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## ORIGINAL ARTICLE

# Safety and efficacy of shoulder arthroplasty following lower extremity periprosthetic joint infection

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**Background:** The safety of arthroplasty in patients with a previous periprosthetic joint infection (PJI) remains unclear. The objective of this study was to determine whether patients with a history of a properly treated PJI complicating lower extremity arthroplasty can safely undergo shoulder arthroplasty without an increased risk of shoulder infection or compromise in their clinical outcomes.

**Methods:** Between 2002 and 2013, 36 patients with successful treatment of an infected lower extremity arthroplasty underwent a subsequent primary shoulder arthroplasty. Three were lost to follow-up. The remaining 33 shoulders were analyzed at a mean follow-up of 3.5 years for radiographic, clinical, and functional outcomes. Nine patients were receiving chronic antibiotic suppression at the time of their index shoulder arthroplasty. The mean time between PJI treatment and shoulder arthroplasty was 4.7 years (range, 0.7–13.1 years).

**Results:** Shoulder arthroplasty led to improved pain scores and range of motion. Excellent or satisfactory modified Neer ratings were achieved in 78.8% of patients. There was no difference in American Shoulder and Elbow Surgeons scores between the groups with and without chronic antibiotic suppression. There were 2 reoperations, both in patients not receiving chronic suppression. The indications were aseptic glenoid loosening and infection after a periprosthetic fracture. The final estimated survival free of infection was 93.3%.

**Discussion/Conclusion:** Shoulder arthroplasty in patients with a history of PJI complicating hip or knee arthroplasty seems to be safe, with a low rate of infection. Thus, previous lower extremity PJI should not be considered a relative contraindication to shoulder arthroplasty.

**Level of evidence:** Level IV; Case Series; Treatment Study

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**Keywords:** Shoulder arthroplasty; periprosthetic joint infection; chronic suppression; revision; shoulder; shoulder infection

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The number of shoulder arthroplasties performed nationwide has been growing exponentially.<sup>9,16</sup> As a result, revision surgery is expected to parallel this increase.<sup>5</sup> Periprosthetic infection represents one potential mode of failure.<sup>17,22,26</sup> The rate of periprosthetic joint infection (PJI) following shoulder arthroplasty has been reported between 0.7% and 5.0%

in the primary setting and between 3.6% and 15.4% in the revision setting.<sup>1,2,8,13,20,22,26</sup> PJI in the shoulder may be managed with a formal revision using a single-stage or 2-stage technique, débridement with retention of components, resection arthroplasty, or arthrodesis with or without chronic suppression.<sup>2,6,12,27-29</sup> The cost of treating such infections is burdensome. Average hospital length of stay following revision for shoulder PJI is nearly double that in the primary arthroplasty setting.<sup>17</sup> The direct hospital costs of treating shoulder PJI are similar to those of the primary arthroplasty; however, this must be considered in conjunction with days off work, antibiotic regimens, and the cost of the initial procedure.<sup>17</sup>

Reduction of the rates of deep periprosthetic infection is thus paramount in performing primary or revision shoulder arthroplasty. Risk factors for deep infection should be identified and addressed preoperatively. Some reported risk factors include younger age, male gender, use of a constrained design, and history of shoulder trauma.<sup>20</sup> Morris et al reported an increased rate of PJI in patients younger than 65 years and with a prior failed arthroplasty.<sup>13</sup> Most surgeons consider a history of previous deep infection complicating arthroplasty a possible indicator of a patient at higher risk for the development of deep infection if arthroplasty of other joints is considered.

Similar to the aforementioned growth in shoulder arthroplasties performed nationwide, hip and knee arthroplasty is expected to increase in an analogous pattern.<sup>10</sup> Along with this, the number of patients affected by PJI after hip and knee replacement will increase as well. When shoulder arthroplasty is contemplated in a patient with previous PJI of the lower extremity, the safety of shoulder arthroplasty, particularly as it relates to the risk of infection, continues to be debated. The objective of this study was to determine whether patients with a history of a properly treated PJI after hip or knee arthroplasty could safely undergo shoulder arthroplasty without an increased risk of shoulder infection or a compromise in their clinical outcomes.

## Materials and methods

Between January 1, 2002, and December 31, 2013, 36 patients with successful treatment of an infected total hip arthroplasty or total knee arthroplasty underwent a subsequent primary shoulder arthroplasty at our institution. Charts were reviewed retrospectively following Institutional Review Board approval. Three shoulders were lost to follow-up. The remaining 33 shoulders were observed for a minimum of 2 years or until reoperation, with a mean follow-up of 3.5 years (range, 2-9.4 years). The mean age at the time of shoulder arthroplasty was 72.9 years (range, 55-87 years). The population of patients included 22 men and 14 women. Patients averaged 1.2 hip or knee surgeries for infection before shoulder arthroplasty. The mean time from their most recent surgery for treatment of hip or knee PJI was 4.7 years (range, 0.7-13.1 years).

Ten patients were prescribed chronic suppression because of concerns about incomplete eradication of infection and remained on such a regimen at the time of shoulder arthroplasty. The study sample was thus divided in 2 groups. Group I consisted of those 26 patients who were deemed to have eradication of their lower extremity arthroplasty infection and were not receiving chronic suppression; 2 were lost to follow-up. Group II consisted of 10 patients receiving chronic suppression for the infected lower extremity arthroplasty at the time of shoulder surgery; 1 was lost to follow-up. Demographic details for both groups are summarized in Table I.

Sixteen patients had a prior total hip arthroplasty, 16 patients had a prior total knee arthroplasty, and 1 patient had a prior unicompartamental knee arthroplasty. At least 3 intraoperative culture specimens were obtained in all cases of hip or knee resection, revision, or reimplantation surgery before the index primary shoulder arthroplasty. Six patients grew methicillin-resistant *Staphylococcus aureus*, 8 methicillin-sensitive *S. aureus*, 11 coagulase-negative staphylococcus, 2 *Enterococcus faecalis*, 1 viridans streptococcus, and 1 *Propionibacterium acnes*. Four patients were considered to have culture-negative infections.

Regarding treatment of lower extremity PJI, 3 patients underwent an irrigation and débridement (I&D) with a polyethylene exchange at an average of 17.6 years after primary arthroplasty, 1 patient underwent an I&D with a head and liner exchange at 20.9

**Table I** Demographic data

	Group I (24 shoulders)	Group II (9 shoulders)	Overall (33 shoulders)	P value
Gender				.46
Male	50%	67%	55%	
Female	50%	33%	45%	
Age at shoulder surgery, mean	74.6 years	68.4 years	72.9 years	.04*
Dominant extremity	62.5%	66.7%	63.6%	.31
Body mass index	32.3	34.0	32.8	.95
Prevalence of diabetes	16.7%	11.1%	15.1%	.40
Tobacco use	12.5%	22.25%	15.2%	.60
ASA class, mean (range)	2.5 (1-3)	2.5 (1-4)	2.5 (1-4)	.45
Charlton Comorbidity Index, mean (range)	4.3 (2-8)	4.3 (2-9)	4.3 (2-9)	.42
Number of lower extremity revision surgeries, mean (range)	1.2 (1-3)	1.3 (1-3)	1.2 (1-3)	.65
Follow-up duration, mean (range)	44.7 months (24-113.6)	33.9 months (24.5-59.5)	41.7 months (24-113.6)	.19

ASA, American Society of Anesthesiologists.

\* Statistical significance.

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