1-stage primary arthroplasty of mechanically failed internally fixated of hip fractures with deep wound infection

Good outcome in 16 cases

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Background and purpose **Mechanically failed internal fixation following hip fracture is often treated by salvage arthroplasty. If deep wound infection is present, a 2-stage procedure is often used. We have used a 1-stage procedure in infected cases, and we now report the outcome.**

Patients and methods **We reviewed 16 cases of deep wound infection after mechanically failed hip fracture fixation, treated between 1994 and 2010. In all patients, a joint prosthesis was implanted in a 1-stage procedure.**

Results **After an average follow-up period of 12 (2–18) years, no reinfection was detected. In 4 cases, a hip dislocation occurred and 3 of these needed further surgery.**

Interpretation **A 1-stage procedure for arthroplasty of an infected, mechanically failed hip fracture fixation is feasible and carries a low risk of infection.**

In the current literature, there are few reports on outcomes following infected failed internal fixation of hip fracture and subsequent arthroplasty. Hsieh et al. (2006) reported on a 2-stage procedure with and without the use of a spacer, in the setting of deep infection following intertrochanteric fracture. There was 1 reinfection in 27 patients after a minimum follow-up of 2 years. A 2-stage procedure has some disadvantages, however, such as prolonged hospitalization, 2 surgical procedures, and prolonged antibiotic administration.

At our institution, periprosthetic joint infections are usually treated by a 1-stage exchange of the infected prosthesis, with subsequent joint arthroplasty (Kordelle et al. 2000). In a similar fashion, we have performed 1-stage arthroplasty in the setting of mechanically failed hip fracture fixation with deep wound infection and we now report the outcome.

Patients and methods

Between 1994 and 2010, we treated 19 patients with 1-stage arthroplasty because of infected and mechanically failed hip fracture osteosyntheses. At the time of follow-up, 1 patient had died from cardiorespiratory failure 1 month postoperatively and 2 other patients had died 4 and 5 years postoperatively, from unrelated causes. The remaining 16 patients (10 of them males) had a mean age, at the time of arthroplasty, of 62 (33–90) years (Table 1).

The 16 patients were interviewed by telephone and asked whether they had developed any postoperative complications, or if they had required further surgery at any other institution. The average follow-up time was 12 (2–18) years.

All patients had been initially treated at other hospitals and had developed a deep wound infection of the site of previous fracture fixation within 1 month postoperatively in 7 cases, within 2–3 months in 6 cases, within 6 months in 1 patient, and in 2 cases after 8 and 17 years. All patients had had more than 1 procedure at the first treatment center prior to attending our institution. 4 patients had undergone revision osteosynthesis, 4 had undergone a single debridement procedure, 4 had undergone from 2 to 6 debridements (without hardware removal). The remaining 4 had undergone multiple debridements with partial removal of hardware.

The diagnosis of infection was in accordance with the Musculoskeletal Infection Society algorithm (Parvizi et al. 2011). The mean CRP levels preoperatively were 37 (3.0–156) mg/L. The mean white blood cell count preoperatively was 8.7 (3.9–17.1) nl.

Treatment

A preoperative joint aspiration was performed in all patients.

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Table 1. Patient data

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Initial diagnosis	
Pertrochanteric hip fracture	8
Femoral neck fracture	3
Femoral fracture	3
Dysplasia	1
Traumatic hip dislocation	1
Fixation device	
Intramedullary nail	11
Screws	3
Plate	1
Dynamic hip screw	1
Risk factors for infection	
Diabetes mellitus	3
Chronic obstructive pulmonary disease	3
Alcoholic cirrhosis	1
Renal failure	1
Charlson index	
0	9
1	1
2	2
3	2
4	1
5	1

The synovial fluid was incubated for 14 days (Fink et al. 2008). Antibiotics were stopped at least 2 weeks before joint aspiration.

Surgical approach

We used a posterior approach with extensive debridement of the infected tissue. At least 5 biopsies were taken around the joints and fixation devices. Again, all samples were incubated for 14 days. Next, the wound was thoroughly irrigated using pulsatile lavage with polyhexanide (Lavasept; Fresenius-Kabi AG, Bad Homburg, Germany) before implantation of the prosthesis with specific antibiotic-impregnated cemented stems and cups (SPII stem, Mark III cup; Waldemar Link Co., Hamburg, Germany) in all cases. The specific antibiotic used depended on the culture and sensitivity results, with expert input from a consultant microbiologist. A drain was used in all cases.

Based on the preoperative aspirate and individual antibiogram, intravenous antibiotics were administered during surgery, following biopsy. Postoperative intravenous antibiotic therapy was continued based on the patient's clinical signs and on monitoring of inflammatory markers. The intravenous antibiotic therapy was administered for 10 days on average.

Drains were removed 2 days postoperatively in all patients, who were allowed full weight bearing.

Table 2. Bacterial growth from preoperative and intraoperative samples

Bacterium	Preoperatively	Intraoperatively
SE	5	5
SA	4	5
MRSA	1	1
EF	1	1
PS	1	1
PA	1	1
SE and PA	1	1
SA and EF	1	0
SA and PS	1	1

SE: *Staphylococcus epidermidis*
SA: *Staphylococcus aureus*
MRSA: methicillin-resistant SA
EF: *Enterococcus faecalis*
PS: *Peptostreptococcus* sp.
PA: *Propionibacterium acnes*

Results

Upon admission to our institution, none of the patients showed any features of sepsis. However, 10 patients presented with a fistula. Apart from 1 patient, the same type of bacterium was detected in the intraoperative biopsies. In this exceptional case, the preoperative aspiration showed growth of *Enterococcus faecalis* (EF) and *Staphylococcus aureus* (SA), but the intraoperative biopsies did not confirm bacterial colonization by EF. The bacteria that were detected preoperatively and intraoperatively are summarized in Table 2.

1 patient died 23 days postoperatively due to cardiopulmonary decompensation. 5 patients had postoperative complications. There were 4 cases of postoperative prosthetic hip dislocation, which were attributed to pre-existing gluteus medius deficiency secondary to previous intramedullary nailing. 2 of these patients had a dislocation 7 and 10 days postoperatively. The other 2 patients had later dislocations, after 1 year. In 3 of these 4 patients, second surgery with implantation of an elevated acetabular liner was necessary.

At the most recent follow-up, there were no cases of reinfection. However, 1 immunocompromised patient with liver cirrhosis developed a new periprosthetic infection 1 year after the single-stage primary THA. The pre- and intraoperative culture results at the primary THA implantation were SA. Due to hip dislocation immediately postoperatively, a revision with implantation of an elevated acetabular liner was performed 2 weeks later. The intraoperative culture samples did not show any bacterial growth at this time. Due to a postoperative hematoma, hip aspiration was repeated and revealed growth of *Staphylococcus epidermidis* (SE). However, in the absence of clinical and laboratory signs of an infection, the growth of SE was thought to be from contamination of the probe. 18 months later, the patient was hospitalized due to persistent pain and early septic loosening of the prosthesis. After a second 1-stage

exchange of the prosthesis, with validation of the growth of SE in the intraoperative samples, no reinfection was noted up to the most recent follow-up time point at 16 years.

Discussion

The rate of deep wound infection after osteosynthesis of hip fractures is reported to range from 1.2% to 5.6% (Mackay et al. 2000, Noumi et al. 2005, Partanen et al 2006, Pollard et al. 2006, Edwards et al. 2008). Salvage THA after a mechanically failed internally fixated hip fracture is challenging, the more so if there is deep wound infection (McKinley and Robinson 2002, Haidukewych and Berry 2003, Mabry et al. 2004). In most institutions, initial removal of the infected fixation devices and implantation of the prosthesis in a 2-stage procedure is a common approach. Hsieh et al. (2006) described the short-term results of 27 cases of deep wound infection of fixated intertrochanteric fractures after 2-stage revision fixation with and without the use of a cement spacer. They had 1 reinfection and reported shorter surgery time, less blood loss, and better functional results in patients with a cement spacer than in patients without a spacer.

Alternatively, periprosthetic infections can be treated by a single-stage approach. In contrast to the 2-stage exchange, the 1-stage process has some advantages, such as the necessity for just one surgery, lower medical costs, shorter hospitalization, and a shorter course of antibiotic treatment. A systematic review and meta-analysis—including 36 studies of 1- and 2-stage exchange—of infection in hip arthroplasty did not show any superiority regarding reinfection rate (Lange et al. 2012).

In the present study, no reinfection was detected after an average follow-up of 12 years. There was 1 case of periprosthetic infection after 1 revision surgery, in the setting of recurrent dislocation in an immunocompromised patient.

There was a relatively high rate of dislocation (4 out of 16) in our study, especially in comparison to the results of Hsieh et al. (2006) who did not describe any episodes of dislocation. One explanation for this high rate may be the radical debridement that is necessary for a successful 1-stage exchange. In the current literature, the rate of hip dislocation in salvage THA without deep wound infection ranges from 2% to 23% (Mehlhoff et al. 1991, Stoffelen et al. 1994, McKinley and Robinson 2002, Mabry et al. 2004, Haentjens et al. 2005).

In conclusion, a 1-stage procedure for implantation of a primary cemented prosthesis in the setting of failed infected fracture fixation at the hip can be a safe procedure with a low risk of reinfection.

PFOL, MC, JMR, TG, and DK contributed equally to the manuscript.

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