Proximal Femoral Replacement for Severe Femur Bone Defect Reconstruction within Two-Stage Treatment of Periprosthetic Infections: Clinical and Functional Outcomes, and Prosthesis Survival

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INTRODUCTION:

One of the most common and devastating reasons following arthroplasty that results in revision arthroplasty surgery is Periprosthetic Joint Infection (PJI). PJI is a genuinely catastrophic complication that results in significant morbidity and, in some cases, has a higher mortality rate than many types of cancer. Single or two-stage treatment for arthroplasty-related PJI treatment can lead to significant bone loss in the proximal femur and the acetabulum. A proximal femoral replacement (PFR) has been suggested as an appropriate way to address a severe osseous defect in the proximal femur. These prostheses allow the patients to return to early function, weight-bearing, and better cosmetic appearance of the limb. Earlier research has shown that replacement prostheses in arthroplasty for non-oncological indications are a good option. However, high rates of complications associated with surgery with this type of implant, such as dislocation and infection, continue to be a serious issue. There is a paucity of literature on the functional and clinical outcomes of PFR usage in the reconstructive stage of a two-stage treatment for PJI. The purpose of this study was: (1) to evaluate the clinical and implant-specific functional outcomes for patients who underwent PFR reconstructive surgery due to severe bone defects following a two-stage treatment for PJI; (2) to determine complication rates and the factors associated with it; (3) determine the implant survival of PFR survival in these group of patients.

METHODS:

A retrospective review of the institutional electronic database and clinical archives related to all PFR arthroplasty cases between 2010 and 2020 was conducted. Patients with less than a minimum follow-up period of 12 months, those with incomplete pre-operative and postoperative data, patients with malignancies, and those with neurocognitive disorders such as Alzheimer's or dementia were excluded. Only patients whose treatment for hip arthroplasty PJI led to advanced bone defects (Paprosky 3B and 4) and who received a proximal femur replacement prosthesis from a single high-volume hip arthroplasty surgeon were included.

The follow-up examinations were conducted in an outpatient setting through clinical, functional, and radiographic imaging evaluations. Patients' functional scores were obtained using the MSTS scoring system during the most recent outpatient visit.

Complications and failures of this prosthesis were analyzed using Henderson Classification for Segmental Endoprosthetic Failure classification. Potential factors associated with failure were analyzed. The data collected was analyzed statistically with IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, USA). Kaplan-Meier survival analysis was performed with a revision of the prosthesis for any reason as the endpoint. The significance level was established at $p<0.05$.

RESULTS:

A cohort of 34 patients [21 (61,8%) women and 13 (38,2%) men patients, average age 72,9 (range 54-89)] were included in our study. 15 patients (44.1%) had at least 1 comorbid disease. Patients included in the study had an average of 3.88 (range: 2-13) operations (e.g., debridement, revision, etc.) in the same hip before the PFR implantation. In 19/34 cases, the left side was involved. 19 (55,9%) have at least one comorbid disease, while 15 (44,1%) patients do not have any comorbidities. The average period between their PJI diagnosis to the definitive reconstruction surgery was less than 6 months for 14 (41,2%), between 6 and 12 months for 15 (44,1%), and between 1 and 3 years for 5 (14,7%) patients. All patients were diagnosed infection-free before PFR arthroplasty. The average follow-up duration for patients was 73,79 months (24-132 months).

Complications

From our cohort, 17 (50%) patients experienced one or more complications. 7 (20,6%) patients had mechanical (5 type IA and 2 type IB), 8 (23,5%) were non-mechanical (2 type IVA and 6 type IVB), and 2 (5,9%) patients had simultaneous mechanical and non-mechanical (type IA and IVB) complications. Among the mechanical complications, the most frequently observed was dislocation, while infection was the most common type of non-mechanical complication.57, 9% (11/19) of patients without comorbidities did not experience any complications compared with 40% (6/15) in patients with comorbidities (P=0.81). At the last follow-up, postoperative radiographs showed no signs of aseptic loosening in the patient's femoral or acetabular side.

Mechanic Failure – Dislocation

No dislocation occurred in the first year after the reconstructive procedure—5 patients presented with dislocation starting from the 5th year post-surgery. Dislocation was seen in 3 patients with 28mm femoral head size and 2 patients with 32 mm head size. No dislocation was observed in patients with a 36 mm femoral head size(p=0.72). The dislocation rate didn't change with the number of surgeries the patients underwent before PFR.

Non-mechanic failure (Infection)

4 infections were observed within 3 months following surgery, while 4 patients with infections presented after the 4th post-surgery.

Functional Results

The mean MSTS score was 66,74% (23% - 93%). MSTS scores of those patients who experienced complications were equal to those who didn't ($p<0.05$). However, patients who experienced complications continued to face more challenges with function and gait. Although the surgeons rated the scores relatively low, the patients showed high satisfaction with the surgery.

Survival

In our series, the revision-free prosthesis survival rate is 90% in 1st year and 65% in 5th year.

DISCUSSION AND CONCLUSION:

PFR in this group of patients can be considered an effective limb salvage tool with satisfactory functional outcomes and good medium-term survival. Our series showed a significant incidence of instability related complications. These observations highlight the benefits of using a large head size, dual-mobility cups, or constrained liners during complex reconstruction cases. We think that the global MSTS score might not be sufficient to assess patients' functional status, as shown by the discrepancy between the scores and patients functional capacity and satisfaction.