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Case report

Revision Total Hip Arthroplasty due to Catastrophic Osteolysis Caused by Massive Chronic Expanding Hematoma

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ABSTRACT

An 84-year-old woman who underwent bilateral cementless total hip arthroplasty (THA) for dysplastic osteoarthritis 22 years ago was subjected to analysis. A huge soft-tissue mass was revealed in her left medial thigh. Plain radiographs of the left hip joint revealed severe osteolysis around the stem, cup, and ischium. Magnetic resonance imaging showed a 25 × 14-cm multilobulated mass with a thick-walled pseudocapsule. Two-stage surgery was performed with resection of the mass followed by a subsequent revision THA. The mass was diagnosed as a chronic expanding hematoma through gross and histologic findings. Two years after the revision THA, there was no recurrence of a hematoma. Two-stage revision THA was useful for definitive diagnosis, and good functional recovery was obtained after surgery.

Introduction

Osteolysis-related periprosthetic soft-tissue mass after total hip arthroplasty (THA) has been well documented [1-8]. Previous articles have reported that polyethylene particle–induced osteolysis was caused by the existence of a periprosthetic soft-tissue mass and aseptic loosening of the implant [1-4]. Conventional polyethylene, which had been used in the past, has been associated with concerns that it potentially makes additional particulate debris that leads to polyethylene particle–induced osteolysis in THA. Until recently, reducing particulate debris generated from the bearing surface had been one of the major issues that needed to be overcome to achieve long-term survival of THA. In recent years, highly cross-linked polyethene has been developed and generally used to reduce particulate debris. In the past decade, metal-on-metal (MoM) THA-related reactions, which are adverse reactions to metal debris have been reported as a cause for early revision THA [5-8]. The high failure rate of MoM THA is associated with nanometer-sized metal particles that derive from the MoM bearing surfaces and taper junctions that cause the development of a localized adverse periprosthetic soft-tissue response, also known as adverse local tissue reaction (ALTR).

On the other hand, a chronic expanding hematoma is a rare entity that often results from trauma, surgery, anticoagulation therapy, or bleeding disorders [9-12]. In addition, osteolysis due to a periprosthetic chronic expanding hematoma after THA is relatively rare [13-15], and a clear preoperative diagnosis could be difficult to determine. Surgeons must be able to exclude other diagnoses, which are ALTR associated with MoM or polyethylene, malignant soft-tissue tumors, and deep infection. In this case report, we present an 84-year-old woman who underwent THA 18 years before the present event. The large soft-tissue mass was revealed in her left medial thigh, and severe osteolysis around the THA was observed. Two-stage surgery with resection of the soft-tissue mass and subsequent revision THA were performed for catastrophic osteolysis due to a large chronic expanding hematoma.

Case history

Informed consent was obtained from the patient and her family for this study. The patient was informed that the data concerning her case would be submitted for publication.

An 84-year-old woman with a medical history of dysplastic osteoarthritis in both hips underwent bilateral THA at another hospital when she was 66 years old. Postoperative recovery was

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uneventful, and she was able to obtain satisfactory activity of daily living without any limitations. However, 5 years before the present event, the patient had become aware of the mass in her left medial thigh without any trauma and that the mass was gradually growing. She complained of discomfort in her left hip joint when walking. At that time, the patient was not recommended to have surgical intervention at the initial hospital because of her age and mild dementia. She consulted our hospital for diagnosis and for considerations of surgical options. At the time of her initial visit, she could not walk without a walker, and a large mass existed in her left medial thigh (Fig. 1). Plain radiographs and computed tomography (CT) examination revealed that the cup was placed in a high hip center position during the previous left THA, and extensive osteolysis was observed around the acetabular cup and ischium. The acetabular defect was classified as Paprosky classification type 3A (Figs. 2 and 3a and b) [16]. In addition, a catastrophic bone defect was observed at the proximal femur while the medial side of the stem was completely exposed, and the femoral defect was classified as Paprosky classification type 4 [17]. Magnetic resonance imaging showed a 25 × 14-cm multilobulated soft-tissue mass with a thick-walled pseudocapsule. The mass demonstrated a combination of heterogeneous low and intermediate intensity on T1-weighted images and a combination of low and high intensity on T2-weighted images (Fig. 4a and b). The heterogeneous structure was visibly enhanced in the peripheral region of the mass on a T1-weighted image after an intravenous injection of gadolinium-diethylenetriaminepentaacetic acid (Fig. 4c). In the CT angiogram, active bleeding was not revealed during the arterial phase, and the femoral vein and artery were curved and displaced to medial by the mass (Fig. 3c). Routine laboratory tests were nearly normal except for mild anemia. However, coagulation studies and C-reactive protein were slightly above the normal range. The patient's laboratory data are given in Table 1. The differential diagnosis that we considered before surgery included deep infection, malignant soft-tissue tumor, particle-related ALTR, and a chronic expanding hematoma. A two-stage surgery was planned considering the possibility of a potential deep infection. During the initial surgery, the implant was loosened, and the removal of the acetabular cup and the femoral stem was not very difficult. There was no evidence of macroscopic damage to the implant, such as corrosion of the stem, metal head, and polyethylene liner; however, conventional polyethylene was used in the previous surgery. An extended bone defect was revealed in the proximal femur along the mass. The mass consisted of a fibrous capsule and contained a mix of a chronic and relatively fresh hematoma. We did not perform total resection of the mass including the capsule because the capsule was extensively supporting the adjacent muscle. Curettage of the hematoma was performed as much as possible in the medial thigh, pelvic cavity, and around the ischium and the pubis. No bleeding source was detected. The total volume of the hematoma without serous hemorrhage before coagulation was measured as 1000 g (Fig. 5a). As latent deep infection could not be ruled out during the first surgery, an antibiotic-loaded acrylic cement spacer was placed preventively (Fig. 6a). Results of the bacterial culture from the intraoperative curettage samples were negative. Pathological examination under hematoxylin and eosin staining for the intraoperative curettage samples was performed. Histological examination demonstrated large amounts of old

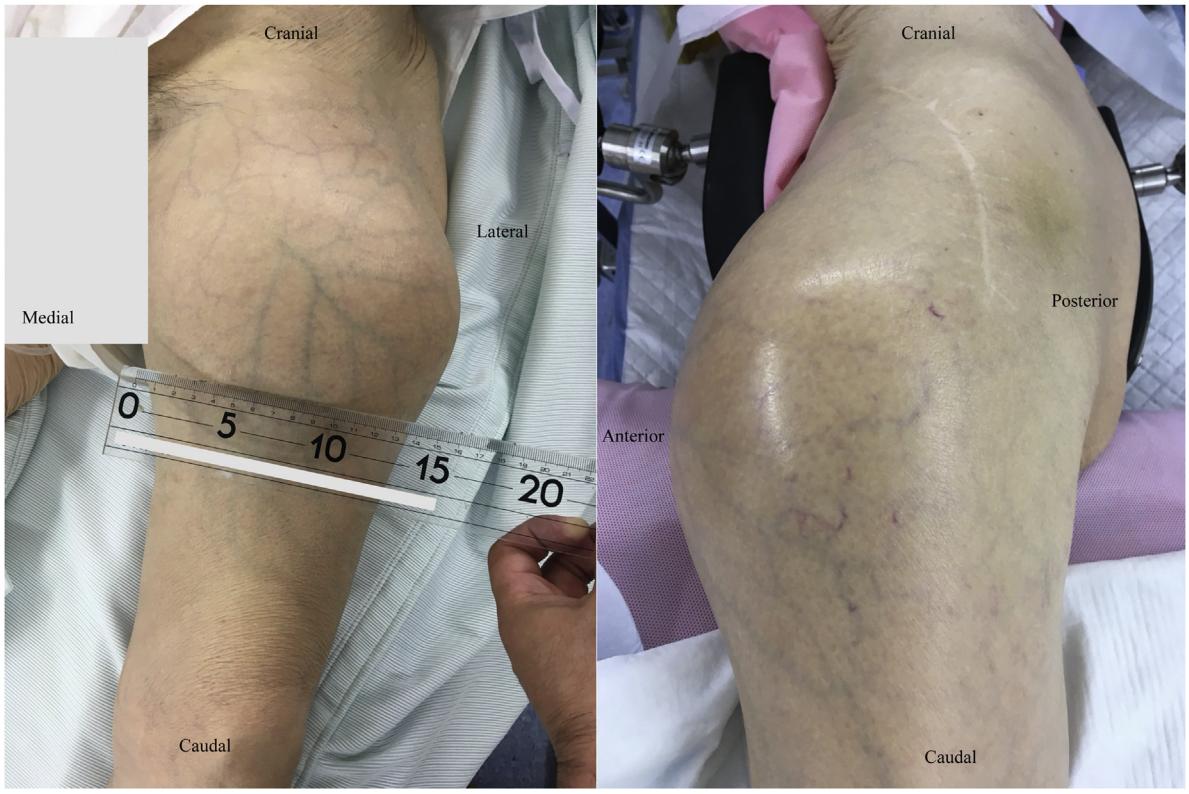

Figure 1. Gross findings.

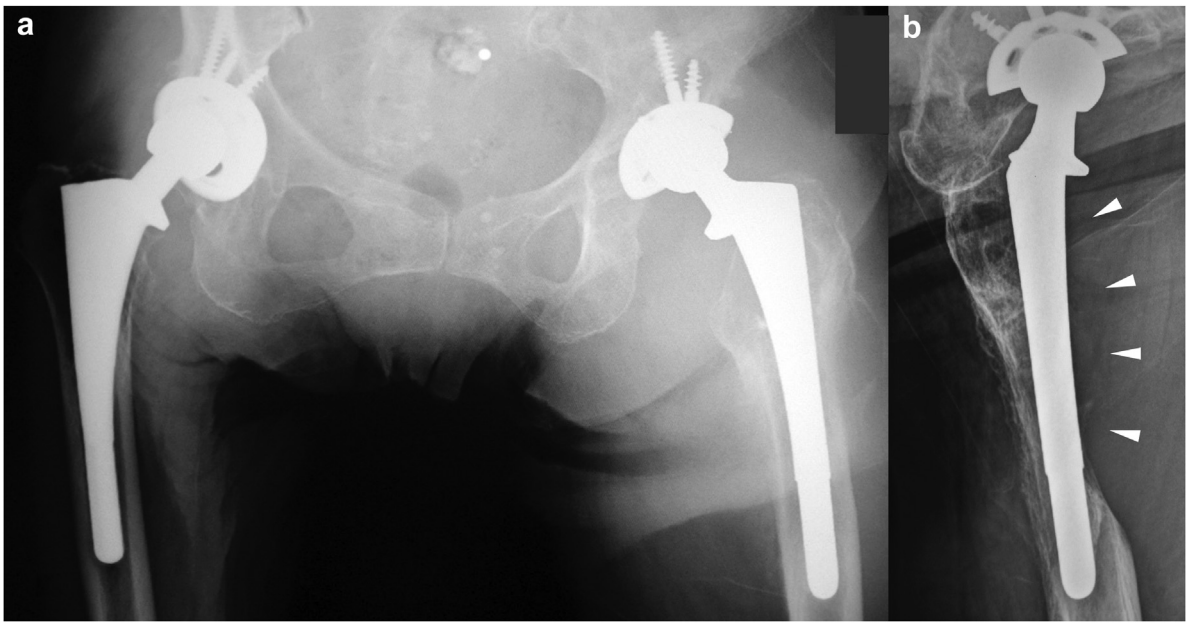

Figure 2. Plain radiograph of the left hip.

clotted blood within the lesion. The capsule of the lesion consisted of hypocellular fibrous tissue. There was no evidence of particle disease as polyethylene particles and metal debris were phagocyted by histiocytes. In addition, there was no evidence of neoplasia. The pathological examination led to the diagnosis of a chronic expanding hematoma (Fig. 5b). Revision THA was performed 3 weeks after the initial surgery. The Hardinge approach with the patient in the lateral decubitus position was used for the revision THA. A bulk femoral head allograft, an acetabular reinforcement device (Kerboull-type plate; Kyocera Medical, Osaka, Japan), and a 48-mm-diameter highly cross-linked polyethylene cemented cup (Exeter X3 rim fit cup; Stryker Orthopedics, Mahwah, NJ) were used for acetabular reconstruction. A cemented tumor prosthesis (GMRS proximal femoral component; Stryker Orthopedics, Mahwah, NJ) and a 32-mm-diameter ceramic head (BIOLOX delta V40 Ceramic Head; Stryker Orthopedics, Mahwah, NJ) were used for femoral reconstruction (Fig. 6b). There were no complications such as uncontrolled bleeding, postoperative infection, deep thrombosis, and dislocation during the perioperative period. Two years after the revision surgery, the patient could walk with a cane, and no recurrence of a hematoma was observed. Magnetic resonance imaging also showed no recurrence of a hematoma 2 years after the surgery (Fig. 7). The Modified Harris Hip score improved from an estimated 18.7 points before surgery to 73.7 points at final follow-up.

Discussion

Polyethylene particle–related osteolysis or MoM-related ALTR after THA has been generally well researched [1-8]. On the other hand, periprosthetic chronic expanding hematoma concomitant with loosening of an implant after THA is quite rare [13-15]. In 1980, Reid et al. first proposed chronic expanding hematoma as a new pathological entity [9]. They reported 6 cases, which included hematomas that appeared or increased in size more than a month after a hemorrhagic event. All 6 cases had the same structure with a peripheral wall of dense made of fibrous tissues and a central space containing fresh and altered blood. To the best of our knowledge, osteolysis due to chronic expanding hematoma after THA has only been reported in 3 case reports to this date [13-15]. Goddard first

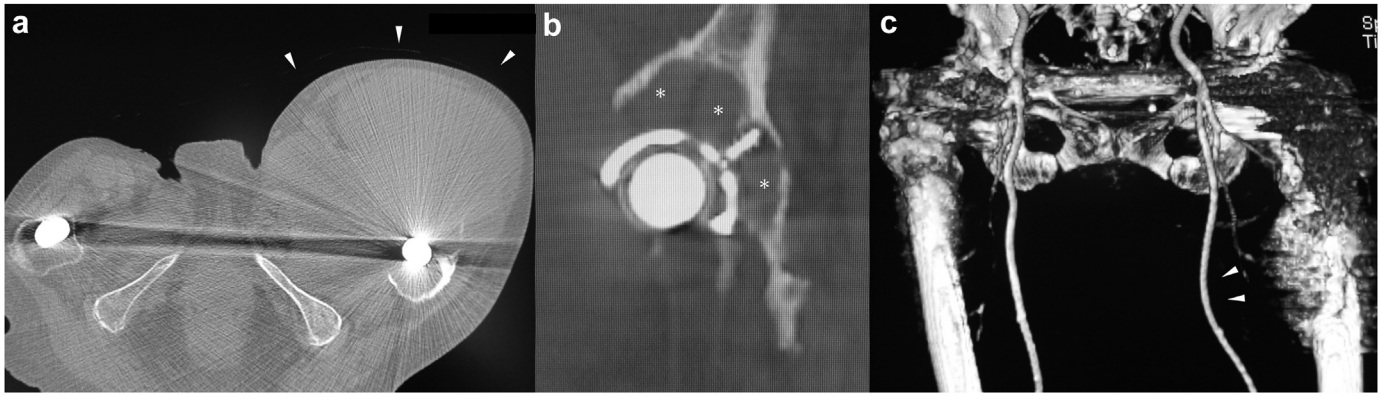

Figure 3. Preoperative CT.

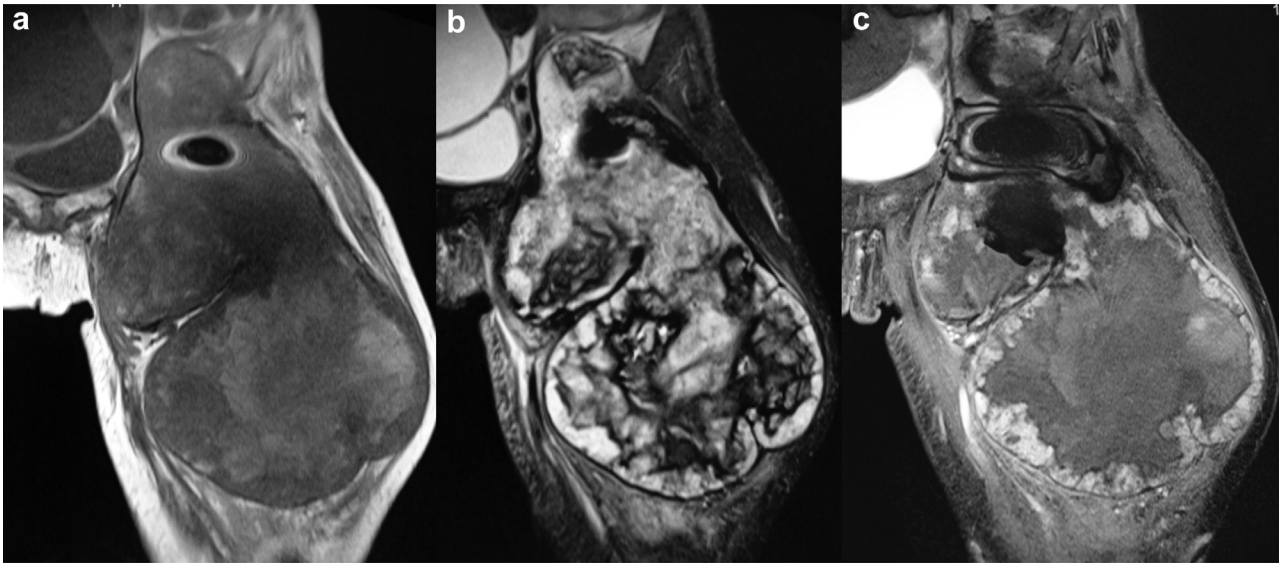

Figure 4. Preoperative MRI.

described a chronic expanding hematoma after revision THA in 2011 [13]. The gross findings of the fibrous pseudocapsule contained chronic hemorrhage, and the lack of histological evidence of a particle-induced disease led to his diagnosis of the lesion as a chronic expanding hematoma. Resection arthroplasty was performed in this case.

There are similar articles by Ando et al. and Matsuda et al. [14,15]. Matsuda et al. hypothesized that osteolysis with a hematoma was associated with an inflammatory reaction from hydroxyapatite debris, which was used in impaction bone grafting in their case [15]. After the removal of the hematoma, granulation tissues, and hydroxyapatite debris, osteosynthesis was performed for the pathological fracture in the greater trochanter. Another case was reported by Ando et al. where a hematoma occurred after MoM THA [14]. However, a high metal ion concentration was not present in the joint fluid, and they could not investigate the cause of corrosion of the implant. To prevent the recurrence of a hematoma or an ALTR, the MoM surface was replaced with a dual mobility system. These 2 case reports suggest that the cause of the chronic expanding hematoma after THA was difficult to determine and that correct preoperative diagnosis could be difficult.

In the present case, initial THA did not include a MoM articular surface; however, a massive soft-tissue mass developed almost 15 years after THA without a definite hemorrhage event. Catastrophic osteolysis was observed both in the femur and the pelvis. The cause of the catastrophic osteolysis and the significant bone defect was difficult to explain. Therefore, preoperative imaging diagnosis was difficult. The following were considered as the preoperative diagnoses: an expanding hematoma, a polyethylene particle–related pseudotumor, deep infection, and a benign or malignant soft-tissue tumor. In order to obtain a correct diagnosis, a two-stage surgery was planned. The gross findings of the extracted implants identified no evidence of macroscopic damage in the stem, metal head, or the conventional polyethylene liner. In addition, metal debris and polyethylene particles were not contained in the curettage sample nor in the surrounding soft tissue on histological examination. In addition, deep infection was ruled out by the results of the bacterial culture from the intraoperative curettage samples. According to these results, particle disease and deep infection were also ruled out.

On the other hand, Park and Ryu and Jansen et al. proposed that repetitive bleeding and hemophilic pseudotumor may lead to bone destruction [18,19]. Currently, however, the mechanism of an enlarged chronic expanding hematoma is still unknown. It is hypothesized that the enlargement of a hematoma is related to inflammation stimulated by blood breakdown products [20]. Inflammation leads to an increased vascular wall permeability, and blood breakdown products create an osmotic gradient that draws more fluid into the hematoma [11,21]. These inflammatory processes may be the cause of the expansion of the hematoma. In the present case, the hematoma increased gradually, even though active bleeding was not revealed during the arterial phase in the preoperative CT angiogram and no bleeding source was detected during surgery. It was hypothesized that the chronic expanding hematoma was caused by similar processes as mentioned previously and was not directly related to the bleeding from damaged blood vessels. Regarding revision THA, surgical alternatives for femoral reconstruction are considered controversial. Impaction

Table 1
Laboratory test

Laboratory test	Results	Reference
White cell (x10^2/μL)	83.2	31.9-83.1
Lymphocyte ratio (%)	14.9	18.0-49.0
Monocyte ratio (%)	4.6	2.0-10.0
Neutrophil ratio (%)	78.9	40.0-75.0
Eosinophil ratio (%)	0.5	0.0-8.0
Red cell (x10^4/μL)	324	371-508
Hemoglobin (g/dL)	9.0	11.0-14.7
Hematocrit (%)	27.9	35.3-46.8
C reactive protein (mg/dL)	1.9	0.00-0.14
ESR 1hr (mm)	9	3-11
AST (U/L)	11	13-30
ALT (U/L)	5	7-23
BUN (mg/dL)	18.1	8.0-20.0
Creatinine (mg/dL)	0.55	0.46-0.79
Platelet (x10^4/μL)	25.5	17.3-38.6
Prothrombin time (s)	13.2	9.4-12.5
Prothrombin activity (%)	73.6	70-100
APTT (s)	37.9	25.0-36.0
PT-INR (INR)	1.23	0.85-1.15

ALT, alanine aminotransferase; APTT, activated partial thromboplastin time; AST, aspartate aminotransferase; BUN, blood urea nitrogen; ESR, erythrocyte sedimentation rate; PT-INR, prothrombin time-international normalized ratio.

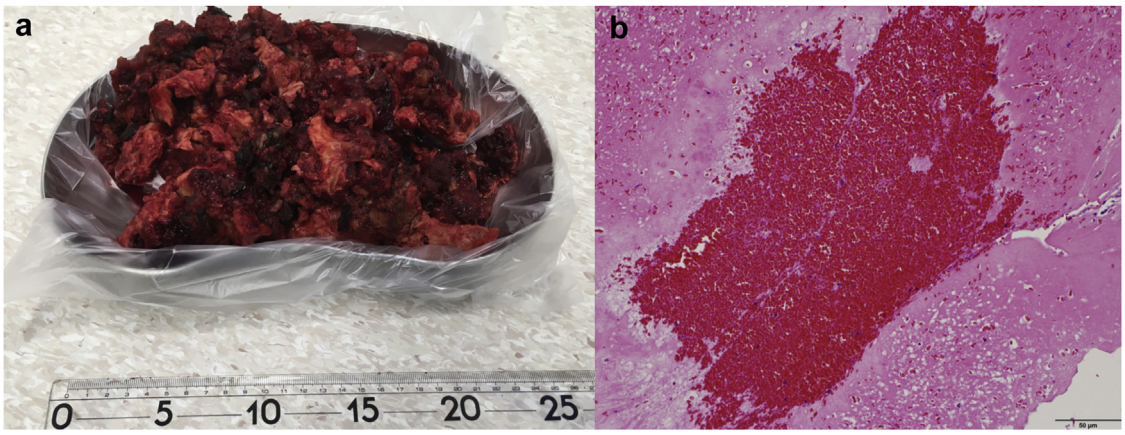

Figure 5. Gross and pathological finding of hematoma.

bone grafting is a preferred surgical option for femoral defects to preserve bone stock. However, the patient in the present case was 84 years old, and the activity level of the patient was not high; therefore, we selected a simple surgical procedure using a tumor prosthesis without impaction bone grafting. Postoperative outcomes were satisfactory at 2 years after surgery. Uncontrolled bleeding and recurrence of a hematoma were not revealed after surgery. However, the limitation in this case report includes the fact that the postoperative follow-up period was quite short and that future observations for recurrence of a hematoma are necessary. However, to the best of the authors' knowledge, this is an exceedingly rare case report of a two-stage revision THA for catastrophic osteolysis due to a chronic expanding large hematoma.

Summary

The causes of a chronic expanding hematoma after THA are difficult to define, and the correct preoperative diagnosis could be difficult to determine. The two-stage revision THA was successfully performed, and the patient who had catastrophic osteolysis due to a chronic expanding large hematoma recovered well.

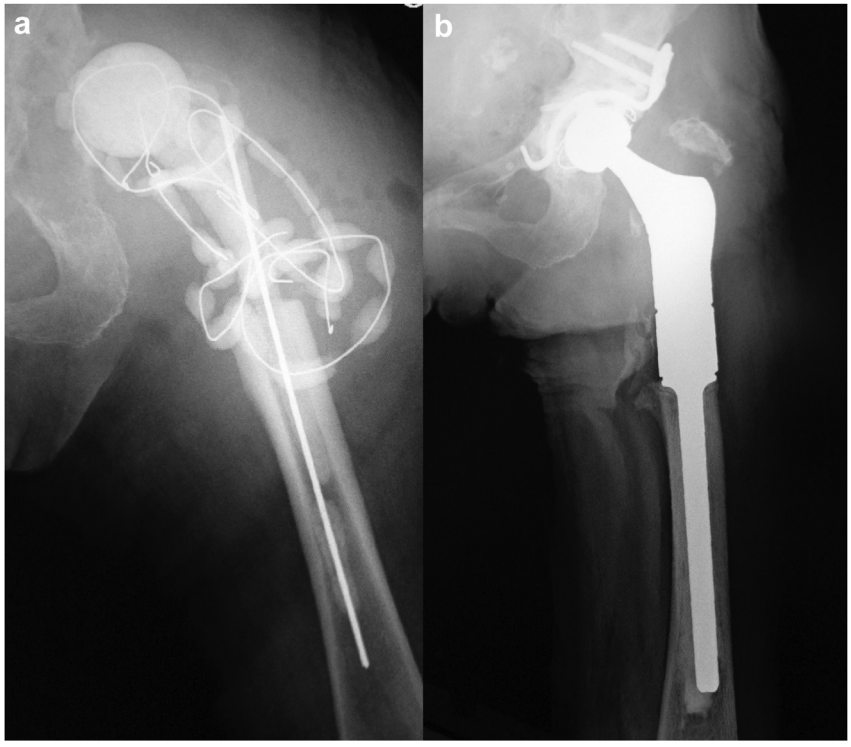

Figure 6. Postoperative radiograph.

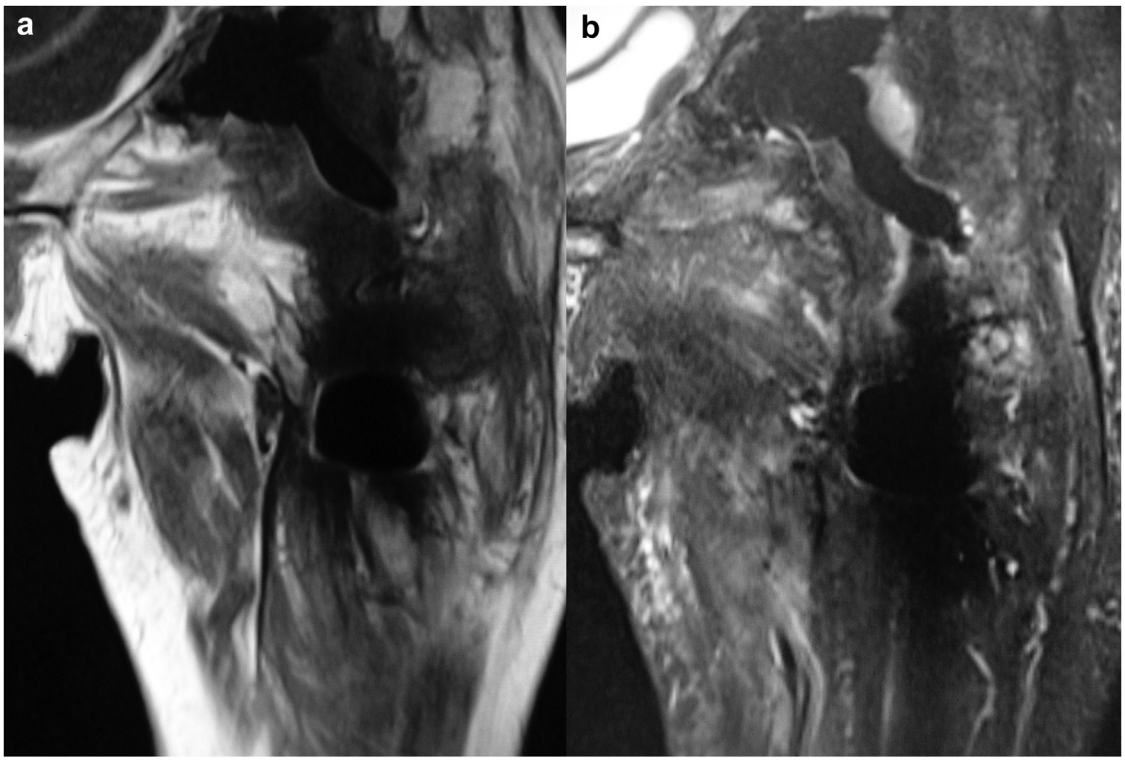

Figure 7. Postoperative MRI.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Informed patient consent

The author(s) confirm that informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

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