

Proximal Femoral Replacement for Infected Non-Union of the Proximal Femur with Adherent Femoral Artery: Surgical Challenges and Techniques to Minimize Vascular Risk

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Abstract:

Introduction: Infected non-union is a challenging complication of fracture healing, requiring simultaneous infection control and restoration of mechanical stability [1]. Non-union occurs in approximately 1.9–10% of fractures and is associated with factors including smoking, malnutrition, open fractures, and bone loss [2,3]. Chronic infection and repeated surgery can further cause bone loss, soft-tissue fibrosis, and anatomical distortion [2]. In proximal femoral reconstruction, these changes may result in unexpected adherence of major vessels, particularly the profunda femoral artery (PFA), increasing the risk of vascular injury. Given the limited literature on infected proximal femoral non-union [3], we present a complex case highlighting reconstructive and vascular challenges.

Case Presentation: A 72-year-old female sustained a four-part intertrochanteric fracture of the right femur in October 2022 following a mechanical fall, initially treated with dynamic hip screw (DHS) fixation. Early postoperative wound discharge due to *Serratia marcescens* was managed with surgical washouts and antibiotics. The fracture failed to unite, complicated by recurrent infection with *Fingoldia magna*, necessitating implant removal in March 2024. Due to persistent non-union and infection, a Girdlestone excision arthroplasty was performed, significantly compromising her functional capacity. Following clinical, laboratory, and joint aspiration confirmation of infection quiescence by April 2025, CT angiography revealed adherence of the superficial and profunda femoral arteries to the medial femoral cortex. She was subsequently planned for proximal femoral replacement.

Discussion: Management of infected proximal femoral non-union is challenging, requiring simultaneous infection eradication, restoration of function, reconstruction of deficient bone stock, and protection of neurovascular structures. Chronic infection and multiple previous surgeries may result

in extensive bone loss, anatomical distortion, and dense vascular adhesions, substantially limiting reconstructive options.

Periprosthetic plating and long-stem revision arthroplasty are potential strategies, however, both depend on adequate bone stock. In this case, extensive debridement and osteolysis rendered the proximal femur biologically and mechanically unsuitable for reliable plate fixation. Locking-plate fixation has also been associated with hardware failure and non-union in high-risk periprosthetic fractures [4]. Similarly, revision hip arthroplasty requires adequate diaphyseal fixation, while recurrent infection and failure remain concerns in previously infected hips [5,6].

A modular cemented proximal femoral replacement (PFR) was therefore selected, providing immediate stability while bypassing deficient bone and allowing restoration of limb length, offset, and femoral version [7]. STIMULAN antibiotic-loaded calcium sulfate beads were used to provide local antibiotic delivery, an approach supported by evidence demonstrating high infection-eradication rates in fracture-related infection and infected non-union [8].

Post-operative instability remains a major challenge following PFR because of compromised abductors and soft-tissue tension. Preservation and fixation of the greater trochanter helped restore the abductor mechanism, while a constrained acetabular liner was used to enhance stability, consistent with evidence supporting reduced dislocation rates in complex reconstructions [9,10]. Prophylactic cerclage wiring further augmented construct stability.

An additional challenge was abnormal adherence of the superficial and profunda femoral arteries to the operative field, likely secondary to chronic infection and previous surgery. Unanticipated vascular injury during hip reconstruction can result in significant haemorrhage and limb-threatening complications [11,12]. Pre-operative CT angiography enabled vascular mapping and surgical planning. Intra-operatively, sharp dissection, early vessel identification and looping, controlled retraction, and Doppler assessment minimized vascular risk. Vascular surgery was also placed on standby during the surgery.

Conclusions: Proximal femoral replacement is an effective solution in cases of complex infected non-union with massive bone loss and compromised soft tissue environments. Its use should be strongly considered when traditional fixation methods are unlikely to achieve stable, infection-free reconstruction. However, the surgical challenge often lies not in implanting the prosthesis, but in navigating the altered anatomy, particularly when major vessels are displaced or adhered due to prior infection and fibrosis. This case underscores the importance of meticulous dissection, pre-operative vascular mapping, intraoperative Doppler use, and preparedness for vascular complications. Proximal femoral replacement, when executed with appropriate technique and foresight, remains a vital limb-salvage tool in complex hip reconstructive surgery.