CASE REPORT

A painful soft tissue mass secondary to impingement of a metal on polyethylene bearing total hip arthroplasty

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SUMMARY
A 60-year-old woman underwent a metal on polyethylene total hip replacement. The patient experienced pain and sustained multiple dislocations over the following 2 years and was referred for consideration of revision surgery. At the time of revision surgery it was found that there was a significant amount of polyethylene wear likely to have arisen as a result of the neutral cup placement and subsequent anterior impingement. A large cystic mass was excised and on histology was found to contain tissue with a lymphocytic infiltrate with a large amount of intracellular birefringent debris, consistent with polyethylene. The appearance of such masses is well reported as pseudotumours in metal-on-metal hip replacements but as yet their aetiology is unknown. We believe that the formation of the mass in this case could represent a model by which these pseudotumours occur.

BACKGROUND
The cause of recently reported pseudotumour formation in patients with metal-on-metal hip replacements is unknown. There has been a postulated association between raised serum metal ions and pseudotumour formation. We present a case where polyethylene debris secondary to significant impingement of a metal on polyethylene bearing resulted in a painful inflammatory mass.

CASE PRESENTATION
A 60-year-old woman underwent a metal on polyethylene total hip replacement for osteoarthritis at another centre. A posterior approach was utilised; surgery was uneventful and the wound healed without complication. Postoperative pain improved and the patient was discharged. The patient sustained a first-time posterior dislocation at 10 months. Subsequently the hip dislocated a further seven times all of which required closed reduction under general anaesthetic.

The patient was referred for consideration of hip revision surgery at 2 years. On retrospective questioning the patient revealed that the hip had become painful 10 months postoperatively at around the time of her first dislocation. The patient described constant groin pain rated 4 out of 10 on a visual analogue scale with no element of startup pain. Examination revealed equal leg lengths, discomfort on full flexion and internal rotation, grade 5 power of hip flexion and hip abduction and no distal neurovascular deficit.

INVESTIGATIONS
A 60-year-old woman underwent a metal on polyethylene total hip replacement for osteoarthritis at another centre. A posterior approach was utilised; surgery was uneventful and the wound healed without complication. Postoperative pain improved and the patient was discharged. The patient sustained a first-time posterior dislocation at 10 months. Subsequently the hip dislocated a further seven times all of which required closed reduction under general anaesthetic.

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Figure 1 Pre-revision surgery anteroposterior X-ray film.
investigations revealed a white cell count of 11, a C reactive protein of 17 and an erythrocyte sedimentation rate of 29. An aspirate of the hip performed under local anaesthetic revealed no growth and therefore infection was deemed unlikely.\(^1\) Injection of local anaesthetic into the hip joint eliminated the groin pain for 3 h.

TREATMENT

Following discussion of the risks and benefits, the patient was listed for revision surgery. The same scar was utilised and extended and the hip exposed using a posterior approach. Assessment revealed impingement of the femoral component neck on the anterior rim of the acetabulum leading to dislocation at 70° flexion and 10° of internal rotation. The cup and the stem were well fixed. Satisfactory stem position was confirmed but the cup was under-anteverted into a more neutral position by between 15° and 20° when compared with the transverse acetabular ligament. The most striking finding, however, was the absence of the anterior 160° of the polyethylene rim of a liner that originally had polyethylene present at a uniform height above the entire circumference of the acetabular shell (figure 3). Arising from this arc and projecting forwards anterior to the psoas tendon was a large cystic mass, which once removed, measured 70×60×30 mm (figure 4).

The cup was excised using a short-curved and long-curved explant blade that also removed 1 mm of the bone that was ingrown into the superior one-third of the acetabular shell. There was no significant membrane to remove from the acetabular bone. The anterior mass was excised and sent for microbiological and histological examination. Five further tissue samples were taken and sent for microbiological examination. Clinically there was no gross sign of infection. The acetabulum was reconstructed with a 62 mm peripherally expanded modular shell (Zimmer Trilogy cup) that achieved very good press fit. This fixation was supplemented with three screws and a 32 mm internal diameter highly cross-linked polyethylene (Zimmer longevity) liner with a 10° lip was inserted. The hip was reduced and on-table assessment confirmed good stability and equal leg lengths (figure 5).

Postoperative intravenous antibiotics were continued until the culture results were returned at 72 h. There was no bacterial growth from any of the five samples. Histological examination of the cystic mass revealed fibroconnective tissue with a lymphocytic infiltrate and reactive tissue changes. Interestingly there were significant amounts of birefringent material consistent with polyethylene debris (figures 6 and 7).\(^2\)

OUTCOME AND FOLLOW-UP

The patient was followed up routinely at 6 weeks, 3 months and 1 year and has experienced satisfactory relief from her pain with no further dislocations.
Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

DISCUSSION

Hip replacement has remained the treatment of choice for advanced osteoarthritis and other degenerative conditions of the hip. Metal-on-metal hip replacement was reintroduced in the early 1990s as a ‘hard’ bearing surface to minimise wear and resulting osteolysis. Early and medium term clinical results for metal-on-metal hip resurfacing (HRA) and metal-on-metal total hip arthroplasty (THA) have been encouraging. The elevated serum metal ions detected in association with these implants have resulted in no proven systemic ill effects in the long term. There have, however, been isolated reports of benign but locally destructive masses closely associated with metal-on-metal HRA and THA.

The Oxford Group recently reported their total series of 1419 HRAs that included 26 symptomatic so-called pseudotumours that required revision surgery. At 8 years the cumulative revision rate for pseudotumours was 4%. In women the rate was 9% and in men it was only 0.5%. Possible reasons for this eightfold higher revision rate for pseudotumours in women include smaller component size requirement and an increased prevalence of metal allergy secondary to wearing jewellery. An increased range of motion in women may also result in impingement and edge loading. While smaller bearing surfaces are less likely to achieve hydrodynamic lubrication they are also less likely to have adequate superior cover. A weight bearing arc of coverage of less than 10 mm, which is a function of cup inclination, bearing size and component design, leads to a higher level of serum metal ions. Smaller components also increase the risk of component malalignment that leads to impingement within a physiological range of motion.

There have been reports of solid, cystic and fluid masses associated with metal on polyethylene THA. Many of these local soft tissue abnormalities are small and often form only minor fluid collections that do not cause symptoms. The overall incidence and any causal relationships have, therefore, not previously been described. Patients with this bearing surface do not usually present with painful symptoms until macrophage-driven osteolysis has significantly affected the bone surrounding the implants. Patients tend to present with symptoms of instability or overt dislocation if component malposition leads to impingement within a physiological range of motion.

This report describes a large inflammatory mass containing significant amounts of polyethylene debris adjacent to the edge of a polyethylene liner that had been worn flat. While the patient had repeated dislocations, constant groin pain was also a significant symptom. A malpositioned ‘neutral’ cup had resulted in repeated impingement of the metal neck of the stem on the edge of the polyethylene liner within a physiological range of motion. The debris produced from a metal on polyethylene bearing and the histological reaction to this debris is different to the pathological process that results in pseudotumour formation in metal-on-metal arthroplasty. The mechanism of edge loading and impingement producing significant volumes of debris resulting in a localised inflammatory process and a symptomatic mass may, however, be similar. The precise positioning of THA and HRA components is key to the long-term success of hip replacement surgery.

Learning points

- Pseudotumour formation in metal-on-metal total hip replacement is well documented but the cause remains unknown.
- In our case, an inflammatory mass similar to these pseudotumours was found to contain lymphocytes with intracellular polyethylene.
- We believe that this provides a possible explanation for the formation of these pseudotumours.

Competing interests None.
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REFERENCES
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