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The Transfemoral Approach for Removal of Well-Fixed Femoral Stems in 2-Stage Septic Hip Revision

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ABSTRACT

Background: The value of a transfemoral approach for removal of well-fixed infected hip arthroplasties in 2-stage revision is unclear, especially whether cerclages for closure of the flap in the first step lead to higher reinfection rates and whether reopening of the flap for reimplantation of a hip arthroplasty leads to a lower union rate of the bony flap.

Methods: Seventy-six septic 2-stage revisions via a transfemoral approach with cerclages for closure of the flap in the first step and reopening of the flap for reimplantation were followed prospectively for a mean period of 51.2 ± 23.2 (24-118) months.

Results: The union rate of the bony flap after reimplantation was 98.7%, and no recurrence of reinfection was recorded in 93.4% of all cases. Subsidence of the stem occurred at a rate of 6.6%, dislocation at a rate of 6.6%, and there was no aseptic loosening of the implants. The Harris Hip Score was 62.2 ± 12.6 points with the spacer and 86.6 ± 15.5 points 2 years after reimplantation. Nine fractures (11.8%) of the flap occurred during the operation because of osteolytic or osteoporotic weakness of the flap itself, but these all healed without further intervention.

Conclusion: The transfemoral approach is a safe method for septic revision of well-fixed hip prostheses, and the use of cerclage wires for closing the osteotomy flap in the first stage does not appear to lead to a higher reinfection rate. Similarly, the reopening of the flap does not appear to decrease the union rate of the flap.

Periprosthetic infections associated with total hip arthroplasty are, with an incidence of approximately 1%, a rare but nevertheless serious complication of hip prosthetic implantation [1,2]. Late infections require revision surgery that involves removal of all foreign materials and radical debridement of the prosthetic bed [3,4]. The removal of all foreign materials can be a complex operation if a well-fixed cementless or cemented prosthetic stem is involved. The transfemoral approach has been shown to be of value in these cases during aseptic revision surgery [5–8]. However, the value of a transfemoral approach in septic 2-stage revision has not been adequately shown because there are only a few reports and these on small patient cohorts. Moreover, there are concerns that cerclages for closure of the flap in the first step as foreign materials may lead to higher reinfection rates, and reopening of the flap for reimplantation of a hip arthroplasty may influence the union rate of the bony flap. In addition, technical details of the surgical procedures described differ between the few reports. Morshed et al [9] carried out an extended trochanteric approach during 13 2-stage revisions. In these cases, the flap over the spacer implanted during the first stage was not closed because the surgeons wanted to avoid using foreign materials such as cerclage wires to fix the osteotomy. In contrast, Lim et al [10] fixed the flap with cerclage wires in 23 cases but, unlike Morshed et al [9], did not reopen the approach in the second stage and implanted the cementless revision stem via the endofemoral route. In a retrospective study carried out by Levine et al [11], the extended trochanteric osteotomy was reopened during the second stage in 12 of 23 cases and in 11 cases not. That study also involved a number of different revision stems (cementless modular, cementless monoblock, and cemented).

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For 2-stage, septic revision surgery of well-fixed implants, we favor the transfemoral approach and closure of the bony flap with cerclage wires to avoid migration of the flap, or its dislocation, as described by Morshed et al. [9]. We reopen the flap during the second stage by removing the cerclage wires so that we can carry out a second radical debridement of the prosthetic bed and ensure that the distally fixed, cementless, modular revision stem is correctly positioned in the isthmus of the femur with the fixation zone distal to the osteotomy.

The lack of publications concerning the transfemoral approach to septic, 2-stage revision surgery means that there is little information regarding the healing ability of the osteotomy after it has been opened twice, the freedom from infection when cerclage wires are used to close the bony flap during the first stage of the procedure, the clinical outcome after placement of the spacer and the implantation of a new prosthesis, and the frequency of subsidence and loosening of the cementless revision stem after the implantation.

The objective of the prospective study reported here was to provide answers to the following questions against a background of a systematic operative procedure:

What is the frequency of complete union of the bony flap after reimplantation?
How frequently does reinfection occur?
What is the frequency of subsidence and loosening of the revision stem?
What is the Harris Hip Score in the interim phase with the spacer, between the first and second step?
What is the Harris Hip Score after the final reimplantation?
What are the complications associated with this approach?

Materials and Methods

Two hundred fifteen patients with late periprosthetic infection of a hip endoprosthesis underwent septic, 2-stage, cementless prosthesis revision surgery between August 2004 and April 2013. In 81 patients, the transfemoral approach was used to remove a solid fixed stem, where the shape of the stem, the roughness of the stem surface or the cement mantle lead to a high risk of uncontrolled periprosthetic fractures during the revision. Two patients died from unrelated causes during the follow-up period, and 3 patients were lost for follow-up, so 76 patients were evaluated prospectively over a follow-up period of at least 2 years (51.2 ± 23.2; 24-118 months). The patient cohort consisted of 37 women and 39 men with an average age of 70.7 ± 9.8 years (43-90 years) and an average body mass index of 28.7 ± 5.5 (19.1-41.9). The original diagnosis that led to the primary arthroplasty was osteoarthritis in 73 cases, femoral head fracture in 2 cases, and 1 case of rheumatoid arthritis. There were 20 cemented and 56 cementless acetabular cups as well as 30 cemented stems (4 revision stems) and 46 cementless stems (16 revision stems). The average life span of the primary implant was 7.9 ± 7.8 years (0.2-26.5 years). In 30 cases, a primary implant was involved, but there were also 12 patients who had already undergone one revision operation. Ten patients had already undergone 2 revision operations (2 with one septic debridement without removal of the implants and 2 with 2-stage septic revision), 18 patients had had 3 operations (4 with one septic debridement without removal of the implants and 2 with additional 2-stage revision after one septic debridement), 4 patients had had 4 operations (one with septic debridement without removal of the implants and one with septic 2-stage revision), one patient 5 operations, and one patient had been given 8 operations with one septic 2-stage revision. Of the operations reported here for treating the periprosthetic infection, half were performed in other institutions in the patients with 2 operations and all in the patients with >2 operations. Eight patients exhibited fistulas in the hip region.

The periprosthetic infection was diagnosed by aspiration of the hip joint, which is a standard procedure in our clinic before any revision of a hip prosthesis is carried out, and bacteriologic cultivation of the aspirated fluid was assessed for 14 days according to Schäfer et al [12]. According to the criteria of the Musculoskeletal Infection Society, the prosthesis was declared as infected when a sinus tract was present or, in addition to the isolation of the microorganism, the serum C-reactive protein (CRP), the synovial white blood cell count, and the percentage of polymorphonuclear cells were elevated, or a purulence was present [13]. In 15 cases, an additional synovial biopsy was performed to isolate the microorganism. Bacteriologic and histologic examination according to the methods of Atkins et al [14], Virolainen et al [15], and Pandey et al [16] of the membrane at the site of loosening, which was removed during the operation, was carried out to confirm the original diagnosis. The microorganisms detected by these methods are listed in Table 1; it should be noted that 2 causative organisms were identified in 25 cases.

The transfemoral approach was performed because the cemented or cementless stems were very well fixed. The transfemoral approach was carried out using a previous published modified Wagner technique [5,6,17–19]. With the patient in a lateral position, an extended posterolateral incision was made and the posterolateral edge of the femur ventral to the linea aspera was exposed in the lateral intermuscular septum after ligation of the perforating vessels. The lateral circumference of the femur was exposed in the area where the end of the osteotomy flap was going to be positioned and 3.2 mm holes drilled while cooling in the ventral and dorsal end of the intended flap. The ventromedial

Table 1
The Microorganisms Identified as the Cause of the Periprosthetic Infections.

Microorganism	Number of cases
Staphylococcus epidermidis	34
MRSE	9
Staphylococcus aureus	9
Propionibacterium acnes	7
Staphylococcus capitis	6
Staphylococcus hominis	4
Propionibacterium granulosum	4
Staphylococcus lugdunensis	4
Staphylococcus warneri	3
Staphylococcus caprae	3
Actinomyces neuii	2
Staphylococcus haemolyticus	2
Streptococcus mitis	2
Enterococcus faecalis	2
Enterococcus faecium	2
Peptostreptococcus micros	1
Staphylococcus chromogenes	1
Streptococcus agalactiae	1
Staphylococcus simulans	1
Corynebacterium striatum	1
Streptococcus anginosus	1
Rhizobium radiobacter	1
Escherichia coli	1
Streptococcus gordonii	1
Dermabacter hominis	1
Streptococcus oralis	1
Corynebacterium minutissimum	1
Corynebacterium jeikeium	1
Corynebacterium amycolatum	1
Propionibacterium propionicum	1
Staphylococcus saccharolyticus	1
Peptostreptococcus asaccharolyticus	1

MRSE, Methicilline-resistant staphylococcus epidermidis.