International Journal of Research and Review
Vol. 10; Issue: 12; December 2023
Website: www.ijrrjournal.com
Case Report *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Periprosthetic Osteolysis (PPOL) Following Total Knee Arthroplasty (TKA) Treated with Hybrid Semiconstrained Prosthetic Revision: A Case Report

Sri Mahadhana[1], Nyoman Gede Grenata Nanda Ustriyana[1], I Wayan Suryanto Dusak[1]

[1]Orthopaedic and Traumatology Department, Prof. IGNG Ngoerah General Hospital Denpasar, Faculty of Medicine Udayana University, Denpasar, Bali, Indonesia.

Corresponding Author: Sri Mahadhana

DOI: https://doi.org/10.52403/ijrr.20231284

ABSTRACT

Periprosthetic Osteolysis (PPOL) is a significant complication following total knee arthroplasty (TKR), often leading to the need for surgical revisions. The precise etiology of aseptic loosening and PPOL remains unclear, but it is a growing problem due to an aging population and increased demand for TKR implants.

A 70-year-old female presented with left knee pain following a fall. She had previously undergone left and right TKR due to osteoarthritis. X-rays revealed a dislodged femoral prosthesis component and bone lysis, indicating PPOL. The patient had poor bone quality and was at risk for further complications. Due to insurance limitations, a hybrid revision technique was chosen, preserving the tibial component and enhancing the femoral aspect with a new augmented implant.

Periprosthetic osteolysis is complex, and treatment options can be limited by financial constraints, such as insurance coverage. In this case, the decision to perform an isolated femoral component revision was made to reduce costs, with close follow-up and rehabilitation planned to prevent complications. Hybrid revision requires careful monitoring.

PPOL restoration necessitates immediate action and rehabilitation to promote optimal joint function. This case highlights the importance of balancing medical judgment and financial constraints, and the potential for hybrid revision in specific cases. It also emphasizes the need for a harmonious relationship between healthcare professionals and healthcare management for patient safety and satisfaction.

Keywords: Complication; Hybrid revision; Periprosthetic osteolysis; Total knee arthroplasty.

INTRODUCTION

The most severe complication post Total Knee Arthroplasty (TKR) is Periprosthetic Osteolysis (PPOL). It primarily arises from the prosthesis-bone interface weakness and is a key factor necessitating surgical revisions.1 In recent years, implant loosening became a growing problem due to aging of general population and to the increase in TKR implant demand.2 It is estimated that over 25% of all prosthetic implants will demonstrate findings of aseptic loosening, often leading to the need for surgical revision.3 The precise aetiology of aseptic loosening still remains unclear.4

Periprosthetic osteolysis predates aseptic loosening in many cases indicating the clinical significance of this pathogenic mechanism. A variety of implant-, surgery-, and host-related factors have been delineated to explain the development of PPOL.5 There is considerable evidence that relates abnormal mechanical stresses/strains to prosthesis/knee malalignment.4,6 Abnormal forces associated with a limb/prosthetic malalignment can degrade

the bone cement layer anchoring implants to the bone. The integrity of the bone–cement interface is especially critical to implant survival.4

Ensuring meticulous surgical technique is crucial to reduce the risk of premature failure in TKR due to aseptic loosening, osteolysis, and associated complications.7 Known factors such as the failure to restore the mechanical axis of the limb, poor component alignment, and/or instability of TKA, all potentially result in increased loading forces across the bone-implant interface and have shown to correlate with polyethylene damage.8

Revision TKR is an option for osteolysis linked to lose or misaligned implants, with or without significant bone loss.9. The main benefits of revision arthroplasty in these scenarios are early mobilization and improvement in knee range of motion.5 Here we present an unusual example of a patient who underwent implant revision by utilizing hybrid semi-constrained TKR in patient with periprosthetic osteolysis.

CASE PRESENTATION

A 70-year-old woman presented to the ER with left knee pain after a fall. Examination revealed swelling, tenderness, and limited knee movement due to a prior surgery. She had knee replacements in 2017 and 2019 due to osteoarthritis. The X-ray indicated a displaced femoral prosthesis component and bone loss, diagnosing Periprosthetic Osteolysis AORI type 2. Loose trabeculation on the distal femur suggested poor bone quality, confirmed by screws reinforcing the tibial component due to low bone density.

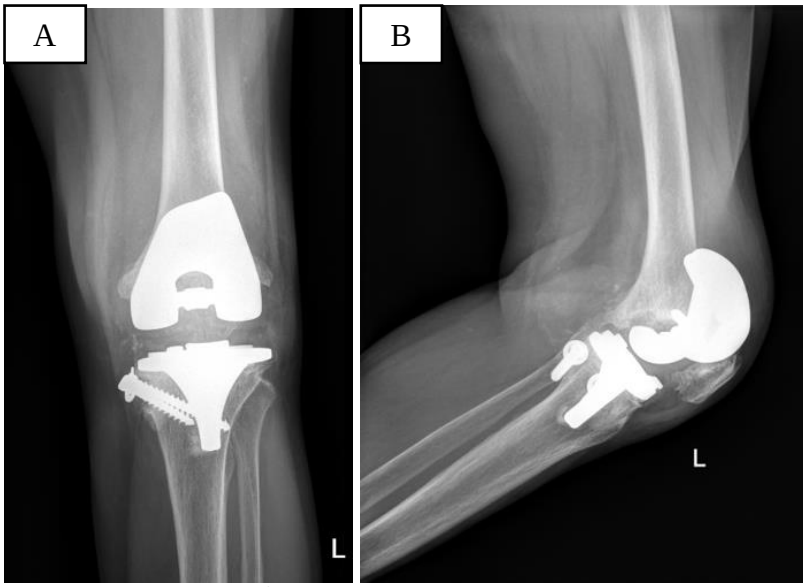

Figure 1. Plain radiograph patients left knee AP (a) and Lateral (b) view taken on admission date.

A total TKR revision was initially recommended due to potential issues with both tibia and femoral components. However, considering limitations in the patient's insurance coverage under the Indonesian national health insurance (BPJS-KIS), a hybrid revision was chosen. This approach involved preserving the tibial component and improving the femoral prosthesis with a new augmented implant and intramedullar stem extension. This hybrid technique halved the surgery cost, ensuring more affordable treatment for the patient, despite the compromised tibial component remaining vulnerable to future issues.

Using the standard anterior parapatellar approach, we removed the failed femoral component prosthesis and the articular insert. The tibial component was preserved as its function was deemed satisfactory. We proceeded with cutting the distal femur and reaming to prepare for the insertion of an augmented femoral component stem. The

new prosthesis included a size 1 femoral component, a semi-constrained articular insert (18 mm), and a cemented extension stem (12 mm x 80 mm). The operation went smoothly with acceptable bleeding (200 mL).

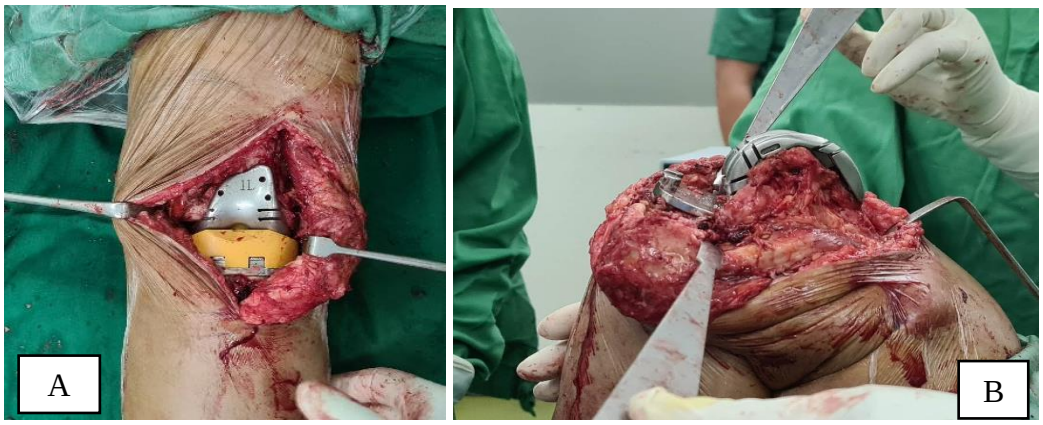

Figure 2. Failed prosthesis system (A), lateral view without articular insert (B)

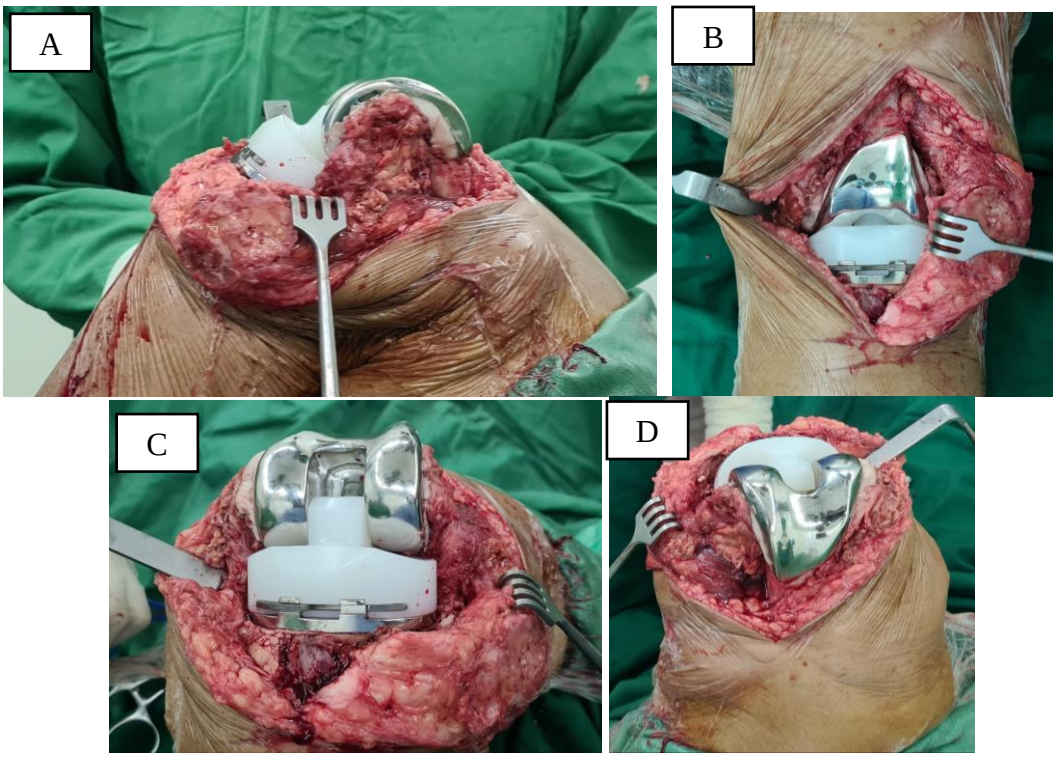

Figure 3. New semi-constrained prothesis system lateral (A), anterior (B), caudal (C), and cranial (D) view displayed fit and tight relation between components.

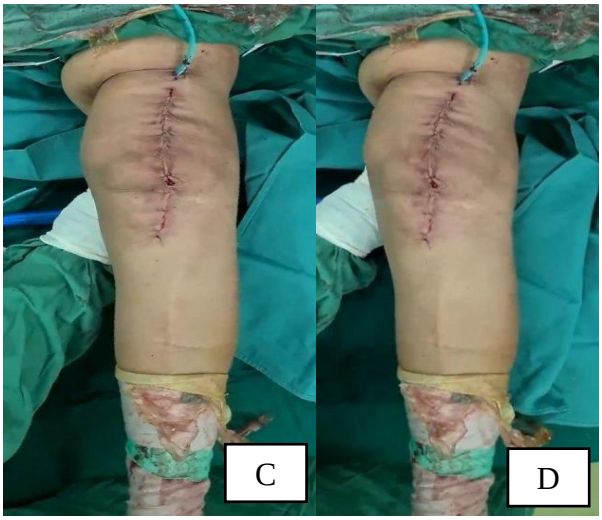

Figure 4. Clinical picture right after wound closure in the OR showing normal knee range of motion in flexion (A), and extension (B) and joint stability test consists of Varus (C) and Valgus (D) stress test showed satisfactory coronal plane stability

Figure 5. Left Knee X-ray postoperative AP (A), and lateral view (B)

Post-surgery, the patient received prophylactic antibiotics and epidural analgesics. Physical therapy commenced immediately, focusing on non-weight-bearing mobilization using double crutches for gradual healing and to prevent prolonged immobilization. The patient was discharged three days after surgery. During the follow-up six days later, limited active range of motion (ROM) due to pain was noted, with flexion limited to 110 degrees. However, joint stability remained consistently acceptable based on various tests.

DISCUSSION

Incidence of periprosthetic osteolysis particularly following TKR is anticipated to be growing in number and so does its complexity. Since its natural cause commonly to be a minor force injury, it is clear that periprosthetic osteolysis generally associated with sub-optimal patient condition.10 Thus, it presents challenges to surgeon who encounter this problem to be able to reconstruct the musculoskeletal pathology whilst considering its underlying risk factors to prevent any miscellaneous threat to the patient's health condition.

In our clinical setting, strict regulations often limit the adoption of recommended treatments due to financial constraints. Specifically, the funding limit from Indonesia's national health insurance (BPJS) hindered total knee implant revision for this

case. In an unconventional approach, considering porotic bone, we opted for isolated femoral component revision to reduce costs for the patient. Close follow-up and careful rehabilitation strategies were vital to prevent complications. Establishing effective communication with the patient and their family, we ensured personalized care throughout the rehabilitation process. Anticipated partial weight-bearing on the third month, aiming for a normal range of motion and satisfactory joint stability.

CONCLUSION

The challenge in restoring periprosthetic osteolysis involves immediate action for early, pain-free mobilization while considering associated comorbidities and the risk of revision failure. A collective effort between medical professionals and managerial stakeholders is crucial to provide optimal service. Despite challenges, the preserved tibial component allowed for a hybrid revision strategy. This unique situation may serve as a model for evaluation and potential impact on revolutionizing healthcare systems, aiming for enhanced patient safety and satisfaction through harmonious relationships.

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Burnett RSJ, Keeney JA, Maloney WJ, et al. Revision total knee arthroplasty for major osteolysis. *Iowa Orthop J*. 2009; 29:28-37.
2. Wooley P, Schwarz E. Aseptic loosening. *Gene Ther*. 2004;11(4):402-407. doi:10.1038/sj.gt.3302202
3. Gupta SK, Chu A, Ranawat AS, et al. Review Article: Osteolysis After Total Knee Arthroplasty. *J Arthroplasty*. 2007;22(6):787-799. doi: 10.1016/j.arth.2007.05.041
4. Gallo J, Goodman SB, Konttinen YT, et al. Osteolysis around total knee arthroplasty: A review of pathogenetic mechanisms. *Acta Biomater*. 2013;9(9):8046-8058. doi: 10.1016/j.actbio.2013.05.005
5. Marmotti A, Messina D, Cykowska A, et al. Periprosthetic osteolysis: a narrative review. *J Biol Regul Homeost Agents*. 2020;34(4 Suppl. 3):405-417.
6. McArthur BA, Scully R, Patrick Ross F, et al. Mechanically Induced Periprosthetic Osteolysis: A Systematic Review. *HSS Journal ®*. 2019;15(3):286-296. doi:10.1007/s11420-018-9641-5
7. Lamba C, Denning K, Ouellette E, et al. An Interesting Case of Osteolysis with Accompanying Metallosis in a Primary Total Knee Arthroplasty. *Arthroplast Today*. 2021; 11:81-87. doi: 10.1016/j.artd.2021.07.002
8. Rassir R, Nellensteijn JM, Saouti R, et al. Bilateral massive osteolysis of uncertain origin after total knee arthroplasty: A case report and review of literature. *Int J Surg Case Rep*. 2021; 80:105678. doi: 10.1016/j.ijscr.2021.105678
9. Dalling JG, Math K, Scuderi GR. Evaluating the Progression of Osteolysis After Total Knee Arthroplasty. *Journal of the American Academy of Orthopaedic Surgeons*. 2015;23(3):173-180. doi:10.5435/JAAOS-D-13-00189
10. Zotti MGT, Campbell DG, Woodman R. Detection of Periprosthetic Osteolysis Around Total Knee Arthroplasties. *J Arthroplasty*. 2012;27(2):317-322. doi: 10.1016/j.arth.2011.03.047

How to cite this article: Sri Mahadhana, Nyoman Gede Grenata Nanda Ustriyana, I Wayan Suryanto Dusak. Periprosthetic osteolysis (PPOL) following total knee arthroplasty (TKA) treated with hybrid semiconstrained prosthetic revision: a case report. *International Journal of Research and Review*. 2023; 10(12): 840-844. DOI: *https://doi.org/10.52403/ijrr.20231284*

******