

Case report

Late Onset Metallosis after Revision Total Knee Arthroplasty with Metal-Backed Patellar Component In Situ

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ABSTRACT

We describe a small case series with severe metallosis after revision total knee arthroplasty (TKA) due to metal-backed patellar component failure. Metallosis is a rare complication after TKA, which may cause systemic and local symptoms. In our cases, diagnosis of metallosis was supported by radiographic imaging and aseptic aspiration. Two of our 3 cases were successfully revised; in the remaining case surgery was not desired because of her poor general condition. Based on these cases, we recommend performing regular checkups in case of a metal-backed patellar component to detect metallosis in an early stage, to prevent extensive revision surgery. Moreover, we recommend applying a low threshold to revise a metal-backed patellar component because of the severe consequences of metallosis that might occur.

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Introduction

Metallosis rarely manifests itself in total knee arthroplasty (TKA). Metallosis is an inflammatory reaction against metal particles released from metal components, for example after (abnormal) metal-on-metal contact or damage of the components. Metallosis can cause a wide variety of local and systemic symptoms, including pseudotumours and neurocognitive disorders [1,2]. Metallosis in TKA has been described in a few case reports with different causes, including clip breakage of the insert, insert wear, and failure of the metal-backed patellar components [3–5].

Early designs of metal-backed patellar components have a high failure rate [6–8]. Owing to polyethylene (PE) wear, the metal baseplate can cause excessive wear of the femoral component, which may lead to metallosis. We have seen 3 cases of severe metallosis after revision TKA (rTKA) with failure of the metal-backed patellar component in the past year in the Sint Maartenskliniek (SMK, the Netherlands). However, in these cases, the patellar component did not show any polyethylene (PE) wear during the first revision procedure and was left in situ.

Intraoperatively, the patellofemoral tracking was acceptable, although the design of the metal-backed patellar component and femoral component used during the revision were from different manufacturers. In this article, we describe these cases. Informed consent for publication of this case report was acquired from all patients.

Case histories

Case 1

An 88-year-old patient was referred to our outpatient clinic because of persisting pain after a cruciate retaining (CR) TKA (LCS, DePuy Synthes, Warsaw, IN). In 2009, the cruciate-retaining (CR) TKA was revised to a posterior stabilized (PS) rTKA (LEGION, Smith & Nephew, Memphis, TN) because of PE wear of the insert and posterior cruciate ligament (PCL) insufficiency. Intraoperatively, the PE of the metal-backed patellar component impressed undamaged. Therefore, we chose to leave the patellar component in situ, because it was uncemented and removal could lead to excessive bone damage. This decision was also informed by the age of the patient (79 years of age at time of surgery). The other components were successfully revised, and the patient was asymptomatic at the last control visit in September 2016. In March 2019, the nursing

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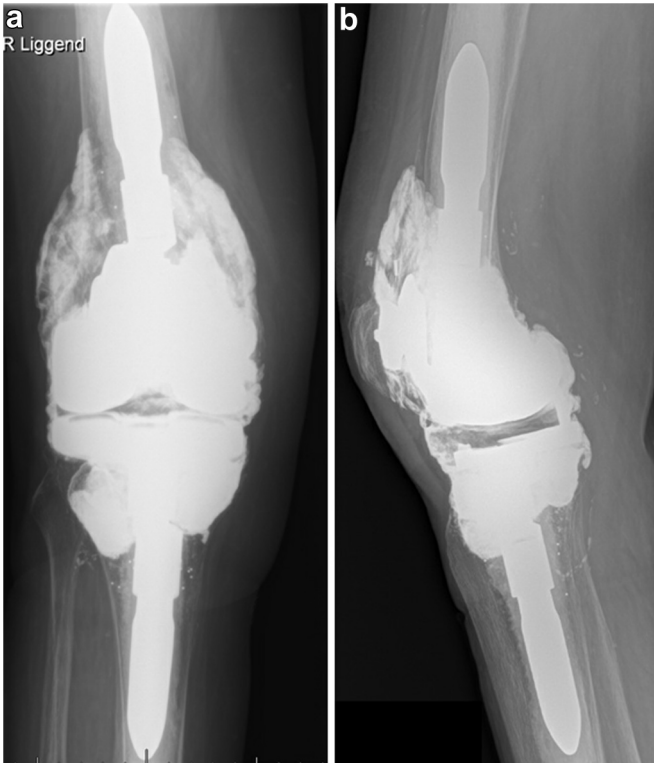


Figure 1. AP (a) and lateral (b) radiograph of the right LEGION TKA showing severe metallosis and a metal-backed patellar component. TKA, total knee arthroplasty.

home doctor informed us that the patient suffered from progressive knee pain. The patient fell regularly on her knee but had no clinical signs of infection and still had decent function. Flexion was 110° and extension lacked 10°, but the knee squeaked during range of motion. Radiographic examination was performed in a hospital nearby her nursing home (Fig. 1). It showed severe metallosis, which was not seen on our most recent radiograph in September 2016. The computed tomography (CT) scan revealed a possible groove in the femoral component, probably caused by grinding of the metal-backed patellar component. This patient did not desire surgical treatment because of her general condition. She was

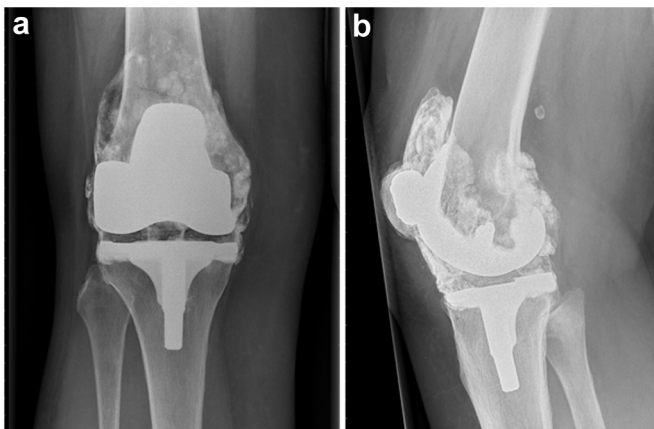


Figure 2. AP (a) and lateral (b) radiograph of the right CR TKA showing metallosis and a metal backed patellar component. CR, cruciate retaining; TKA, total knee arthroplasty.

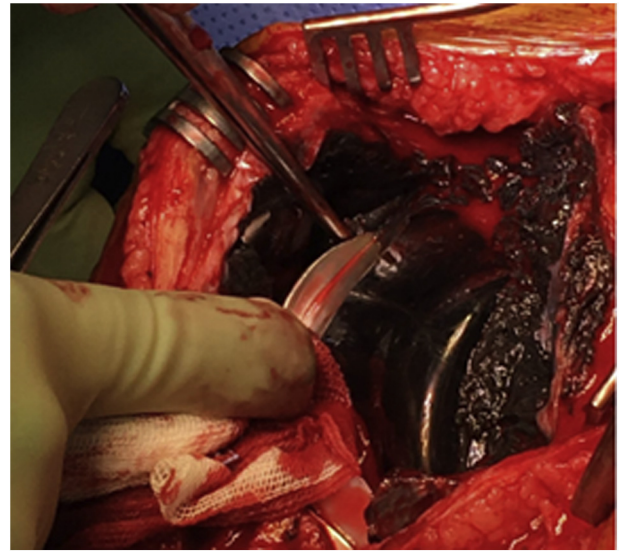


Figure 3. Picture of TKA in situ during revision surgery showing extensive synovial metallosis and damage to the femoral component. TKA, total knee arthroplasty.

treated conservatively by the nursing home doctor. The pain was relieved to her satisfaction with painkillers.

Case 2

A 58-year-old patient was referred to our clinic in May 2018 because of progressive pain and a feeling of tightness around the knee. In 2001 she received a patellofemoral prosthesis (company info unknown) at MC Zuiderzee, which was revised in 2012 to a CR TKA (Genesis, Smith & Nephew) because of progressive medial osteoarthritis at the same hospital. Intraoperatively, they saw an undamaged metal-backed patellar component and chose not to revise the patellar component. The radiograph of her first visit to our clinic showed significant abnormalities, which were not identified as metallosis (Fig. 2). A Tc-99m bone scan revealed high uptake around the patellar component and synovial chondromatosis. We suspected synovial chondromatosis due to mismatch of the metal-backed patellar component with the femoral component. After informed consent of the patient, we decided to revise the TKA in August 2018, including revision of the patellar component. Intraoperatively, we saw an extensive mass of metallosis in all the



Figure 4. Picture of TKA after extraction showing extensive damage of the femoral and patellofemoral components. TKA, total knee arthroplasty.

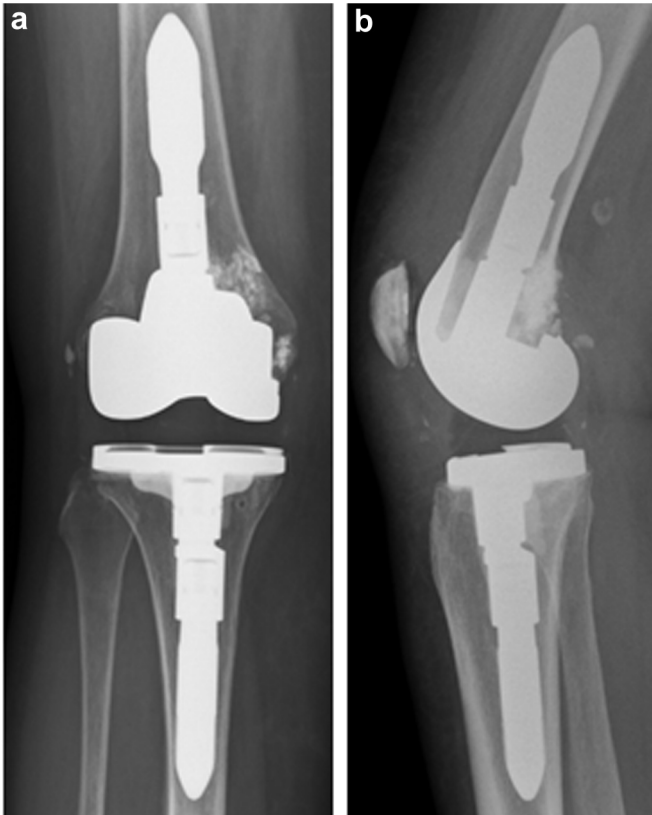


Figure 5. AP (a) and lateral (b) radiograph 6 wks after revision surgery.

synovial layers and in the superficial bone around the patella and femur, a broken insert, and a groove in the femoral component (Figs. 3 and 4). Diathermy could not be used because it caused sparks attributable to the metal particles. After extensive synovectomy, a posterior-stabilized (PS) rTKA (LEGION, Smith & Nephew, Memphis, TN) was placed and the metal-backed patellar component was revised. The radiograph showed nearly complete removal of the metal particles (Fig. 5). One year after surgery, the patient was asymptomatic and very satisfied with the result.

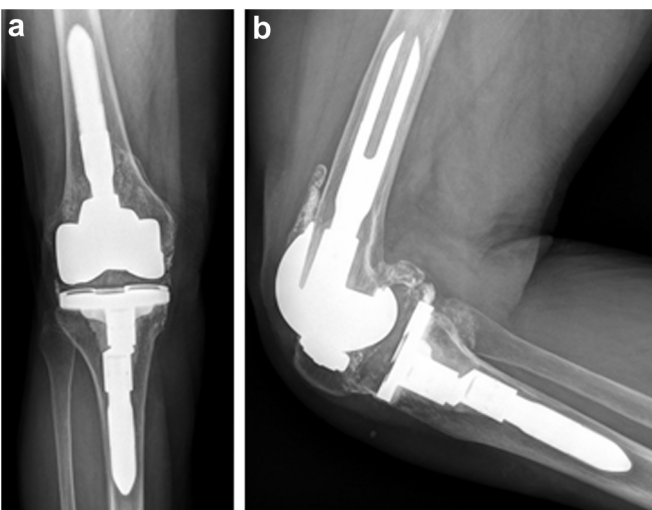


Figure 6. AP (a) and lateral (b) radiograph of the right LEGION TKA showing metallosis and a metal-backed patellar component. TKA, total knee arthroplasty.

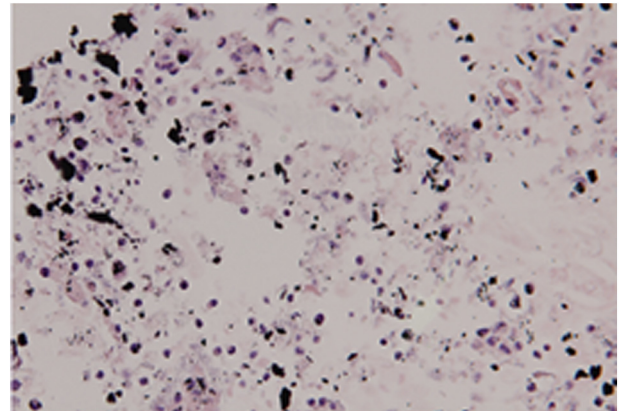


Figure 7. Microscopic image of aseptic aspirate showing metal particles in synovial fluid.

Case 3

A 74-year-old patient visited our clinic with persisting lateral knee pain, 8 years after revision of a CR TKA (LCS, DePuy Synthes, Warsaw, IN) to a PS rTKA (LEGION, Smith & Nephew, Memphis, TN) due to anteroposterior instability. Intraoperatively, the metal-backed patellar component was deemed undamaged and left in situ. The persistent pain on the lateral side of the knee did not respond to an ultrasound-guided infiltration in the iliotibial tract. The radiograph and CT scan showed signs of metallosis (Fig. 6). Thus, we decided to perform an aspiration of the knee. The aspirate contained many black metal particles, macroscopically and microscopically, and no bacterial growth was present in culture (Fig. 7). To prevent worsening of the metallosis, we decided to perform a patellar component revision and synovectomy. However, we observed extensive metallosis and extensive damage to the femoral component intraoperatively (Figs. 8 and 9). Therefore, we performed an extensive synovectomy, revision of the patellar component to an inlay component and revision of the femoral component. The PS tibial insert was replaced by a constrained insert. Three months after revision, the patient was asymptomatic. The radiographs showed appropriate component sizing and alignment (Fig. 10).

Discussion

Metallosis is a very rare but severe complication after TKA. Different causes of component failure lead to deposition of metal

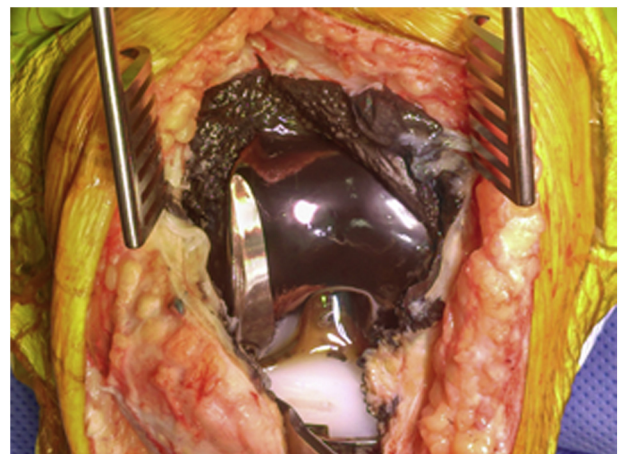


Figure 8. Picture of TKA in situ during revision surgery showing extensive synovial metallosis and damage to the femoral component. TKA, total knee arthroplasty.

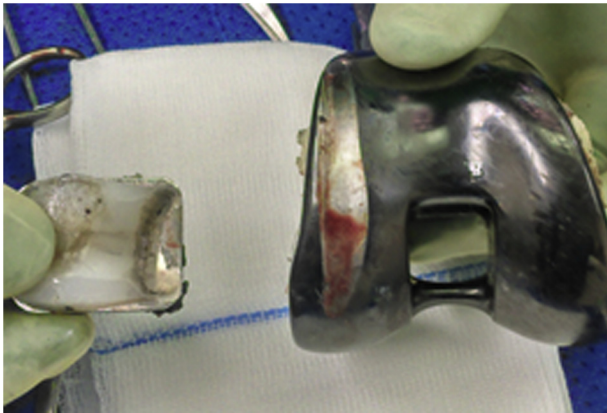


Figure 9. Picture of TKA after extraction showing extensive damage of the femoral and patellar component. TKA, total knee arthroplasty.

debris in the synovium, potentially triggering an inflammatory response. This can cause local and systemic symptoms [1,2]. The most common clinical symptoms are pain and squeaking during mobilization. Radiographs may show distinctive signs, such as the bubble sign (pseudotumour), cloud sign, and metal-line sign [5].

Metal-backed patellar components were invented in the 1980s and originally thought to be advantageous in wear and stress on the bone-implant interface. However, especially in early designs, metal-backed patellar components were associated with an increased risk of metallosis. Owing to wear of the PE, metal-on-metal contact of the metal patellar baseplate with the femoral component leads to release and deposition of metal debris. Rader et al [6] and Anderson et al [7] reported an increased failure rate in metal-backed patellar components compared with other patellar components. Modern designs of metal-backed patellar components have resulted in lower complication rates and longer survivorship, potentially attributable to thicker PE and improved congruity [8,9].

A few cases of metallosis in TKA due to failure of a metal-backed patellar component have been described in literature. Our cases are

distinctive from these cases in 2 aspects: (1) The metal-backed patellar components were seen without wear during revision surgery and (2) had a normal patellofemoral tracking despite the design difference between the design of the patella and the trochlea of the revision femoral component. Unfortunately, years after the revision surgery, severe metallosis developed. In retrospect, we can highly recommend revising the component during revision surgery or perform regular follow-up visits of these patients with radiographs. Our first case developed severe metallosis 10 years after revision surgery, and surgery was not desired anymore because of her medical condition. Revision is challenging, but our other cases proved that it can be performed without excessive damage to the patellar bone. In line with our observations, Garcia et al [10] showed that isolated revisions for metal-backed patellar component failures come with satisfactory results.

The third case emphasizes the importance of regularly monitoring of patients with metal-backed patellar components because of the increased risk of metallosis. This patient was diagnosed with metallosis sooner such that revision surgery was not as extensive as in our second case.

Metallosis is not always recognized, as demonstrated by our second case. An aseptic aspiration, as performed in our third case, can help to differentiate between metallosis and, for example synovial chondromatosis.

Summary

Metallosis is a rare complication after TKA, which can develop in the presence of a metal-backed patellar component. The patellar component should either be revised to prevent metallosis or regularly monitored on radiographs, for example annually or when symptomatic, to perform revision surgery at an early stage of metallosis. Awareness of metallosis in TKA is important to recognize because more cases might show up years after the implantation of metal-backed patellar components.

Conflict of interest

Gijs van Hellemond, MD, reports royalties from Smith & Nephew; speakers bureau/paid presentations for Smith & Nephew/ZimmerBiomet/Materialise; Research support from Smith & Nephew as a principal investigator; and a board member for the European Knee Society. Kirsten Veenstra, MD, reports speakers bureau/paid presentations for Smith & Nephew revision knee surgery presentations irregularly. All other authors declare no potential conflicts of interest.

For full disclosure statements refer to <https://doi.org/10.1016/j.artd.2020.02.015>

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.artd.2020.02.015>.

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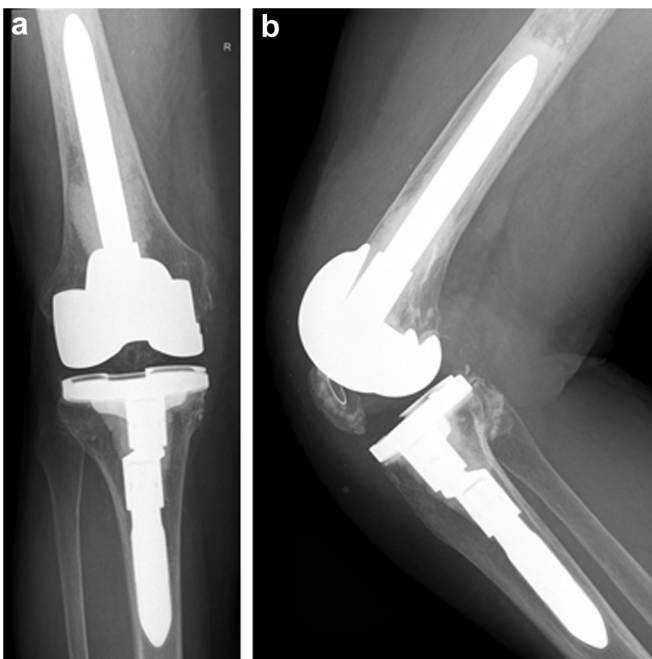


Figure 10. AP (a) and lateral (b) radiograph 3 mo after revision surgery.

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