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The Fate of Unplanned Retention of Prosthetic Articulating Spacers for Infected Total Hip and Total Knee Arthroplasty

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ABSTRACT

Eighteen patients with periprosthetic joint infection (11 hips and 7 knees) treated by prosthetic articulating spacers retained their spacers and were followed up at an average of 43.8 months(range, 13–78 months). Fifteen patients maintained well-functioning spacers for an average of 42.7 months, of which 4 patients died with the spacers in situ at an average of 48.7 months. The mean Harris Hip Score and Knee Society knee and function scores of survivors were 92, 92, 88, respectively. Spacers were revised in 3 patients because of recurrent infection (n = 1) at 24 months and mechanical loosening (n = 2) at 74 and 50 months. Findings of this study suggest that a proportion of patients with unplanned retention of prosthetic spacers appear to function well up to 6 years without necessarily requiring further surgical intervention.

Treatment of periprosthetic joint infection (PJI) after total hip arthroplasty (THA) and total knee arthroplasty (TKA) is challenging. Of several treatment options, two-stage exchange arthroplasty with delayed reimplantation is considered the gold standard for the treatment of chronic PJI [1,2]. The principles of two-stage revision are component removal and thorough debridement of necrotic tissues including cement, followed by a course of parenteral antibiotic administration at the first stage, and delayed reimplantation of prosthesis after eradication of infection at the second stage [3].

During the interim periods of two-stage reconstruction, two types of temporary spacer are commonly utilized: (1) non-articulating static block or beads of antibiotic-impregnated cement, (2) articulating metallic or cement spacer [3]. These temporary spacers are usually expected to be removed and replaced by new implants at the time of second stage reimplantation. In practice, however, the second stage reimplantation is not always performed as scheduled for various reasons and temporary spacers are occasionally retained as a permanent solution for infection control [4,5].

In the literature, prolonged spacer implantation has been sporadically described [4–7]. However, detailed information of follow-up outcome of retained spacers has not been well documented. The purpose of this study was to report the follow-up outcome of unplanned retention of prosthetic articulating temporary spacers used in two-stage revision arthroplasty for PJI.

Materials and Methods

From January 1999 to December 2011, 64 patients (39 THA, 25 TKA) of PJI were treated by two-stage exchange arthroplasty using prosthetic articulating spacers composed of metallic femoral and all polyethylene acetabular cup for the hip and metallic femoral and polyethylene tibial components for the knee fixed with antibiotic-laden cement. Of 64 patients, 37 patients (25 THA, 12 TKA) underwent planned second stage reimplantation, 6 patients (2 THA, 4 TKA) were lost to follow-up, and 2 patients (1 THA, 1 TKA) died of unrelated medical illness within 12 months. One TKA patient underwent amputation. The remaining 18 patients (11 THA, 7 TKA) did not undergo second stage reimplantation and retained their prosthetic articulating spacers more than 12 months. We retrospectively analyzed follow-up results of these 18 patients. The reasons for not undergoing second stage procedure included patient's preference due to satisfactory spacer joint function without pain (n = 16) and medical conditions unfit for surgery (n = 2). The mean time of follow-up with retained spacer was 43.8 months (range, 13–78 months).

There were 15 men and 3 women with a mean age of 71 years (range, 51–90 years) at the time of first stage procedure. Infection occurred after primary THA in 9 patients and revision THA in 2, and after primary TKA in 7 patients. The diagnoses for the primary arthroplasty were osteoarthritis (n = 12), femoral neck fracture (n = 2), post-traumatic arthritis (n = 1), and unknown (n = 3). Type of infection was classified as early postoperative, acute hematogenous, late chronic infection, and patients with positive intraoperative cultures as described by Tsukayama et al [8]. There were 2 early postoperative, 6 acute hematogenous, and 10 chronic

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Table
Patients Data and Follow-Up Results.

Case	Sex	Age (y)	Host Condition	Microorganisms	Joint	F/U (mo)	HSS	UCLA	KSS knee	KSS function	Outcome	Reasons for Failure	Remarks
1	F	76	A	no growth	hip	63	92	5					
2	F	70	C	MRCNS	hip	13					died		
3	M	69	B	MRSA	hip	24					failed	recurrence	
4	M	70	B	no growth	hip	74	73*	4*			failed	loosening	
5	M	70	A	MSSA	hip	74					died		
6	M	88	B	MSSA	hip	78	86	4					Abx
7	M	80	B	MRSA	hip	62	98	4					
8	M	54	A	MRCNS	hip	55	95	5					
9	M	72	B	MSCNS	hip	15	83	5					Abx
10	M	90	B	MSCNS + Streptococci	hip	60					died		
11	M	68	A	Streptococci	hip	48					died		
12	M	51	A	MSSA	knee	50		4*			failed	loosening	Abx
13	M	82	B	no growth	knee	50		4	90	90			
14	M	76	B	*Klebsiella oxytoca*	knee	27		2	95	80			Abx
15	M	52	A	*Staphylococcus lugdunensis*	knee	29		7	90	90			Abx
16	F	67	A	*Propionibacterium acnes*	knee	32		6	100	100			
17	M	68	A	Streptococci	knee	16		7	92	90			
18	M	77	B	MSSA + *Candida*	knee	18		3	83	80			antifungal

HSS, Harris Hip Score; UCLA, UCLA Activity score; KSS, Knee Society scores;
M, male; F, female; Abx, chronic oral antibiotic suppression. *Scores before failure.
A, uncompromised; B, compromised; C, significantly compromised; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; MRCNS, methicillin-resistant coagulase-negative *Staphylococcus*; MSCNS, methicillin-sensitive coagulase-negative *Staphylococcus*.

infections. Patients were classified according to McPherson et al [9] to characterize their host status: 8 uncompromised, 9 compromised, and 1 significantly compromised. The average time from prior arthroplasty to the diagnosis of infection was 41 months (range, 1–96 months).

Preoperative aspiration or intraoperative culture from periprosthetic soft tissue demonstrated that methicillin-sensitive *Staphylococcus* was the most common causative organism (n = 5) followed by methicillin-resistant *Staphylococcus* (n = 4). Three joints showed negative culture results. *Streptococcus* (n = 2), *Klebsiella* (n = 1), and *Propionibacterium* (n = 1) were identified as other causative organisms. There were 2 mixed infections (Table).

The first stage operation involved removal of implants and all foreign materials including cement, possible necrotic bone and soft tissues. After copious irrigation, articulating temporary spacers consisting of a new femoral stem (n = 11) and an all polyethylene acetabular cup (n = 11) for the hip, and new (n = 6) or resterilized (n = 1) metallic femoral component and all polyethylene tibial components (n = 7) for the knee were inserted. No constrained polyethylene cup was used for the hip. Based on the size of original implants and bone defects, proper-sized femoral, acetabular, and tibial components were chosen. Antibiotic-loaded bone cement (40 g of cement with 2.4 g of tobramycin and 1.0 g of vancomycin) was used for spacer fixation. When the antibiotic cement reached a very doughy state, the back side of the implants was coated by the cement and inserted into the femoral, acetabular, and tibial side without pressurization to avoid excessive interdigitation of the cement into the cancellous bone.

The postoperative course was similar to conventional primary THA and TKA. Patients were permitted to weight bear as tolerated and range of motion exercise after the operation, and a six-week period of organism-sensitive intravenous antibiotic therapy was applied. When the culture study showed negative results, empirical broad-spectrum antibiotic was given to cover for possible resistant organisms in consultation with an infectious disease specialist. All patients were initially planned to receive the second-stage reimplantation procedure when laboratory parameters showed a trend of normalization and the patients' general condition recovered. Patients' medical records and radiographs were retrospectively reviewed. When patients died during follow-up, a telephone interview was made

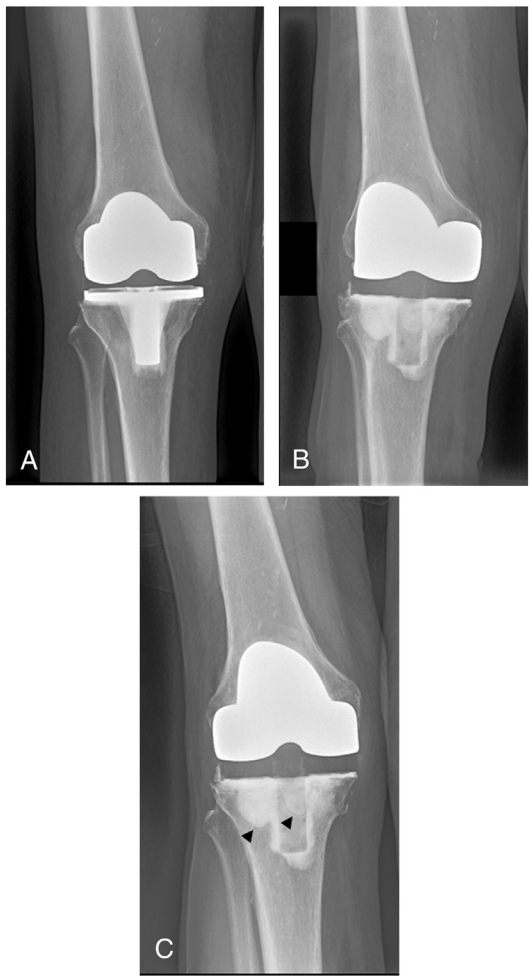

Fig. 1. An 82-year-old man with infected TKA (A) was treated by component removal and prosthetic spacer insertion with antibiotic-loaded cement fixation (B). At 50-month follow-up, temporary spacer was well maintained with satisfactory joint function and infection control. Radiolucent line is seen at the cement-bone interface at tibial side (arrow heads) (C).