is intact.

If the cortical defect is minimal as in case of intratunnel blowout at the external opening of the tunnel, it may be possible to continue with planned suspensory fixation. Commercially, available cortical suspension devices are easier to use in salvage situations. If the lateral femoral cortex is not breached to a greater extent, then specialized extended cortical suspension buttons, available in lengths up to 20 mm (XtendoButton; Smith and Nephew) can be used. The benefits of these devices are that the original graft can still be used, indeterminate of whether it was a bone-tendon-bone or a soft-tissue graft. This also lessens the duration of surgery and minimizes soft-tissue dissection as compared to augmentation with screw and post [14, 15]. However, these are costly and availability during the crisis situation is an issue.

We have used suture disc in our case in a similar manner as an extended cortical suspension button. Suture disc having a larger diameter than endobutton, was placed directly over the lateral cortex and endobutton was passed through one of its holes while still attached to the native graft. After the fixation was complete, the non-absorbable green suture of the endobutton was tied with suture disc to prevent any slippage and again knotted with the white suture for additional safety measure. CT scan images at 2 years showed the device to be stable in its position.
position (Fig. 6a, b). It was more cost-effective, readily available, used the same prepared graft along with the Ultrabutton (Smith and nephew), and needed minimal soft-tissue dissection laterally than screw and post. It consumed less time, since the same graft preparation could be utilized along with the adjustable loop and we did not need loop removal and re-whip stitching with non-absorbable sutures at the proximal end of the graft which would have been needed with screw and post fixation.

Conclusion

Our case report highlights a novel technical modification to utilize suture disc as a cost effective and readily available alternative to extended cortical suspension buttons as a salvage measure of an intratunnel blowout of femoral tunnel at its outer opening during a revision ACL reconstruction. We could achieve excellent functional outcome, consumed lesser operative time with minimal soft-tissue dissection.

Clinical Message

Intratunnel blowout of femoral tunnels at its outer opening should be kept in mind of the operating surgeon despite being a rare complication, particularly during revision ACL reconstructions. Osteolysis around the previous tunnel can compromise the mechanical strength and contribute to this type of problems. This present case could be salvaged intraoperatively with a modification in suspensory fixation technique using a suture disc as a cost-effective and readily available alternative to extended cortical suspension buttons.

References

1. Bach B, Tradonsky S, Bojchuk J, Levy M, Bush-Joseph C, Khan N. Arthroscopically assisted anterior cruciate ligament reconstruction using patellar tendon autograft: Five- to nine-year follow-up evaluation. Am J Sports Med. 1998;26:20-29.

2. Noyes FR, Barber-Westin SD. A comparison of results in acute and chronic anterior cruciate ligament ruptures of arthroscopically assisted autogenous patellar tendon reconstruction. Am J Sports Med. 1997;25:460-471.

3. Shelbourne KD, Gray T. Anterior cruciate ligament reconstruction with autogenous patellar tendon graft followed by accelerated rehabilitation: A two- to nine-year follow-up. Am J Sports Med. 1997;25:786-795.

4. Fagelman M, Freedman KB. Revision reconstruction of the anterior cruciate ligament: Evaluation and management. Am J Orthop. 2005;34:319-328.

5. Wetzler MJ, Bartolozzo AR, Gillespie MJ, Miller LS. Revision anterior cruciate ligament reconstruction. Operative Techniques in Orthopedics. 1996;6:181-189.

6. Cain EL Jr, Gillogly SD, Andrews JR. Management of intraoperative complications associated with autogenous patellar tendon graft anterior cruciate ligament reconstruction. Instr Course Lect. 2003;52:359-367

7. Getelman MH, Friedman MJ. Revision anterior cruciate ligament reconstruction surgery. J Am Acad Orthop Surg. 1999;7:189-198.

8. Pastrone A, Ferro A, Bruzzone M, et al. Anterior cruciate ligament reconstruction creating the femoral tunnel through the anteromedial portal. Surgical technique. Curr Rev Musculoskelet Med. 2011;4:52-56.

https://doi.org/10.1007/s12178-011-9078-7.

9. Hammond KE, Potini V, Dierckman BD, Xerogeanes JW, Labib SA. Femoral tunnel “blowout” during ACL reconstruction: a biomechanical analysis (SS-65). Arthroscopy. 2011;27:e64-e65.

10. Herbert M, Heletta S, Raschke MJ, et al. Accidental perforation of the lateral femoral cortex in ACL reconstruction: an investigation of mechanical properties of different fixation techniques. Arthroscopy. 2012;28:382-389.

11. Provencher MT. Anterior cruciate ligament surgery. Orthopedics. 2008;31:561-564.

12. Rue JH, Busam ML, Detterline AJ, Bach BR Jr. Posterior wall blowout in anterior cruciate ligament reconstruction—avoidance, recognition, and salvage. J Knee Surg. 2010;21:235-240.

13. Chen JL, Allen CR, Stephens TE, et al. Differences in mechanisms of failure, intraoperative findings, and surgical characteristics between single- and multiple-revision ACL reconstructions: a MARS cohort study. Am J Sports Med. 2013;41:1571-1578.

14. Conner CS, Perez BA, Morris RP, Buckner JW, Buford WL, Ivey FM. Three femoral fixation devices for anterior cruciate ligament reconstruction: comparison of fixation on the lateral cortex versus the anterior cortex. Arthroscopy. 2010;26:796-807.

15. Kamelger FS, Onder U, Schmoelz W, Tecklenburg K, Arora R, Fink C. Suspensory fixation of grafts in anterior cruciate ligament reconstruction: a biomechanical comparison of 3 implants. Arthroscopy. 2009;25:767-776.
