Risk Factors and Reconstructive Consequences of Infection After Proximal Humeral Endoprosthetic Reconstruction: A Multi-Institutional Study

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Significance & Hypothesis/Techniques

Endoprosthetic reconstruction of the proximal humerus following oncologic resection provides reliable limb salvage but remains vulnerable to serious complications. Periprosthetic joint infection is particularly devastating because it may jeopardize implant retention, shoulder stability, and functional recovery, yet large-scale data defining risk factors and reconstructive consequences in this setting remain limited. The purpose of this study was to define the incidence of infection, identify patient- and surgery-related risk factors, and characterize the downstream clinical impact of infection after proximal humeral endoprosthetic reconstruction.

Innovation

This study provides one of the largest multi-institutional evaluations of infection after proximal humeral endoprosthetic reconstruction in an oncologic population. It is clinically innovative in its anatomic specificity and in moving beyond incidence reporting to identify a high-risk subgroup and quantify the reconstructive consequences of infection, including instability, reoperation, chronic antibiotic suppression, and implant loss.

Approach (Materials & Methods)

We performed a retrospective multi-institutional cohort study of patients undergoing proximal humeral endoprosthetic reconstruction after oncologic resection at 6 tertiary referral institutions from 2010–2024. The primary outcome was postoperative infection as defined by MSIS criteria. Patient demographics, tumor characteristics, and surgical variables were analyzed to identify factors associated with infection. Secondary outcomes included reoperation, instability, functional range of motion, and implant retention. Continuous variables were compared using Mann–Whitney U testing and categorical variables using Fisher's exact testing.

Results

Among 295 patients, 9 developed infection (3.0%). Patients with infection had significantly higher body mass index (33.4 vs 29.2 kg/m², $p=0.026$) and were more likely to undergo revision oncologic reconstruction (44% vs 9%, $p=0.007$). Tumor characteristics, including resection length, reconstruction type (hemiarthroplasty vs reverse total shoulder), use of mesh, cuff repair, and patient demographics were otherwise not significantly associated with infection.

Infection was associated with markedly increased reoperation (89% vs 15%, $p<0.001$) and dislocation rates (44% vs 7%, $p<0.001$). Final shoulder range of motion and oncologic outcomes were otherwise similar between cohorts.

Treatment data was available for 8 of 9 patients. All infected cases met MSIS criteria; five of eight patients (62.5%) met major diagnostic criteria (sinus tract or ≥2 positive cultures). Staphylococcus was the offending organism in 75% of patients (n=6/8). 5 underwent debridement and implant retention (DAIR), 2 underwent two-stage revision, and 1 underwent explant without attempted re-implantation due to recurrent wound dehiscence. 62.5% of patients were chronically suppressed with oral antibiotics (n=5/8). Despite multiple treatment strategies, implant salvage was rare, and 87.5% of infected patients ultimately required implant explantation.

Discussion & Impact

Infection after proximal humeral endoprosthetic reconstruction was uncommon but had major reconstructive consequences, including frequent reoperation, instability, chronic antibiotic suppression, and implant loss. Elevated BMI and revision reconstruction identified a clinically recognizable higher-risk subgroup, suggesting opportunities for perioperative optimization, risk-adjusted counseling, and heightened postoperative vigilance. These findings help define not only

who is most vulnerable to infection, but also the magnitude of reconstructive failure that may follow when infection occurs.