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CASE REPORT

Preservation of the shoulder joint by the use of a hybrid-spacer after septic loosening of a reversed total shoulder joint arthroplasty: a case report

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Abstract Infections of a total joint replacement (TJR) of the shoulder are rare complications. After revision surgery, the incidence rises dramatically. If infection occurs, it leads to a loss of function and may be devastating to the joint. Treatment options range from single- to multiple-staged revision programs, permanent resection arthroplasty or exarticulation. In this case, a reversed shoulder endoprosthesis, which was implanted after multiple revisions of a TJR due to a posttraumatic omarthrosis and rotator cuff insufficiency, got infected. A hybrid-spacer, made of a humeral nail and a custom-made PMMA spacer forming the humeral head, was used during the revision program. After two operations, clinical and paraclinical signs turned back to normal. The patient felt well and was satisfied with the result of the therapy. The hybrid-spacer was then left in situ as a definitive solution with a satisfying range of motion. This case report shows that a hybrid-spacer can be helpful in the treatment of an infected shoulder TJR.

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Introduction

Next to major vascular, soft tissue or neural injury, the septic arthritis is known as the major complication in association with total joint replacement (TJR). Principally, infections of TJR are divided into two groups:

- acute infection of the TJR: clinical, paraclinical and radiological signs occur less than 6 weeks after implantation of the TJR.
- chronical infection of the TJR: clinical, paraclinical and radiological signs occur more than 6 weeks after implantation of the TJR.

The treatment of these infections is closely related to this classification. While the preservation of the arthroplasty is known as the paramount goal during the treatment of an acute or early infection, it is generally agreed that late or chronical infection of the TJR apriori leads to removal of the arthroplasty with the surrounding bone cement and surgical debridement of the bone and surrounding soft tissue. In a later phase of the treatment, the re-implantation of the TJR has to be considered.

Infections of total shoulder arthroplasties occur in nearly up to 4 percent for primary and in up to 15 percent for revision endoprosthesis [3, 4, 10, 11]. Early and aggressive treatment of acute infections may help to preserve the TJR. If treatment is delayed, the implant including the surrounding cement mantle has to be removed consequently [5]. A one- or two-stage revision strategy must then be considered.

Up to 30% of infected shoulder arthroplasties lead to the persistent state of a resection arthroplasty [2, 4].

This implies a significant lack of function of the shoulder joint and this (especially in younger patients) should be avoided [7].

In order to do so, the temporary implantation of spacers during the phase of infect eradication is described in the literature [5, 6, 12]. They should help to keep the soft tissue balancing and lead to a certain stability of the shoulder joint, which is one of the key facts in the treatment of osteoarticular infections.

Case report

In 1994, a 34-year-old woman suffered from a left arm caput humeri fracture that led to open reduction and internal fixation by a plate osteosynthesis. During the next 4 years, she developed a severe posttraumatic omarthrosis that necessitated the implantation of a total shoulder joint arthroplasty. Eight years later, she again injured her shoulder and now suffered from a rotator cuff lesion and a slight loosening of the humeral stem. The rotator cuff lesion was treated by open surgery, and the humeral part of the arthroplasty was changed. In 2006, the patient injured her shoulder once more and this time the TJR was luxated and a major rotator cuff lesion was diagnosed. Once again surgery was proceeded. The TJR was restored and the rotator cuff lesion was fixated. Five days after this procedure, signs of a severe infection occurred. With further surgical revisions and antibiotic treatment, the situation could be solved. But due to these revisions, the rotator cuff was destabilized because of the loss of soft tissue, and during the following months, the arthroplasty luxated frequently. In September 2006, a reversed shoulder arthroplasty (Grammont prosthesis) [1] was implanted. All these procedures were performed in external institutions. We do not have more detailed information about the patient's history before the lady was sent to our department of septic and reconstructive surgery in July 2007. We could not obtain precise information why the primary osteosynthesis led so rapidly to a severe omarthrosis, about the implantation of the TJR and finally why a reversed endoprosthesis was implanted in such a young lady.

When she came to our department, she showed signs of an acute exacerbation of the already known infection of the left shoulder joint (white blood cell count (WBC): 9.3×10^9/l, C-reactive protein (CRP): 37 mg/l). First goal was to get in control of the infected articulation and preserve shoulder function.

The patient was taken into the surgical revision program. In the first step, the arthroplasty was removed as well as the surrounding bone cement. Necrotic and infected bone and soft tissues were removed, a hybrid-spacer made from an intramedullary nail and a custom-made gentamycin PMMA spacer was implanted (Fig. 1). The microbiological examination of the specimen taken during the first surgical revision lead to the detection of *Staphylococcus epidermidis*. Thus, an additional antibiotic therapy was performed. After two further operations (debridement and lavage), no further sign of infection could be detected. The wound healing showed no pathological findings and the paraclinical values turned back to normal (WBC: 9.2×10^9/l, CRP: 6 mg/l). No bacteria could be detected microbiologically from the specimen taken during the last operation.

Our planned approach was to reconstruct the shoulder joint by custom-made tumor-TJR 12 weeks after we gained sterility. But the patient refused any further surgical procedures. The patient felt well and was highly satisfied with the result of the last procedure. Even though the hybrid-spacer, which was now replacing her left shoulder joint, was not planned to be a definitive solution, it was left in situ.

Twelve weeks after surgery, the range of motion of the shoulder was as follows: active: 40/0/10° (anteversion/retroversion); 30/0/10° (abduction/adduction) with free passive motion (Fig. 2).

She was recommended not to carry more than 3 kilos of weight with her left arm. At her 12 months check up, the lady was still highly satisfied with her situation. Meanwhile, she had turned back to work in her beauty parlor (administration and supervision tasks, no active hairdressing anymore).

Discussion

Infections of TJR of the shoulder are rare complications. In general, they lead to a loss of function and sometimes may be devastating to the joint [4]. In revision surgery, the infection rate rises dramatically [3, 4, 10].

The experience in the treatment of this disease is limited, because of the relatively small number of cases and expertise in this field.

The treatment options are similar to the treatment of total hip arthroplasties:

- One-stage revision program (surgical revision of bone and soft tissue plus exchange of the prosthesis in one intervention).
- Two-stage revision program (surgical revision of bone and soft tissue plus explantation of the TJR in the first intervention. Reimplantation of the TJR after calming of the infection in a second operation).
- Multi-stage revision program (surgical revision of bone and soft tissue plus explantation of the TJR in the first intervention. Reimplantation of the TJR after calming of the infection in a later operation).

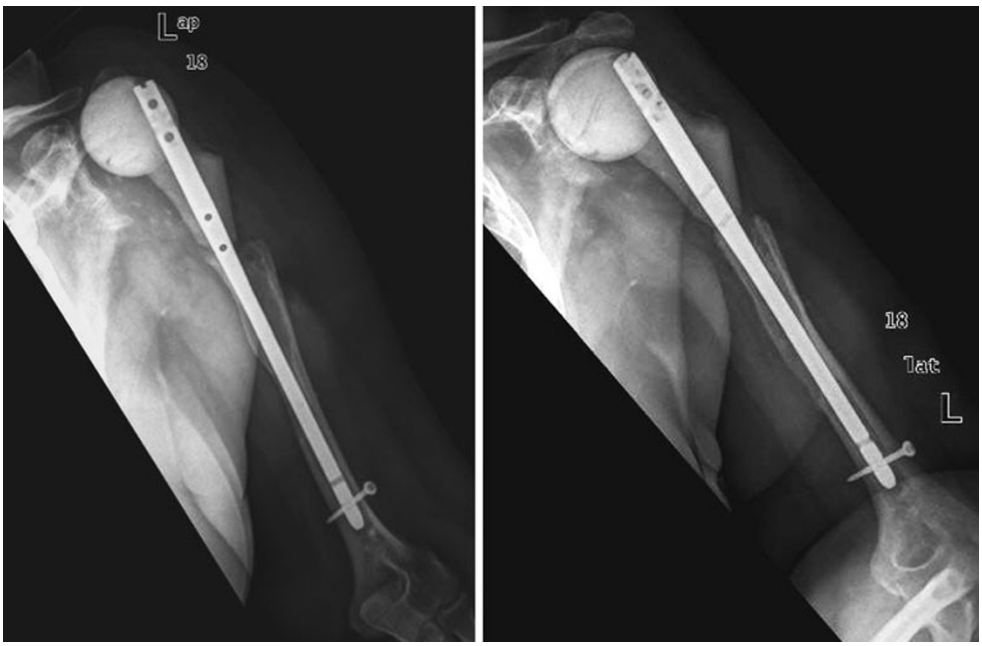

Fig. 1 Custom-made hybrid-spacer ap and lateral view

Fig. 2 Passive and active motion 12 weeks after implantation of the hybrid-spacer

- Permanent resection arthroplasty.
- Exarticulation.

It is understood that the surgical treatment has to be combined with the correct antimicrobial therapy.

Due to the absence of long-term outcome studies, no binding guidelines are defined [13].

Independently from the individual chosen procedure, the loss of bone stock plus the loss of soft tissue, especially in the rotator cuff, represents the major problem that occurs when septic revision surgery of the shoulder is requested.

The loss of bone stock and soft tissue (rotator cuff) represents the basic reason for instability of the shoulder and thus for the persistence of the infection. It is understood, that in any two-or multiple-stage revision program, a temporary shoulder stabilizer has to be implanted [9, 12]. Especially if the loss of bone is extensive, the choice of the correct "spacer" is problematical. In terms of custom-made PMMA spacers, the following problems have to be solved:

- The spacer shaft may not be long enough to ensure a safe fit in the remaining humeral shaft.
- The spacer shaft may be too thin and thus may fracture.
- No safe distal locking is possible without weakening the spacer shaft.

One possible solution to this problem may be the use of "hybrid-spacers". These spacers are built from a humeral nail, which is imbedded by a custom-made PMMA spacer at its proximal end. Hybrid-spacers may solve the above named problems. Due to the fact that they include a humeral nail, the optimal length of the shaft may be chosen

to ensure the correct tension of the soft tissue, to preserve the correct length of the arm and to provide optimal stability of the shoulder. The nail may be safely distally locked by inserting a locking screw. Only titanium nails should be used because they are bioinert and titanium implants are especially recommended in septic bone surgery [8].

Additionally, the PMMA spacers may be loaded with antibiotics and thus may work as adjuvant local antibiotic carriers.

The paramount goal of septic surgery of the shoulder is to preserve a good function. As contrasted with the hip, there is no weight bearing in the shoulder. Therefore, in the absence of any further problems (no clinical and paraclinical signs of infection), in combination with an agreeable function and subjective sense of well-being, the preservation of the spacer may be discussed. It has to be stressed out that this is a limited goal procedure. Preserving of such a hybrid-spacer may be accompanied with loss of function. Most often, patients who went through multiple revisions are highly satisfied with the absence of pain and the preservation of a basic articular function as mentioned above. In addition, it has to be mentioned that this procedure primarily should be used as a temporary solution. Definite aim of the treatment should remain the implantation of an arthroplasty. If this is, for some reason, not possible or the patient denies any further surgical treatment, the described method may be successful as a definite solution and leads to patient contentment.

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