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Removal and successful re-implantation of a customized interpositional knee device following an early postoperative infection: A Case Report

Case Report

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Abstract: We report the first case of early postoperative infection after a medial hemiarthroplasty of the knee with a customized ConforMIS iForma™ interpositional device. The infection was treated successfully by revision surgery with implant removal and antibiotic therapy. Despite the additional diagnosis of rheumatoid arthritis that did not affect the treated knee, the preservation of bony and ligamentous structures enabled a successful re-implantation of another iForma™ implant 9 months later with good clinical results at follow-up examination 1 year postoperatively. This is very much in contrast to the extensive and complex revision surgery, with significant bone loss, in patients with infected unicompartmental or total knee arthroplasties. The iForma™ device may be an alternative treatment option in early and moderate unicompartmental arthritis of the knee, with easy revision with the same type of implant in the rare case of infection.

Keywords: *Unicompartmental osteoarthritis • Knee interpositional device • Hemiarthroplasty • Complication*

1. Introduction

The concept of a metallic hemiarthroplasty in early unicompartmental knee arthritis has a long history. It was introduced more than 50 years ago by MacIntosh [1] and a little later by McKeever and Elliott [2]. Clinical reports by Scott et al. [3], Emerson et al. [4] and Springer et al. [5] showed good long-term results and easy revisions to unicompartmental (UKA) and total knee arthroplasty (TKA) with the McKeever device. These devices were partially fixed with a keel or rough underside and needed a wide exposure of the knee joint. Prior to the period of UKA and TKA, they were mainly used for unicompartmental knee arthritis, but some cases of bicompartmental arthritis were also treated in this manner [6]. Although adverse outcomes have been reported with the re-established interpositional Unispacer™ knee system (Zimmer, Inc), with devastating early failure rates ranging between 20 and 30 percent caused mainly by implant dislocation and persistent pain [7-9],

No clinical results have been reported so far for the iForma™ interpositional device (ConforMIS, Inc, Burlington, MA, USA), which was used in our case and is customized via magnetic resonance imaging (MRI). Only the reliability of leg axis correction in unicompartmental knee arthritis with this device has been demonstrated [10].

Early postoperative infection is still an ongoing problem in knee replacement, with infection rates ranging between 3.3% for superficial infection and 1% for deep wound infection after TKA [11,12]. The rate of septic failure is lower after UKA than after TKA, but the difference is not significant [13]. According to Zimmerli and Ochsner [14], early infection of a UKA or TKA? up to 3 months after implantation is usually treated by debridement, irrigation, and antibiotics, but the surface

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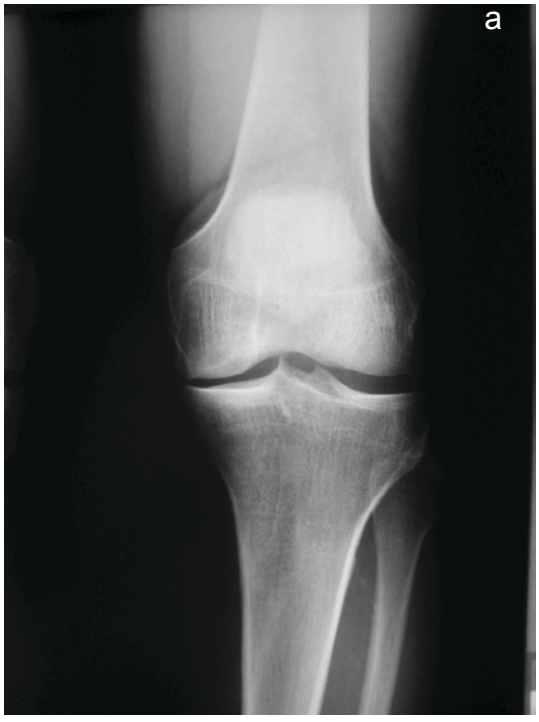
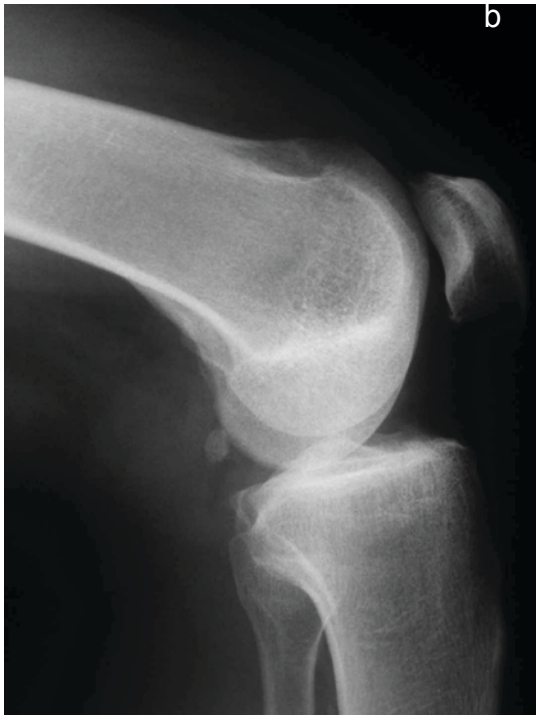
Figure 1. (a) a.p. x-ray pre primary iForma implantation; (b) Lateral x-ray pre primary iForma implantation.



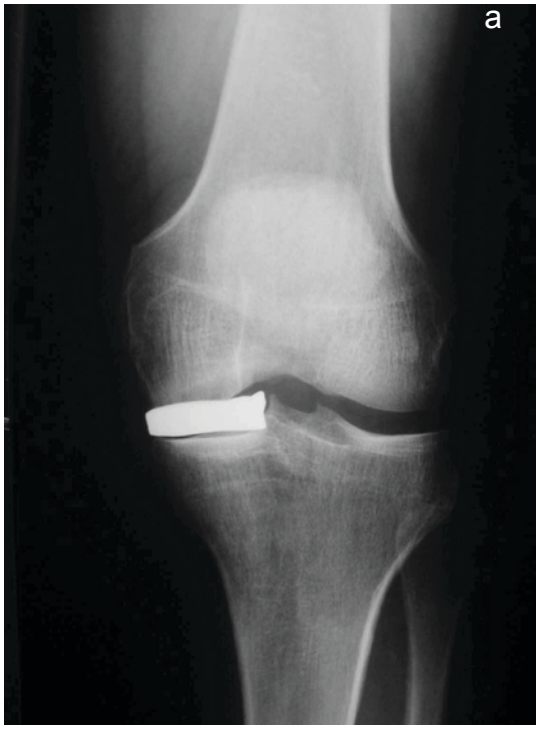


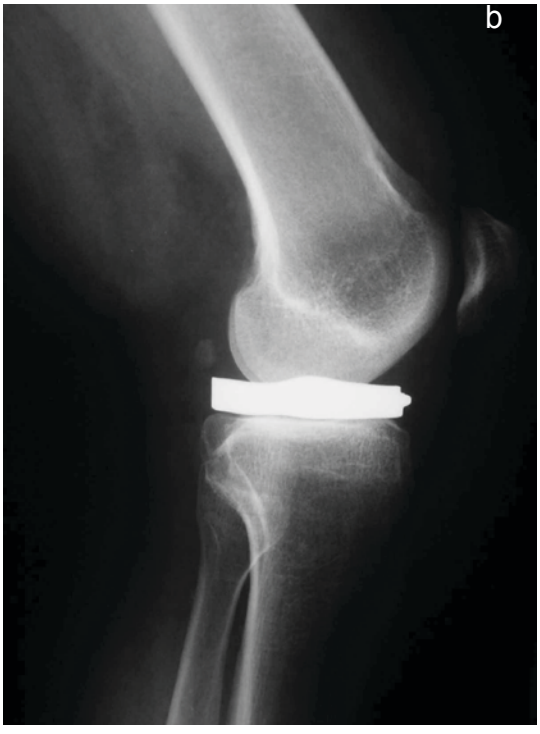
of the remaining implant remains a potential risk factor for re-infection. Additionally, in case of a late infection, the device is explanted. Re-implantation can be performed after successful treatment of the infection, as monitored by clinical and blood variables. Apart from the postoperative interval, further criteria for the individual treatment are the type of infection and the condition of the implant and the soft tissue, as well as the comorbidity [14]. Owing to bone loss after explantation of the infected prosthesis, the two-stage re-implantation is often a technically demanding procedure. Although infection of a tibial hemiarthroplasty is seen only rarely [15,16], it is a surgical problem to be addressed with the same strategies as infection of UKA and TKA. The following case report describes a patient with unicompartmental osteoarthritis (OA) of the knee and rheumatoid arthritis (RA). The benefits of the tibial hemiarthroplasty in case of an infection are demonstrated.

2. Case Report

A 63-year-old retired man underwent a primary hemiarthroplasty of his left knee with a metallic ConforMIS iForma™ interpositional device in May, 2006, for treatment of moderate medial osteoarthritis (Figure 1a and 1b). His major problem was pain, with walking limited to less than 10 minutes, and recurrent effusion despite continuous use of analgesics, repeated intra-articular corticosteroid injections, a previous arthroscopic debridement, and partial resection of the medial meniscus. Because of absent extra-articular deformity and the patient´s age, there was no indication for a high tibial osteotomy. A patient-specific iForma™ implant was produced via computer-aided design and manufacturing technology on the basis of preoperative MRI according to a special protocol. During the minimally invasive surgical procedure, only the damaged medial meniscus was removed; no bone cuts were performed, and no cartilage was removed. The patient had a history of several previous surgical procedures because of an infected prepatellar bursitis with secondary wound healing approximately 15 years prior to the present surgery. These procedures resulted in an extensive area of prepatellar scarring. In addition, a positive smoking history and a nonclassified spondylarthritis were identified as established risk factors predisposing the patient to postoperative infection. At the time of hospital discharge, 6 days after surgery, normal wound healing was observed, with no signs of infection. The patient was mobilized almost pain-free, with full weight-bearing with use of a crutch. Knee function had already returned to free extension and flexion to 110°. Postoperative blood tests showed decreasing but slightly elevated levels of C-reactive protein (CRP) due to the operative procedure.

Figure 2. (a) a.p. x-ray 12 months post iForma re-implantation; (b) Lateral x-ray 12 months post iForma re-implantation.





On the 20th postoperative day, the patient returned with purulent wound drainage from the medial mini-incision. The CRP was elevated to 87 mg per liter; the leucocyte count was 12.2 per nanoliter, and erythrocyte sedimentation rate 45 mm at 1 hour and 95 mm at 2 hours. The implant was removed, and a joint lavage with physiological saline solution was performed, along with a total arthroscopic synovectomy. It was determined that because of the poor condition of the skin and soft tissue a two-stage procedure with implant removal and later re-implantation would be the best option. In order not to damage the remaining cartilage, no antiseptic agents were used for irrigation. Methicillin-sensitive *Staphylococcus aureus* was identified as the causative agent. Cefazolin (MIP Pharma, Blieskastel-Niederwuerzbach, Germany: 3x 2g/d) was administered intravenously for 7 days, followed by oral cephaclor (Lilly, Bad Homburg, Germany: 500 mg tid) for another 3 weeks. The patient was mobilized with partial weight-bearing at 15 kg for 4 weeks. Knee flexion was limited to 90° for 1 week. Wound healing progressed uneventfully after the antibiotic therapy, and knee flexion was 115° at 4 weeks. However, laboratory variables indicating infection did not decrease as expected 4 weeks postoperatively (CRP, 21 mg/l). Antibiotic therapy was discontinued, and the knee was punctured 1 week later, with no recovery of the infectious agent. Clinical inflammatory signs in other joints, such as the elbow and wrist, strongly suggested an early rheumatoid arthritis, which was subsequently confirmed by highly sensitive laboratory testing (anti-citrullinated protein antibodies, 195.2 RE/ml, and mutated citrullinated vimentin, 121.0 U/ml). The patient's rheumatoid disease was successfully managed by single-drug therapy with Decortin H (Merck Pharma, Darmstadt, Germany: 5 mg tid).

Nine months after the implant removal, the variables indicating infection were completely normal (CRP, 5.1 mg/l). The patient again had pain, marked limitation in walking, joint instability, and recurrent effusion of his left knee. At his request and in view of previous reports of successful hemiarthroplasty in rheumatoid arthritis [15,16], it was decided to re-implant an iForma™ interpositional device. The MRI was repeated, and a new device similar to the design of the original was manufactured. During arthroscopic surgery, a postinfectious scarring of the synovial membrane was seen, but without inflammation. The new iForma™ device was inserted by simply reopening the medial mini-approach and inserting the device into the intraarticular space with a grasper instrument. Antibiotic coverage with ceafzolin/cephaclor was continued for 2 weeks during the immediate peri- and postoperative periods. Primary wound healing without any signs of re-infection occurred on full weight-bearing. The CRP level at time of discharge was 7.2 mg/l. Twelve months postoperatively, the patient had no evidence

of infection, with good knee function and pain relief. The range of motion (extension/flexion) increased from 0°/120° at 4 weeks after re-implantation to 0°/130° at 12 months after re-implantation. The patient was able to walk for 1 hour without supportive devices or a need for analgesics. Radiographic examination 12 months after re-implantation showed a correct and stable implant position in anteroposterior and lateral views (Figure 2a and 2b). The reduced version of the Western Ontario and McMasters University Osteoarthritis (WOMAC) Index [17,18] was 53 before primary iForma™ implantation, decreased to 49 before re-implantation, and increased to 72 12 months after iForma™ re-implantation. The level on the visual analogue scale for walking on a flat surface was 6 before primary implantation, 7 before re-implantation, and 2 one year after re-implantation.

3. Discussion

Early postoperative infection is a rare complication after tibial hemiarthroplasty of the knee. Hastings [6] analysed 50 cases of double hemiarthroplasty with the MacIntosh device in patients with RA. He reported one case of early superficial infection and one case of late deep infection; he did not detail the treatment of superficial infection but reported that the late deep infection was treated by irrigation and chemotherapy. MacIntosh [12] reported four deep infections after a total of 130 hemiarthroplasties. He described four with ”poor results”, two of them resulting in an arthrodesis. In contrast, no cases of infection were reported for the Mc Keever [3,16] and the Unispacer devices [7-9].

This is the first case of infection reported after the placement of an interpositional iForma™ device. The infection in our case occurred in a patient with well recognized risk factors. Thus, even after revision surgery with implant removal, lavage, and synovectomy, all bony and ligamentous structures remained intact. Therefore, a successful re-implantation with an identical type of implant was possible.

In our case, the standard treatment regime for early infection after knee arthroplasty as discussed in the literature [14] was not strictly followed. For one example, the implant could be removed easily without destruction of any bony and ligamentous structures, and for another, the patient had high risk factors for re-infection in the remaining implant. No cancellous bone was exposed after revision, and the treatment was comparable to the procedure for septic arthritis of the knee [19].

The decision to re-implant an iForma™ device was made despite the diagnosis of RA made in the interval. According to current literature, Potter, et al. [16] found no difference regarding the outcome of patients with OA and RA who used the McKeever and MacIntosh devices. MacIntosh himself reported an 80.5% success rate after hemiarthroplasty in OA and 68.5% in RA, with a mean follow-up of 3.5 years [15]. Thus, he found hemiarthroplasty to be a useful method of dealing with painful knee deformities in both forms of arthritis.

Removal of an interpositional iForma™ device due to early infection leaves no implant surfaces as potential agents for persisting infection. Furthermore, any movement of an iForma™ implant, however slight, argues for removal of the device even in cases of early infection [14]. The iForma™ device also has strong advantages in cases of late infection; during revision surgery, the cancellous bone is not opened, and no bone loss is seen. Moreover, re-implantation after an infected UKA or TKA is a technically challenging procedure, with the need for larger and more complex implants that carry a higher risk for recurrent infection [13]. Therefore, the simple and rapid two-stage re-implantation of an iForma™ device is a useful surgical technique in a small group of patients, and the option of implantation of a UKA or TKA in the future is preserved. However, the main goal of using an interpositional iForma™ device should be restoration of function and pain relief, and a secondary argument for this type of implant may be easy revision in case of infection.

Conflict of interest statement

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