Contribution of MR studies in the management of metal-on-metal hip prostheses failure

Poster No.: C-2186
Congress: ECR 2012
Type: Scientific Exhibit
Authors: S. Serrano González-Gallarza¹, R. Delgado Sevillano², C. campos¹, M. Martínez Schmickrath³, P. Sanchez Lopez¹, C. Izquierdo López⁴; ¹Oviedo/ES, ²Gijón/ES, ³MADRID/ES, ⁴Avilés/ES
Keywords: Prostheses, Foreign bodies, Diagnostic procedure, MR, Musculoskeletal joint, Bones
DOI: 10.1594/ecr2012/C-2186

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Purpose

- To evaluate the reasons for the recent market withdrawal of the hip prostheses models DePuy ASR and ASR XL (DePuy International TD, United Kingdom)

- To describe the imaging findings in MR studies performed to patients with these devices that can lead to the diagnosis of failure or complications.

Hip resurfacing arthroplasty, consisting of metal-on-metal articulations, has become increasingly used in younger patients as an alternative to conventional surgery (metal on polyethylene) due to its longer viability, enhanced stability and greater preservation of bone stock.

Orthopedic implants are created from various metal alloys. The articular interface, the ball and socket joint where motion occurs, is usually made from very hard alloys comprised of various combinations of aluminum (Al), chromium (Cr), cobalt (Co), iron (Fe), magnesium (Mg), molybdenum (Mo), nickel (Ni), and/or vanadium (V); the most commonly used alloy is comprised of Co and Cr. These hard alloys allow for smooth motion and facilitate great weight bearing required of a successful joint.

Common complications of hip resurfacing include fracture of the femoral neck, avascular necrosis with collapse of the femoral head, femoral impingement and aseptic loosening of a component. However, the greatest concern after metal-on-metal hip resurfacing may be the development of metallosis.
Methods and Materials

Between February 2010 and May 2011 18 hip MR studies were performed to patients with DePuy ASR or ASR XL metal-on-metal hip prostheses presenting clinical failure symptoms, according to the recommendations of the Spanish Medicines and Healthcare products Regulatory Agency. Also, cobalt and chromium levels in serum blood were evaluated.

All MR examinations were performed on a 1.5 T magnet (Philips Achieva, the Netherlands). The routine MRI imaging protocol for post-arthroplasty pelvic imaging was employed, which usually consists on T1 and T2-weighted spin-echo, and STIR coronal and axial sequences. Images review was performed by two 5-year experienced radiologists in consensus.

The term metallosis is defined as an infiltration of peri-prosthetic soft tissue and bone by metallic debris resulting from the wear of arthroplasty. At a cellular level it has been shown that there is perivascular infiltrate of T- and B-lymphocytes and plasma cells, high endothelial venules, massive fibrin exudation, accumulation of macrophages with droplike inclusions with eosinophil infiltration leading to necrosis. These have become known as aseptic vasculitis associated lesions (ALVAL).

Pandit et al used the term 'pseudotumour' to describe non-infective cystic and solid masses associated with resurfacing devices. They estimated that 1% of patients who have a metal-on-metal resurfacing develop a pseudotumour within five years and speculated that the adverse effects could be mediated by an allergic response to 'normal' levels of metal debris, or could be caused directly by toxic concentrations of chromium (Cr) and cobalt (Co) generated from bearing surfaces experiencing abnormal wear.

There is currently no clear consensus in the literature defining the boundaries of the terms metallosis, ALVAL and pseudotumour. Reports suggest that tissues examined following revision surgery often exhibit a combination of the above pathologies.

Recently, the term Adverse Reactions to Metal Debris (ARMD) has been introduced. It is used to describe joint failure secondary to surface wear of the bearing surface or corrosion debris, in the absence of any other obvious explanation. It encompasses metallosis, pseudotumour and ALVAL.
Results

50% of the patients developed periprosthetic collections, communicating with the adjacent joint.

In most cases (6 out of 9) lesions were located at the anterior and posterior aspect of the joint (Figures 1-4).

2 cases showed only anterior lesion involving the region of the ilio-psoas bursa (Figures 5-6).

In one case there was a small cystic lesion in the posterior aspect of the joint.

All lesions were cystic in nature with a low signal intensity wall and foci of susceptibility artifacts representing metallic debris (Figures 7-8).

Out of 18 patients, 6 had elevated cobalt serum levels (> 7ng/ml): four of them with periprosthesic collections and the other two with normal MRI scan.

To date, 4 patients presenting elevated cobalt levels and positive MRI have undergone revision surgery with conversions to total hip replacement.

Follow-up blood test after the revision surgery has shown baseline-normalized levels of metal ions.

A number of articles and reviews report that the degree of metal-on-metal excessive wear can be assessed by evaluation of serum chromium and cobalt concentration. Serum Co and Cr are recommended as the optimal tests for evaluation of implant wear. Patients symptomatic for implant wear with serum Co >7 ng/mL are likely to have significant implant deterioration.

There is growing evidence to support the correlation between development of a pseudotumor and high levels of serum metal ions, although this is not always related to the incidence of symptoms.

In our experience, only symptomatic patients with both elevated ion levels and pseudotumors underwent hip replacement, whereas isolated pseudotumors or high cobalt levels are under follow-up.
Fig. 1: Axial T1 image showing a both anterior and posterior fluid collection surrounding the adjacent joint (*).

© RADIOLOGY, HOSPITAL LA PAZ - MADRID/ES
**Fig. 2:** Axial T2 image showing a both anterior and posterior fluid collection surrounding the adjacent joint (*).
Fig. 3: Coronal T1 image showing a both anterior and posterior fluid collection surrounding the adjacent joint (*).

© RADIOLOGY, HOSPITAL LA PAZ - MADRID/ES
Fig. 4: Coronal STIR image showing a both anterior and posterior fluid collection surrounding the adjacent joint (*).

© RADIOLOGY, HOSPITAL LA PAZ - MADRID/ES
**Fig. 5:** Axial STIR image showing an anterior fluid collection involving the region of the iliopsoas bursa (*).
Fig. 6: Axial T1 image showing an anterior fluid collection involving the region of the iliopsoas bursa (*).
Fig. 7: Axial T2 image reveals a fluid collection compatible with pseudotumor along the inferior aspect of the hip with a low intensity signal wall and foci of susceptibility artifact due to metal content resulting in an appearance unlike that of pure fluid (>).

© RADIOLOGY, HOSPITAL LA PAZ - MADRID/ES
Fig. 8: Coronal STIR image reveals an extensive fluid collection compatible with pseudotumor with a low intensity signal wall and foci of susceptibility artifact due to metal content resulting in an appearance unlike that of pure fluid (>).

© RADIOLOGY, HOSPITAL LA PAZ - MADRID/ES
Conclusion

- Hips MRI is the imaging technique of choice for the evaluation of symptomatic patients with suspected biological reactions or failure of metal-on-metal prostheses.

- Periprosthetic cystic lesion detection turns out to be the key in the therapeutic decision-making and management of patients with elevated serum cobalt and chromium levels.
References


