Clinical Report

Clinical case report: bimodal salvage of a distal femoral periprosthetic fracture and subsequent biofilm infection in a high-bmi geriatric patient

Keywords: periprosthetic fracture, TKR, ilizarov, DAIR, CLAP

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Introduction

There is an inherent complexity in the clinical management of periprosthetic distal femur fractures (PDFF) in the elderly population due to bone quality and the presence of prosthetic devices. In the presence of significant excess weight in the patient, there is an added complexity of tissue restraints and high mechanical stress loads attributed to destabilization devices.[1,2] The following report outlines the successful binary limb-salvage strategy for the patient who suffered a Periprosthetic supracondylar fracture in October 2024 and subsequent periprosthetic joint infection in November 2025. The report also illustrates how high tension circular fixations and CLAP were utilized effectively for preservation of the original prosthesis in 2022.[3,4]

Figure 1 Periprosthetic supracondylar fracture of the femur without dislodgement of prosthesis

Clinical history and timeline

Table 1 Clinical progress and applied procedure.

Date	Clinical milestone	Intervention strategy
2022	Primary TKA	Management of severe osteoarthrosis
Oct 2024	Periprosthetic Fracture	Ilizarov apparatus Fixation
Oct 2024 - Mar 2025	Osteosynthesis	5-month consolidation period
March 2025	Fixator Removal	21-day posterior back slab stabilization
November 2025	PJI Presentation	DAIR with 10-day CLAP therapy
Late 2025 (Dec last week)	Follow-up	Complete resolution; TKA component retained

Phase 1: Management of periprosthetic fracture Classification

In October 2024, the patient presented with a displaced supracondylar fracture proximal to her stable TKA. The injury was classified as:

Table 2 Supracondylar Fracture (Proximal to Stable TKA) classified as below.[5]

Classification System	Grade/Type	Key diagnostic findings
Lewis & Rorabeck	Type II	Displaced fracture; Stable femoral component.
Su Classification	Type II	Fracture starts at the proximal femoral flange and moves upward.
Kim Classification	Type IB	Stable prosthesis; fracture is irreducible (cannot be set manually).

Ilizarov Osteosynthesis in Obese patient

The circular fixator was chosen for the purposes of multi-planar stability as well as early mobilization. Nevertheless, the patient's BMI caused "difficulty in application." The rings had to be large in size (220-240 mm) in order for there to be a 2 cm skin margin, which inherently decreases the axial rigidity.[1,6,7]

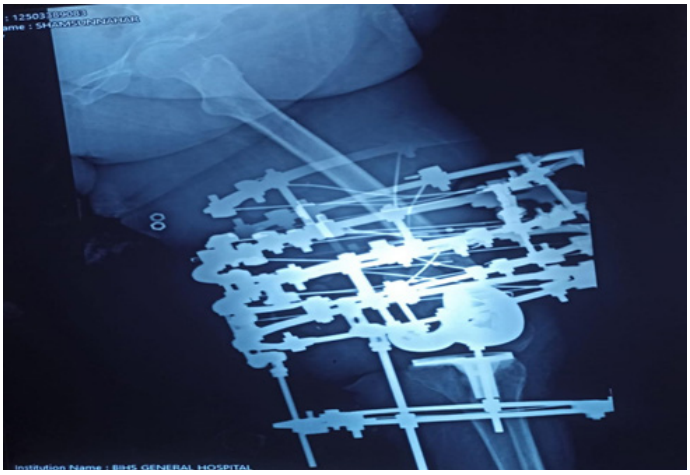

Figure 2 Periprosthetic supracondylar fracture was aligned and fixed with Ilizarov apparatus.

Table 3 Olive Wire Risks of Failure in High-BMI Index Patients.[1,6,8]

Factor	Mechanical Risk to Consequence	Risk to Hardware
Ring Size	Decreased construct stiffness	Increased sagging and non-linear displacement
Axial Loading	Dominance of "cable" behavior	Yield failure of the wire under heavy mass
Cyclic Loading	Repetitive stress at bone-stopper interface	Metal fatigue leading to sudden wire breakage

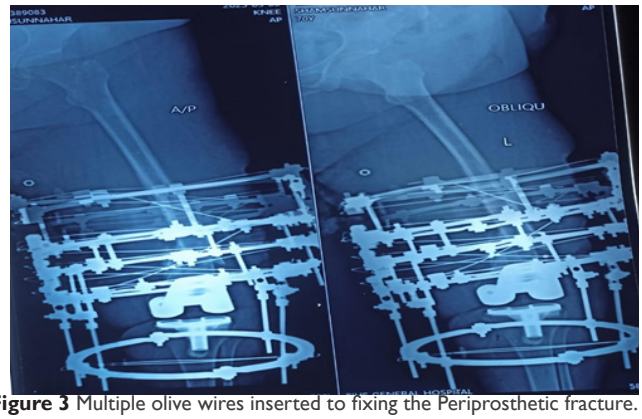

Figure 3 Multiple olive wires inserted to fixing the Periprosthetic fracture.

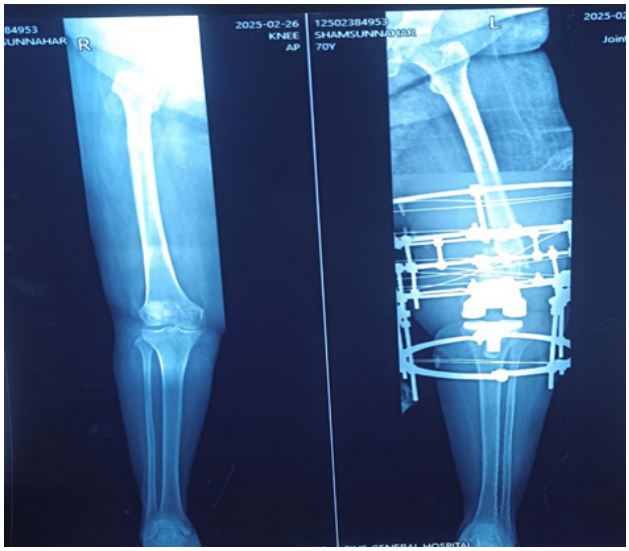

Figure 4 On X-ray stress view no limb length discrepancy.

To mitigate these effects, Russian bolts were used for tensioning purposes. The Russian bolts enable manual tensioning of high torque (1600N to 1695N), adequate to provide stiffness to prevent wire fatigue when the patient walks.[1,2,8]

Justification of the 21-Day Back Slab

After five months of union, the frame was removed in March 2025. A posterior fixation with a back slab was then used for 21 days to offer temporary stabilization. This is an essential step in the fixation of the pin tracks because the cavities created by the 1.8 mm wires are known as "stress risers" of the bone, which tend to increase the chances of secondary fractures during the process of weight-bearing stress.[1,6,8]

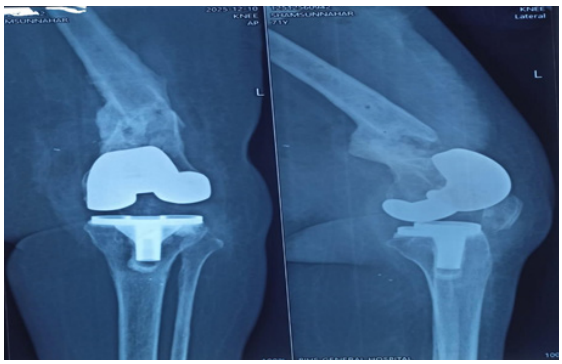

Figure 5 After demounting of the Ilizarov apparatus the Periprosthetic fracture was healed by callus formation

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Phase 2 : Treatment of prosthetic joint infection

In November 2025, the patient was in the late stages of PJI. The treatment was DAIR therapy supplemented by CLAP therapy.[9,10]

Figure 6 The CLAP therapy was applied to the Prosthetic Joint infection.

Figure 7 The negative pressure drain was used as outflow tract in CLAP therapy

CLAP Therapy Dose Calculation

The protocol was developed in order to keep a bactericidal dose of an antibiotic in the biofilm site itself,[3,4,10]

Figure 8 Syringe pump is used for accurate dose calculation in inflow tract of CLAP therapy

Carrier Solution: Gentamicin 160mg (2×80mg ampules) + 46ml 0.9 % Normal Saline.

Localised Concentration: 160 mg in 50 ml = 3.2 mg/ml = 3200 µg/ml

Perfusion rate: 2 ml/hr via intra-joint dual-lumen tubes

Daily Dose Rule/Formula: 2 mL/hr × 24 hr × 3.2 mg/mL = 153.6 mg/day

Progress and monitoring

The 10-day CLAP course showed rapid biological response:

Figure 9 Swelling and inflammation subsided after application of CLAP therapy

Inflammatory Trends: Serum C-reactive protein (CRP) reached a 'fast response pattern,' lowering to a ratio of < 0.4 of its original value by day 4.

Clinical Findings: The erythema, warmth, and effusion resolved completely by the end of the 10-day perfusion phase.[3,4]

Safety Profile: Despite the fact that the patient was elderly with significant weight, the serum gentamicin trough levels were kept below values of less than 2.0 µg/mL.[10]

Discussion

The success of this case emphasizes the balance of mechanical and biological salvaging techniques that must be used on the high-risk patient.

In **Phase 1,** The Ilizarov technique was chosen due to the fact that traditional internal plating has a complication rate as high as 35% in obese, osteoporotic populations, often secondary to hardware "cut-out". A circular frame allowed axial load distribution over multiple points, providing controlled micromotion to allow for secondary bone healing.[1,2,8]

In **Phase 2,** CLAP therapy overcame the basic inadequacies of systemic use of antibiotics. In clearing mature biofilms from implant surfaces, concentrations 100 to 1000 times the MIC are needed-levels that would be systemically toxic if given intravenously. Locally infusing 153.6 mg/day, the investigators maintained an intramedullary gradient of ≥ 500 µg/ml. In addition, Continuous Passive Motion (CPM) was incorporated during the 10-day perfusion period to allow fluid to circulate throughout the recesses of the joint to ensure complete coverage of the antibiotic on all prosthetic surfaces and to prevent arthrofibrosis.[3,9,10]

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Figure 10 On Follow up patient is able to stand by the support of Walker and there is no limb length discrepancy.

Conclusion

The patient has since made a full recovery, with the primary 2022 TKA functional. This represents that morbid obesity and advanced age are not absolute contraindications to successful limb salvage in complicated periprosthetic cases.[1,2,10] Such a resolution was rested on three pillars:

High tension hardware constructs (> 1600N) to avoid component failure within a high-BMI setting.

Transitional immobilization to protect the bone during consolidation of pin-site stress risers.

Local pharmacological perfusion allows for the safe use of bactericidal concentrations not attainable by systemic methods.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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