



## Pseudotumours associated with metal-on-metal hip resurfacing : 10-year Newcastle experience

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We report the incidence of pseudotumours in a single-surgeon consecutive series of 670 metal-on-metal hip resurfacings performed in the last ten years, with a minimum follow-up of one year. Two cases of pseudotumours have been found and are discussed in detail including metrology and wear analyses of the explanted components. The first was a painless, large synovial cyst in the thigh, secondary to aseptic femoral cup loosening 8 years following hip resurfacing. The second was a painful collection of wear debris in the psoas region at one year post surgery caused by impingement, resulting in eccentric edge wearing. In the first case it was decided to retain the bearing surface ; in the second case, conversion to a metal-on-polyethylene hip replacement was performed. In our experience the risk of pseudotumours is low (0.15%) and can be fully explained. In selected cases the bearing surface can be retained.

**Keywords :** hip resurfacing ; metal-on-metal ; pseudotumours.

### INTRODUCTION

Metal-on-metal hip resurfacing is gradually becoming more popular for young active patients following promising early to mid-term results (1,6). Concern has been raised with regards to the biological effect of metal ions. Prospective studies following Birmingham Hip resurfacing have revealed that chromium ion levels rise to a peak at 9 months following surgery and then gradually decline.

However, this does not appear to be of any clinical consequence in these patients (2). Pseudotumours, most presenting with unexplained pain and discomfort, have been recently reported to be associated with meta-on-metal resurfacing (3,5,15). The true incidence and explanation of these pseudotumours is not fully understood.

Synovial cysts arising from the hip following joint replacement are not common but can develop in response to intra-articular derangement and increased intra-articular pressures (14). There are several reports in the literature discussing the cause and management of these cysts. They have been reported in relation to metal-on-polyethylene, metal-on-metal and ceramic-on-ceramic hip replacements (4,7,10-14,18).

A single surgeon experience of BHR over a 10-year period is presented with two cases of pseudotumours and their contrasting management discussed in detail.

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## MATERIAL AND METHODS

All patients operated by the senior author from 1998 to 2007 have been included, with a minimum follow-up of one year. Posterior approach was utilised in all and the implant used was the Birmingham Hip Resurfacing (Smith and Nephew). All patients have been under regular follow-up in the clinic in Newcastle. A standard protocol is in place to investigate patients with problems. This includes routine radiographs, blood investigations and imaging in the form of ultrasound scan or MRI scan after discussion with the radiologist.

## RESULTS

During the 10-year period, 670 procedures have been performed at a mean age of 52 years; 63% were in male patients (533) and 37% in females (247). All are under regular review in an arthroplasty clinic with a mean follow-up of 4.5 years (range: 1 to 10 years).

No ALVAL (aseptic lymphocytic vasculitis) or primary infection has been seen in the series. Two patients were found to have pseudotumours and are discussed in detail. Both were females and had hip resurfacing for dysplasia.

### Case one

A 46-year-old lady developed a large thigh swelling 8 years following BHR in 1998. It had gradually increased in size over a period of a few months. The mass was non tender, cystic, and tracked along almost the proximal two-thirds of the lateral aspect of the thigh. Range of painless movement of the hip had reduced from 100° flexion at 5-year review to 70°. Apart from the obvious cosmetic concern, this did not cause her any functional problem. She denied any pain, clicking, squeaking, grinding or discomfort related to the hip and was able to perform her work as a finance advisor and could walk unlimited distances. The primary operation had been uncomplicated and was performed for developmental dysplasia of the hip using a 42 mm size head and a dysplasia cup with two screws.

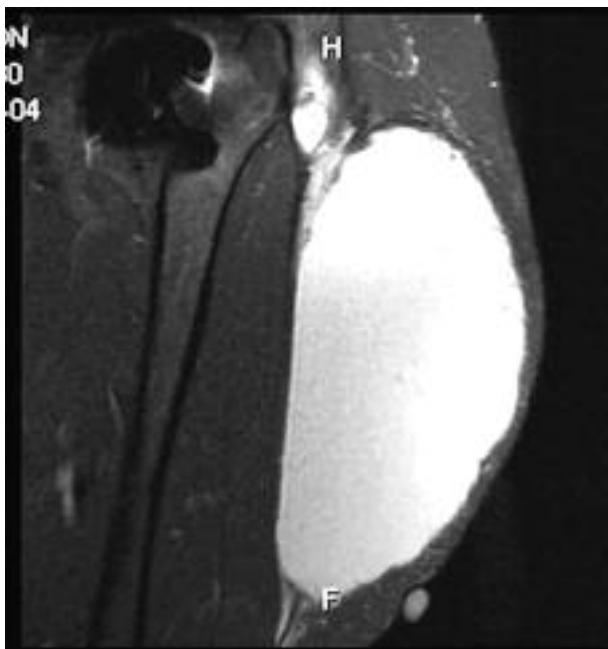
Sequential radiological assessment revealed development of a radiolucent line along the stem of the femoral component indicating movement of this



**Fig. 1.** — Case 1 – A-P radiograph showing the lucent area on the inferior aspect of the neck and along the stem of the femoral component.

device (fig 1) and also evidence of neck narrowing in the inferior aspect of the head neck junction. An ultrasound scan revealed a large 24 cm cystic mass at the lateral aspect of the thigh tracking up to the hip joint. MRI scan confirmed that the cyst was originating from the hip joint (fig 2). Aspiration of the cyst revealed about 800 ml of clear straw coloured fluid which did not grow any organism on routine cultures. Blood results were all within normal limits. The thigh mass reappeared in a few days after the aspiration. The cyst and impending fracture was the obvious worry and therefore exploration with a view to a revision hip replacement was performed.

Preoperative planning worked on the hypothesis that the cyst was due to loosening of the femoral component causing raised intra-articular pressure; however a reaction to metallic debris was an obvious concern.



**Fig. 2.** — Case 1 — MRI scan showing a large fluid filled cyst communicating with the hip joint.

During surgery the cyst was found to be just underneath the subcutaneous tissue. It had split the fascia lata and tracked down the lateral aspect of the thigh, overlying the vastus lateralis, to the supracondylar area of the distal femur. In its proximal extent, the neck of the cyst cavity was seen to disappear down a very narrow tract into the antero-inferior aspect of the hip joint. The whole cyst with its lining was excised. No gross evidence of metallosis or infection or neoplastic process was found during the surgery. The femoral component was not overtly loose and the neck had to be sawed off. The acetabular socket was well fixed and in the absence of any obvious metallosis it was left alone. The dilemma was whether to revise the whole device to a non-metallic hip replacement bearing (which would involve the complex and potentially hazardous removal of a well fixed dysplasia acetabular component) or to remain conservative and revise only the theoretically problematic part of the resurfacing to a modular head on a stem.

A CPCS (Smith & Nephew) cemented femoral stem was implanted with a large modular Birmingham head and the existing cup retained as

there was no overt evidence of bearing failure or reaction.

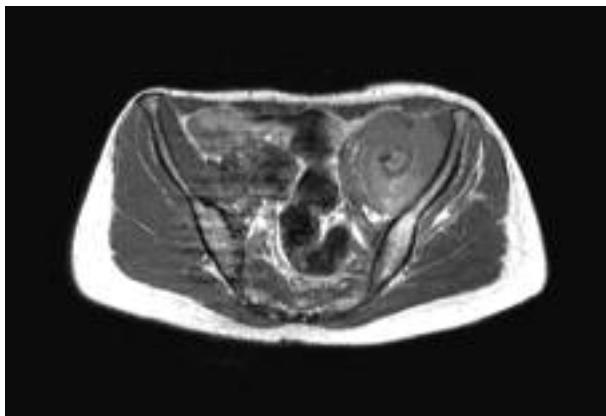
Histological analysis of the cyst revealed a hyperplastic synovial lining with patchy lymphoplasmocytic infiltrate; large haemosiderin laden macrophages and very occasional macrophages containing finely granular weakly bi-refrangent black material. The bone removed from the femoral component was viable and showed foreign body and histiocytic reaction. There was no macroscopic evidence of overt metallosis. No evidence of neoplastic change was noted.

Wear analysis of the femoral component was performed at the manufacturer's laboratory and revealed a maximum linear wear of  $8.85 \mu\text{m}$  at 8 years and 3 months with a rate of  $1.07 \mu\text{m}/\text{yr}$ , which is very favourable and low in comparison to average values obtained from other retrieval database for the same time.

The patient made an uneventful recovery from surgery and the cyst has not recurred at up to 24-month review. The Harris Hip Score at the most recent follow-up was 100.

## Case two

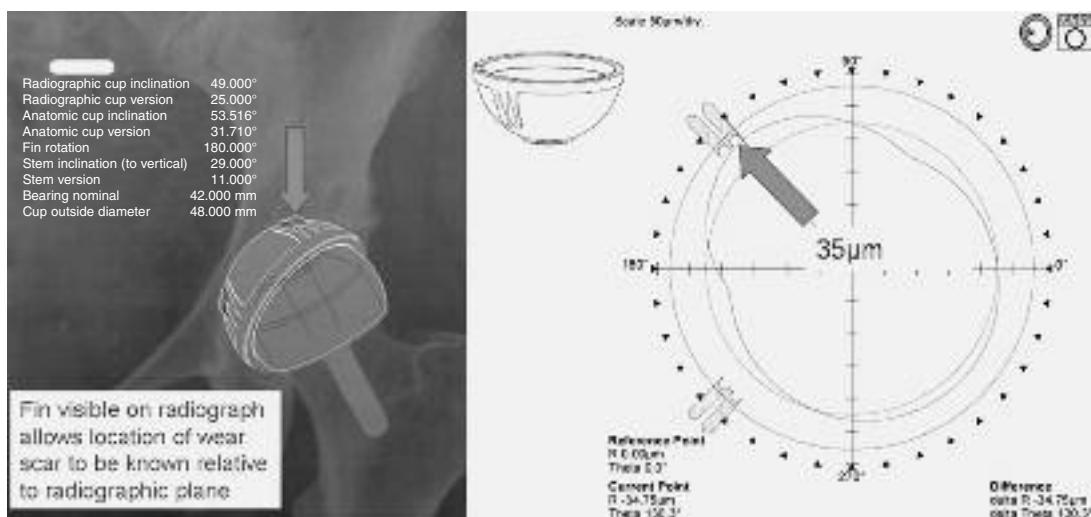
A 44-year-old lady underwent an uneventful BHR in 2006. She began to complain of groin discomfort 8 months following the procedure. Apart from pain she also reported intermittent clicking and mild groin swelling. Blood results including ESR and CRP were normal. An ultrasound scan showed mild diffuse swelling around the hip and psoas tendon. Conservative treatment for psoas tendonitis was commenced. The symptoms persisted and she developed paraesthesia along her thigh. An MRI scan (fig 3) showed a psoas mass on the affected side. An ultrasound guided needle biopsy revealed a mass of eosinophils but no evidence of infection or malignancy. Metal debris were noted. A revision procedure was subsequently carried out. During surgery grey stained fluid was noted with metal stained wear debris all around the joint and escaping anteriorly to the acetabulum into the pelvis, although no obvious wear to either the cup or head was found macroscopically. An impingement notch was seen on the postero-inferior aspect



**Fig. 3.** — Case 2 – MRI Pelvis – Demonstrating the psoas collection.



**Fig. 4.** — Case 2 – Impingement notch in the bone and also noted on the preoperative radiograph.



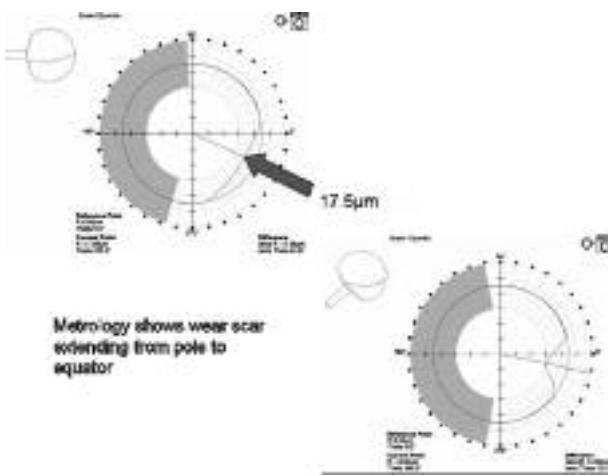
**Fig. 5.** — Case 2 – Wear analysis of acetabular component showing maximum wear of 35 µm depth near the rim superiorly

of the neck (fig 4) from an acetabular osteophyte which was already noted in the preoperative radiographs. Due to obvious tissue reaction, the patient underwent a complete revision to a conventional metal-on-polyethylene bearing hip replacement.

Radiographic analysis carried out in the manufacturer's laboratory revealed a radiographic cup abduction angle of 49°, cup anteversion angle of 25° and stem version of 11°. The fin on the acetabular cup visible on radiographs allows location of the wear scar to be known relative to the radiographic plane. Wear of the acetabular component was 35 µm depth near the rim superiorly (fig 5). Surface analysis revealed a wear scar of 17.5 µm

depth on the antero-superior aspect of the femoral component (fig 6).

Further position and range of movement studies were also carried out by extrapolating data from the preoperative, immediate postoperative and subsequent radiographs. They revealed that the cup-head version and the osteophyte restricted the range of extension to 7° immediately postoperatively. Inferior/Posterior impingement had caused subluxation leading to edge wear and the limit of extension had increased from 7° to 26° due to compression of the posterior/inferior cortex of the neck (fig 7). Postero-inferior impingement levered the joint out antero-superiorly leading to antero-superior wear



**Fig. 6.** — Case 2 – Wear analysis of femoral component showing a wear scar of 17.5  $\mu\text{m}$  depth on the antero-superior aspect of the femoral component.



**Fig. 7.** — Case 2 – Position and range of movement study – Impingement causing compression of cortex postero-inferiorly resulting in a progressive increase in the limit of extension from 7° immediately postoperatively to 26° at revision.

of the femoral component and superior edge wear of the acetabular component. It is likely that the abduction and anteversion angles in this case contributed to the accelerated wear.

At 18-month follow-up, the patient continues to do well with her hip replacement with a Harris Hip Score of 100.

## DISCUSSION

Metal-on-metal hip resurfacing has been a significant recent development in hip arthroplasty. It preserves bone stock, optimises stress transfer to the proximal femur and offers inherent stability and range of movement (8). The long term biological effects of elevated metal ion levels found in all patients with metal-on-metal bearings is a matter of debate, with the lack of any conclusive evidence of adverse long-term effects (17). However, recent reports have brought these concerns to the forefront again (3, 5, 15).

Raised intra-articular pressure may initiate the formation of synovial cysts from the hip joint, usually occurring through the weaker anterior joint capsule (9). Communication between the iliopsoas bursa and the hip joint is present in 15% of normal hip joints and up to 40% of osteoarthritic

joints (16,19,20). The bursa may enlarge with excess production of synovial fluid. The cyst may dissect its way between muscle groups and extend proximally into the pelvis, anteriorly in the groin and may even track laterally, as demonstrated in one of our cases, into the lateral aspect of the thigh.

Synovial cysts in relation to metal-on-metal resurfacing are rare. We could find just three reports in the literature (3,5,15). In two of these, it was hypothesised that a pelvic mass arose through migration of metallic wear debris along the psoas tendon into the muscle, leading to ischaemic necrosis of the muscle (3,5). In a larger case series, pseudotumours were reported within five years following hip resurfacing surgery with no clear explanation of their origin or cause (15). Pain and discomfort was the commonest presenting feature and the histology revealed extensive necrosis of connective tissue within the pseudotumour.

In our single surgeon, single centre series of 670 cases with minimum follow-up of one year we have found just one case of these pseudotumours and one synovial cyst. All these patients have been under regular follow-up in an arthroplasty clinic. This gives an incidence of 0.15% for pseudo tumour in our series in contrast to an estimated 1% in the series reported by Pandit *et al* (15).

In the first case of synovial cyst, we found no evidence of metallic wear in either bone or soft tissue histology. The cyst had a synovial lining, which again is unusual. The bone histology did suggest evidence of foreign body histiocytic reaction but macrophages with metal particles were very occasional. The possibility of an aseptic lymphocytic vasculitis associated lesion (ALVAL) was also considered but was excluded on the basis of histological findings and a lack of pain that is typically the presenting symptom of these patients (21). These are characterised by perivascular cuffs of lymphocytes as a result of T lymphocyte mediated type IV hypersensitivity reaction (delayed type hypersensitivity) to the metal wear particulate debris. This is in contrast to the predominantly macrophagic and fibroblastic response noted in the periprosthetic tissue of other bearing surfaces (21,22).

The presentation of this first case was unusual in that the patient only complained of the swelling and slight stiffness without pain or dysfunction at 8-year follow-up. The radiological findings of slight neck thinning and lucency around the femoral stem were the only clues to implant malfunction. At surgery there was no evidence of metal wear debris or abnormal tissue reaction which would suggest a metal bearing issue, therefore the acetabular component was left *in situ* and only the femoral component was revised. Further wear analyses confirmed low component wear. At two year follow-up the cyst has not recurred, therefore it probably was not a bearing surface issue, the pathology being due to early femoral component loosening.

The case of true pseudotumour had obvious features of metallosis with definitive evidence of impingement, edge loading and proven wear. The eosinophilic reaction was likely to be associated with this.

This case demonstrates how a retained osteophyte associated with implant mal-positioning may lead to early failure, leading to wear debris and an associated tumour like mass. Edge loading secondary to subluxation caused by impingement with a slightly open and mildly over anteverted cup was the probable cause. This was confirmed by extensive wear analysis and the impingement notch noted in the postero-inferior part of the neck. It demon-

strates the importance of maintaining good component alignment and of clearing protruding osteophytes. The ideal component alignment is a matter of debate and the risk of impingement needs to be balanced against the risk of wear secondary to poor cover (23,24). Aim should be to achieve an acetabular inclination of 45° and anteversion of 10-20° (23,24), with femoral stem-shaft angle between 5° and 10° of relative valgus to the native neck-shaft angle (25). This can be achieved with good soft tissue clearance and osteophyte excision coupled with rigorous attention to details including patient positioning, identification of anatomical landmarks like the transverse ligament and correct pin and jig placement.

In our experience the risk of pseudotumours is low and can be fully explained by either wear or loosening. Care needs to be taken with orientation of the cup in all patients but especially in relation to DDH or borderline dysplasia where femoral anteversion may be excessive. Head loosening can be treated by femoral revision alone, retaining the acetabular component. Neither of these cases was a problem caused necessarily by the bearing surface alone. Although immunological and tissue reaction to metallic particles is a concern, if it can be ruled out, less complex revision options are feasible.

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