SN Comprehensive Clinical Medicine (2023) 5:221
https://doi.org/10.1007/s42399-023-01553-6

CASE REPORT

TKA Complications in 80-Year-Old Patient: a Case Report

Sujoy Bhattacharjee[1] · Abhishek Mehta[2] · Mohammad Jamshed[2]

Accepted: 19 August 2023

Abstract
Ankylosing spondylitis (AS) is characterized by osteoproliferation-induced axial skeleton and sacroiliac joint damage that leads to spinal deformity and functional disability; up to 70% of patients have knee and other joint involvement and may require total joint replacement despite adequate pharmacological support Total knee arthroplasty (TKA) is an effective procedure in an AS patient but very little has been reported on the outcomes. But the peculiar gait pattern due to ankylosed joints, which do not improve substantially after TKA, increases the incidence of falls, leading to complications. An 80-year-old Asian male with primary TKA suffers extensor mechanism disruption and medial collateral ligament injury after a fall and undergoes rotating-hinge knee and patellar tendon repair augmented with semi–T graft. The patient could initially achieve early weight-bearing with splint support, later with the cylindrical cast. Rotating-hinge knee is a viable option in low-demand patients with good outcomes in patients with collateral ligament rupture. Semi–T augmented PT repair reinforced with suture anchors gives the relatively best result.

Keywords Revision total knee arthroplasty · Rotating-hinge knee · Extensor mechanism disruption · Patellar tendon repair · Semitendinosus graft · Ankylosing spondylitis

Introduction

Seronegative spondyloarthropathies, which include the chronic inflammatory disorder known as AS, typically affect the axial skeleton and the sacro-iliac joints and can cause spinal deformity, functional disability, and severe pain and stiffness [1, 2].

However, research has revealed that the hips, knees, and other joints are affected in 25 to 70% of patients [3]. Additionally, sagittal imbalance brought on by spinal deformities can affect knee flexion, worsening disability and increasing joint pain and falls [4].

The extensor mechanism disruption (EMD) during or after total knee arthroplasty (TKA) significantly incapacitates the patients. It presents the surgeon with a therapeutic challenge primarily if it would have been associated with any other collateral ligament rupture [5]. The proximal and distal EMD involving quadriceps and patellar tendons is reported in 0.17–2.5% of all TKA and is multifactorial [6, 7].

The combination of EMD and collateral ligament rupture in the post-TKA patient is even more challenging; as the majority of surgical methods available to manage EMD give disappointing results, even things become more complicated when associated with revision knee surgery; also, there are no clear guidelines regarding rehabilitation protocol and extent of improvement [8, 9]. We are presenting a case with EMD rupture and medial collateral ligament (MCL) rupture, post-TKA, treated by revising primary knee implant with RHK and a novel surgical technique of patellar tendon repair and augmentation with semi–T graft and PERMA Tape with encouraging results for EMD.

This article is part of the Topical Collection on *Surgery*

✉ Sujoy Bhattacharjee
drsujoy1972@gmail.com

Abhishek Mehta
mehta07abhi@gmail.com

Mohammad Jamshed
jamshed.ucms@gmail.com

[1] Robotic Joint Replacement, Sarvodaya Hospital, Faridabad, Haryana, India

[2] Advanced Robotic Arthroplasty, Sarvodaya Hospital, Faridabad, Haryana, India

Published online: 09 September 2023

Case Presentation

An eighty-year-old Asian male patient, with known case of AS, was admitted with severe osteoarthritis (OA) in both knees and substantial neurological involvement in both lower limbs and typical AS presentation with a stiff neck, lower back, and chest involvement. He underwent cemented bilateral total knee replacement in a single sitting with a cruciate retaining implant (Aesculap AS) under computer navigation in August 2019. Tourniquet was not used, the patella was not everted, flexion and extension gap were perfectly matched, and implantation placement was uneventful (Fig. 1).

Weight-bearing with support was started within 12 h post-surgery; the patient had a range of motion (ROM) from 0 to 900 on the 4th postoperative day (Fig. 2). He recovered satisfactorily and started walking with minimal support after a month.

The patient suffered a fall in April 2020, sustaining an injury to the right knee. After the injury, the patient was able to stand but had pain; he self-medicated, applied a splint, and started walking with support with gradually increasing pain and deformity. He reported to us in May 2020 in a wheelchair.

On examination of the right knee, there was tenderness at the medial joint line; the patella was situated higher than normal, with no erythema and local rise of temperature or effusion. On examination with a valgus stress test, there was a medial opening. The patella was high up with lateral

Fig. 2 Post-primary total knee arthroplasty X-rays

Fig. 1 Pre-surgery X-rays

subluxation on flexing knee and increased lateral translation of the patella with extension lag.

Right-side medial opening and patella alta on the X-rays led to the diagnosis of EMD and MCL rupture. The situation was explained to the patient and a revision surgery was planned for the patient (Fig. 3).

On exploration, MCL was avulsed from the tibial end and patellar tendon from tibial tuberosity with 7- to 9-cm proximal migration of the patella and extensive fibrosis in between with significant contracture of the lateral retinaculum.

We decided to revise the primary knee implant with a rotating-hinge knee implant to deal with MCL and semi–T augmented, 5-mm suture anchor–assisted patellar tendon repair for the extensor mechanism disruption.

The knee was thoroughly debrided after removing the primary knee implant and the cement mantle. Rotating-hinge knee (Zimmer) was done with 12-mm tibial articular surface insert; no metal augment was used since there was no bone loss.

The semitendinosus tendon was harvested through the same incision using a tendon stripper and 310 mm tendon length with 4 mm width prepared and augmented with PERMA Tape to increase the strength of construct. After thorough debridement of the patella, the subperiosteal elevation of the quadriceps tendon, and the release of lateral contracted retinaculum of the patella, a single 4-mm wide tunnel was transversely drilled through the patella, and a 6-mm-width hole was drilled horizontally into the tibial tuberosity.

The surgical procedure involves passing the free end of the graft to the medial through the patella, putting 5-mm anchors at the upper lateral part of the tuberosity, passing each side graft simultaneously through the tibia tunnel then tying the superior surface of the tuberosity, using a separate knot for graft and PERMA Tape while keeping the 30 knees in flexion, and suturing the inner part of the tendon with anchor threads to augment the repair (Fig. 4).

Without tension, a 90° intraoperative flexion could be easily accomplished. Postoperative radiographs demonstrated a good patellar height restoration. The patient was given a posterior splint and allowed full weight-bearing for 12 h. The first post-op dressing was done on the 3rd post-op day when the ROM at the knee was also assessed; the patient could do full extension at the knee with flexion up to 700 and convert to a cylinder cast for 4 weeks (Fig. 5).

There is no description of combined lesion of MCL and EMD following post-primary TKA in old-age patients in the literature. The biological repair of both ligaments may have an uncertain outcome, specially MCL, which needs rigid fixation with good strength of harvested autologous ligaments, which could be doubtful in such elderly patients.

Fig. 3 Radiographs taken after fall showing patella alta and medial opening on the right side

Fig. 4 Immediate postoperative AP and lateral X-rays

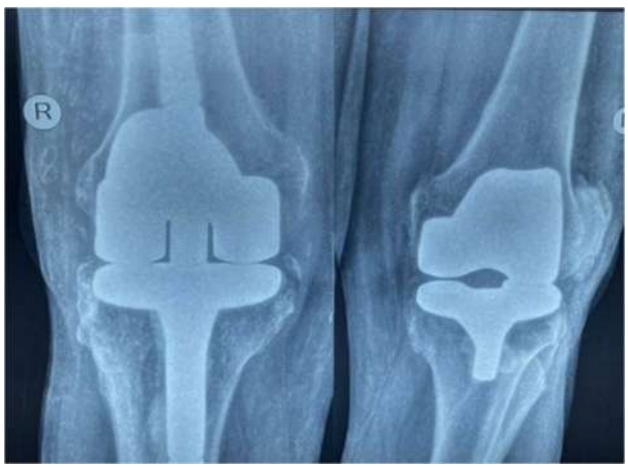

Fig. 5 Thirteen-month follow-up AP and lateral follow-up X-rays

Rotating-hinge implants are an evolution of fixed hinge models, which combine the flexion-extension movement with rotation, improving movement mechanics and decreasing stress transmission with the fixation [4, 10]. In a revision TKA, indications for a rotating hinge or a pure hinge implant include infection, loosening, instability, and bone loss [11]. Hinge prostheses are a solution for instability in more severe cases. Still, they have the disadvantage of a higher stress transmission to the bone-implant interface and a non-physiological movement pattern [10, 12, 13]. The rotating -hinge design is desired since it decreases the stress on the fixation and allows a more physiological movement of the knee [4, 10].

Prosthetic revisions with a modular rotating-hinge design were studied by Barrack et al. in 2000. They suggested that the second-generation modular rotating-hinge component can be used successfully in selected salvage revision cases [14].

Dislocation of rotating-hinge TKAs was studied biomechanically by Ward et al. in 2003. Stability and laxity were greater at any given level of articular distraction when the stem was shorter, and its taper was greater [15].

A review of the literature on rotating-hinge prostheses for complex revision TKA was published in 2018 by Kouk et al. Rotating-hinge knee implants had a 10-year survival rate ranging from 51 to 92.5 % in this study. 9.2 to 63% of patients experienced complications, with infection and aseptic loosening being the most common [16].

There is good long-term survival in the range of 51 to 92.5 % at 10 years postoperatively for rotating-hinge knee implants, according to Rodríguez-Merchán in 2019 [11].

With a mean follow-up of 50 months, Rand et al. examined 36 prostheses (19 primary, 17 revision). They concluded that an implant should be used in case of functional absence of a collateral ligament that cannot be managed by soft tissue reconstruction [17].

According to Burnett et al. [18], tensioning the allograft at full extension is a crucial success factor. Using allograft tissue raises issues with immune response, disease transmission, and graft strength. Deep freezing of the allograft has significantly reduced the risk of an immune response, but graft failure is always possible. In patients who had previously had a total knee replacement, promising early results were reported after using an extensor mechanism allograft to reconstruct a failed extensor mechanism [19, 20].

When Achilles tendon allografts were used with extensor mechanism repair, Crossett et al. found that patients had better walking and less extensor lag 3 months after surgery [21]. In the case of chronic tissue loss and infection due to patellar tendon rupture, Mittal et al. found that direct repair without augmentation could not be replicated [22].

According to Anand et al., utilising a semitendinosus autograft is successful, is easily repeatable, and does not call for additional surgery to remove the implant [9]. Only 25% of patients who underwent direct repair of the extensor mechanism had a successful outcome, according to Dobbs et al.'s analysis of 18 knees treated for patellar tendon rupture following TKA [23].

Human ligamentous grafts in young cadaveric specimens were studied by Noyes and colleagues and found that the semitendinosus tendon had superior mechanical properties to the grafts of the gracilis [24].

Combination injuries of MCL and EMD in the post-TKA patient are rare. Disruption of the extensor mechanism results in a crippling loss of knee function. Although the extensor mechanism and these disruptions can happen anywhere, the compromised patellar ligament insertion that follows surgery is most likely to be the cause of patellar ligament disruptions. There are many factors to consider when deciding how to treat an extensor mechanism injury: the extent of the injury, the degree of functional loss, the type of injury (patellar, patella, or quadriceps tendon), and the availability of viable tissue for either direct primary repair or augmentation. Suturing, stapling, or wiring tendons to the tubercle is an option for direct repair, as is a primary repair with a biologic or synthetic graft or allograft. Primary repair is unlikely to restore extensor function following a total knee replacement. Autogenous tissue grafts that improve extensor mechanism reconstruction include the semitendinosus and gracilis tendon, free fascia lata graft, plantaris tendon, and gastrocnemius muscle flap. Although trauma was the initial cause of the EMD and MCL rupture in our case, a more likely explanation could be an ageing, inherently weak tendon that ruptured from sudden stretching as a result of trauma and then migrated proximally as a result of neglect. In this instance, direct primary repair of the EM was not possible, and the most difficult part was to lower the patella.

Conclusion

Patients with collateral ligament rupture often have favourable outcomes after undergoing the rotating-hinge knee procedure. This procedure is an option worth considering for low-demand patients. The relatively best result can be achieved by performing a semi–T augmented PT repair that is then reinforced with suture anchors. The current research suggests that similar approaches should be taken for such neglected ruptures because doing so guarantees a very satisfying result.

Abbreviations *AS*: Ankylosing spondylitis; *TKA*: Total knee arthroplasty; *EMD*: Extensor mechanism disruption; *MCL*: Medial collateral ligament; *OA*: Osteoarthritis

Author Contribution SB, AM, and MJ: conceptualization and resources.
SB: writing, reviewing, and editing.
SB and AM: formal analysis and investigation.

Data Availability Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Code Availability Not applicable.

Declarations

Ethics Approval Not applicable.

Consent to Participate Written informed consent was obtained from the patient for participation in this case report.

Consent for Publication Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing Interests The authors declare no competing interests.

References

1. Robertsson O, Dunbar M, Knutson K, Lewold S, Lidgren L. Validation of the Swedish Knee Arthroplasty Register: a postal survey regarding 30,376 knees operated on between 1975 and 1995. Acta Orthop Scand. 1999;70:467–72. https://doi.org/10.3109/17453679909000982.
2. Ong KL, Mowat FS, Chan N, Lau E, Halpern MT, Kurtz SM. Economic burden of revision hip and knee arthroplasty in Medicare enrollees. Clin Orthop Relat Res. 2006;446:22–8. https://doi.org/10.1097/01.blo.0000214439.95268.59.
3. Callaghan JJ, O'Rourke MR, Liu SS. The role of implant constraint in revision total knee arthroplasty. J Arthroplast. 2005;20:41–3. https://doi.org/10.1016/j.arth.2005.03.008.
4. Barrack RL. Evolution of the rotating hinge for complex total knee arthroplasty. Clin Orthop Relat Res. 2001;392:292–9. https://doi.org/10.1097/00003086-200111000-00038.
5. Freeman PA. Walldius arthroplasty. A review of 80 cases. Clin Orthop Relat Res. 1973;85–91.
6. Jones EC, Insall JN, Inglis AE, Ranawat CS. GUEPAR knee arthroplasty results and late complications. Clin Orthop Relat Res. 1979;145–52.
7. Postler A, Lützner C, Beyer F, Tille E, Lützner J. Analysis of total knee arthroplasty revision causes. BMC Musculoskelet Disord. 2018;19:55. https://doi.org/10.1186/s12891-018-1977-y.
8. Cadambi A, Engh GA. Use of a semitendinosus tendon autogenous graft for rupture of the patellar ligament after total knee arthroplasty. A report of seven cases. J Bone Joint Surg Am. 1992;74:974–9.
9. Anand S, Kanwat M, Mishra A, Mittal R, Yadav CS. Management of patellar tendon rupture after total knee arthroplasty using hamstring graft: a case report. J Orthop Case Rep. 2018;8(57–60) https://doi.org/10.13107/jocr.2250-0685.1050.
10. Pour AE, Parvizi J, Slenker N, Purtill JJ, Sharkey PF. Rotating hinged total knee replacement. J Bone Joint Surg. 2007;89:1735–41. https://doi.org/10.2106/JBJS.F.00893.
11. Rodríguez-Merchán EC. Total knee arthroplasty using hinge joints: indications and results. EFORT Open Rev. 2019;4:121–32. https://doi.org/10.1302/2058-5241.4.180056.
12. Heim CS, Greenwald AS. Implant bearings in total knee arthroplasty. In: Revision Total Knee Arthroplasty; 2017. p. 9–26. https://doi.org/10.1007/978-3-319-67344-8_2.
13. Springer BD, Hanssen AD, Sim FH, Lewallen DG. The kinematic rotating hinge prosthesis for complex knee arthroplasty. Clin Orthop Relat Res. 2001:283–91. https://doi.org/10.1097/00003086-200111000-00037.
14. Barrack RL, Lyons TR, Ingraham RQ, Johnson JC. The use of a modular rotating hinge component in salvage revision total knee arthroplasty. J Arthroplast. 2000;15:858–66. https://doi.org/10.1054/arth.2000.9056.
15. Ward WG, Haight D, Ritchie P, Gordon S, Eckardt JJ. Dislocation of rotating hinge total knee prostheses. A biomechanical analysis. J Bone Joint Surg Am. 2003;85:448–53. https://doi.org/10.2106/00004623-200303000-00008.

16. Kouk S, Rathod PA, Maheshwari AV, Deshmukh AJ. Rotating hinge prosthesis for complex revision total knee arthroplasty: a review of the literature. J Clin Orthop Trauma. 2018;9:29–33. https://doi.org/10.1016/j.jcot.2017.11.020.
17. Rand JA, Chao EY, Stauffer RN. Kinematic rotating-hinge total knee arthroplasty. J Bone Joint Surg Am. 1987;69:489–97.
18. Burnett RSJ, Berger RA, Della Valle CJ, Sporer SM, Jacobs JJ, Paprosky WG, Rosenberg AG. Extensor mechanism allograft reconstruction after total knee arthroplasty. J Bone Joint Surg Am. 2005;87(Suppl 1):175–94. https://doi.org/10.2106/JBJS.E.00442.
19. Burnett RSJ, Berger RA, Paprosky WG, Della Valle CJ, Jacobs JJ, Rosenberg AG. Extensor mechanism allograft reconstruction after total knee arthroplasty. A comparison of two techniques. J Bone Joint Surg Am. 2004;86:2694–9. https://doi.org/10.2106/00004623-200412000-00016.
20. Barrack RL, Stanley T, Allen Butler R. Treating extensor mechanism disruption after total knee arthroplasty. Clin Orthop Relat Res. 2003;416:98–104. https://doi.org/10.1097/01.blo.0000092993.90435.69.
21. Crossett LS, Sinha RK, Sechriest VF, Rubash HE. Reconstruction of a ruptured patellar tendon with Achilles tendon allograft following total knee arthroplasty. J Bone Joint Surg Am. 2002;84:1354–61. https://doi.org/10.2106/00004623-200208000-00010.
22. Mittal R, Kumar N, Yadav C, Kumar A. Direct repair without augmentation of patellar tendon avulsion following TKA. Case Rep Orthop. 2015;2015:391295. https://doi.org/10.1155/2015/391295.
23. Dobbs RE, Hanssen AD, Lewallen DG, Pagnano MW. Quadriceps tendon rupture after total knee arthroplasty. Prevalence, complications, and outcomes. J Bone Joint Surg Am. 2005;87:37–45. https://doi.org/10.2106/JBJS.D.01910.
24. Noyes FR, Butler DL, Grood ES, Zernicke RF, Hefzy MS. Biomechanical analysis of human ligament grafts used in knee-ligament repairs and reconstructions. J Bone Joint Surg Am. 1984;66:344–52.