CASE REPORT

Metallosis in a total knee arthroplasty

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Accepted 19 February 2014

SUMMARY

A 70-year-old woman presented with right knee pain and a 'grinding' sensation 6 months after a total knee replacement for osteoarthritis. Clinical examination revealed a valgus deformity, patellofemoral crepitus and a reduced knee flexion. Radiographs revealed distinctive findings including the 'bubble sign', 'cloud sign' and the 'metal line sign', which are diagnostic of metallosis. Metallosis is an uncommon complication of total joint replacements, where bone and periprosthetic soft tissues are infiltrated by metallic debris from wearing of the prostheses. This usually occurs in high-wear joints such as hips and knees. Treatment for patients diagnosed with metallosis is synovectomy and a revision surgery. Our patient underwent revision surgery 5 years after her initial surgery.

BACKGROUND

Despite being an uncommon condition, metallosis is a well-recognised complication following total arthroplasties. Metallosis can manifest as common postoperative symptoms such as pain, swelling, dislocations and instability and, therefore, should be included in the differential diagnosis. Metallosis causes progressive destruction of the joint and, therefore, we emphasise the need for early diagnosis and revision surgery.

CASE PRESENTATION

A 70-year-old woman with diabetes presented with right knee pain and a 'grinding' sensation 6 months after a total knee replacement for tri-compartmental osteoarthritis. The prosthesis used was a Genesis Total Knee System with implant components including cobalt chromium molybdenum alloy (Co-Cr-Mo) and titanium alloy (Ti-6Al-4V), with an ultra-high molecular weight polyethylene insert. Previous patch testing had confirmed a cobalt and nickel allergy. Clinical examination revealed a 5° valgus deformity, patellofemoral crepitus and a reduced knee flexion to 95° (figures 1–3).

OUTCOME AND FOLLOW-UP

Initially, it was thought that there was a polyethylene failure leading to a subsequent component failure. Common practice dictated a standard two-stage revision arthroplasty. However, the patient still reported knee pain despite the revision. After ruling out infective causes with blood tests and microbiology samples, it was thought that her symptoms were due to her metal allergy. She, therefore, had a total revision arthroplasty with Oxinium prostheses 5 years after her initial surgery. Plain film radiographs taken 6 months postoperatively (figures 4 and 5) did not show any loosening

or wearing of the implant. The patient's symptoms have since been stable and she is currently under regular clinical follow-up.

DISCUSSION

Metallosis is an uncommon complication of total joint replacements where bone and periprosthetic soft tissues are infiltrated by metallic debris from wearing of the prostheses. The resulting chronic inflammatory arthritis is thought to be due to metal hypersensitivity, particle-induced synovitis and the direct toxic effects of the metal particles.¹ Often, there is significant osteolysis associated with this.

Clinical symptoms include pain, swelling, sensation of instability, dislocations and rashes (indicating necrosis). Although noise progression has been reported as a symptom of metallosis in hip arthroplasties, this has not been reported in knees in the available literature.²

Metallosis is most commonly described in high-wear joints such as hips and knees, but has also been described in smaller upper limb joints.³ In total knee replacements, metallic debris most commonly results from failure of the metal-backed patella components or the dissociation/wear of the polyethylene liner. Prosthetic loosening, trauma

Figure 1 A curvilinear radiodensity referred to as the 'bubble sign'. This is also seen in figure 2 (arrow A).

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To cite: Vivegananthan B, Shah R, Karuppiyah AS, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-202801

Figure 2 (Arrow B) An amorphous cloudy density within the soft tissues posterior to the prosthesis, known as the 'cloud sign'. The same image also shows evidence of periprosthetic osteolysis. Arrow A shows the 'bubble' sign as previously mentioned.

and soft tissue imbalance are other mechanisms resulting in the above. Rader *et al* describe metallosis in 7 of 30 patients who underwent total knee replacements using metal-backed patellar components. Dissociation of the polyethylene liner was also described in four of these patients.⁴ In our case, the tibial insert dissociation from the tray resulted in considerable metal-on-metal articulation.

A Genesis replacement containing a cobalt alloy was used in our patient who was known to have a nickel and cobalt allergy, which was confirmed on patch testing. This raises the possibility that the patient's allergy status contributed to the metallosis.

Figure 3 A thin rim of increased linear density outlining a portion of the joint capsule. This is known as the 'Metal-line Sign', which is diagnostic of metal-induced synovitis. Other radiological findings associated with metallosis are joint effusion, pseudotumours and metallic fragmentation.

Figure 4 Six-month follow-up films after the revision total arthroplasty with the Oxinium prostheses, showing no loosening or wearing.

Wigren and Fischer⁵ describe a similar case where a patient who tested positive for a cobalt patch test developed metallosis following a knee replacement.

Treatment for patients diagnosed with metallosis is synovectomy and a revision surgery. Indications for this include aseptic loosening, joint instability, periprosthetic fracture and generalised damage or failure of the prosthesis.⁶ All cases of metallosis following knee arthroplasties described in the literature have required revision surgery.^{6,7}

A reported increase in the failure rate with time emphasises the need for early revision surgery to prevent progressive destruction of the joint.⁴ In an attempt to decrease the prosthetic wear leading to debris deposition, newer alternative materials such as Oxinium are being utilised. Our patient underwent a revision with Oxinium prosthesis 5 years after the initial surgery.

Figure 5 Six-month follow-up films after the revision total arthroplasty with the Oxinium prostheses, showing no loosening or wearing.

Learning points

- ▶ Metallosis is a well-recognised complication following total arthroplasties, especially in high wear joints.
- ▶ Metallosis can manifest as common postoperative symptoms such as pain, swelling, dislocations and instability and, therefore, should be included in the differential diagnosis.
- ▶ The radiological findings associated with metallosis are distinct and easy to identify.
- ▶ Metallosis causes progressive destruction of the joint and, therefore, we emphasise the need for early diagnosis and revision surgery.

Acknowledgements The authors would like to thank Mr Maurice Needoff, Orthopaedic Consultant from Kings Mill Hospital, for his input.

Contributors BV and RS researched the topic and wrote the case report. ASK reviewed the radiological findings. SVK liaised with the patient and provided review of the case.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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