Unusual Presentation of Cobalt Hypersensitivity in a Patient With a Metal-on-Metal Bearing in Total Hip Arthroplasty

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Abstract

Pain after hip arthroplasty is less likely to be attributed to dermal sensitivity from orthopedic implants. Unexplained persistent pain after hip arthroplasty typically leads to further investigation, occasionally revealing a metal sensitivity.

Our case study presents an unusual finding of a delayed type IV cobalt hypersensitivity in a patient several years after use of cobalt in the contralateral hip. Recognition and a high index of suspicion are needed for timely treatment of metal allergy when it presents as persistent pain after hip arthroplasty.

Dermal sensitivity to metals has been reported to affect up to 15% of the population and is primarily related to nickel sensitivity in up to 14%. Nevertheless, metal sensitivity to orthopedic implants with cobalt, chrome, or polyethylene bearing surfaces is seldom reported.[1] With increasing use of cobalt-chrome hard bearing surfaces, however, the total amount of metallic debris is likely to increase along with the potentially significant risk for metallosis and delayed type IV hypersensitivity reaction to metallic implants. The typical clinical presentation is continued unexplained pain after total joint arthroplasty, or development of unexplained pain after an initial pain-free interval,[2] usually within the first 6 months after implantation. Radiographs can be unremarkable but may show progressive radiolucencies with evidence of aseptic loosening and failure of osseous ingrowth, particularly at the acetabular component.

Although there have been several case reports of metallosis and delayed type IV hypersensitivity reactions to metallic implants,[3] to our knowledge no one has reported delayed hypersensitivity developing in a patient who had a well-functioning contralateral hip arthroplasty.

Here we present the case of a patient who developed cobalt sensitivity after undergoing cobalt-chrome–on–cobalt-chrome, metal-on-metal hip arthroplasty 5 years after primary contralateral cobalt-on-polyethylene hip arthroplasty. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A woman in her late 50s with a lifetime history of intolerance to certain types of earrings underwent right total hip arthroplasty (THA) with a titanium shell, an ultra-high-molecular-polyethylene liner, a cobalt-chrome stem, and a 28-mm cobalt-chrome ball. Five years later, she underwent left THA with a nonmodular cobalt-chrome acetabular component, a titanium stem, and a 43-mm cobalt-chrome head (DePuy, Warsaw, Ind). The later surgery was performed through a computer-navigated mini-posterolateral incision. The postoperative course was unremarkable. The patient was discharged home on hospital day 3 (postoperative day 2). Her 2- and 6-week postoperative visits were unremarkable (Figure 1). In fact, she was doing extremely well, was fully weight-bearing, and had discontinued all pain medications, anti-inflammatories, and ambulatory aids. At her 3-month postoperative visit, she complained of a dull, aching pain on the anterior aspect of the hip. This pain was thought

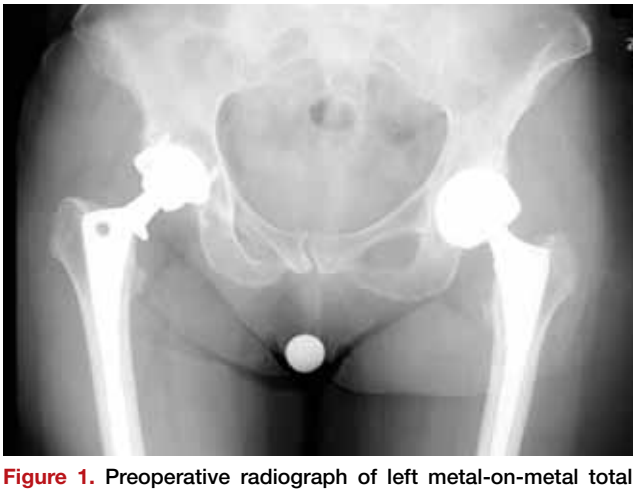

Figure 1. Preoperative radiograph of left metal-on-metal total hip arthroplasty.

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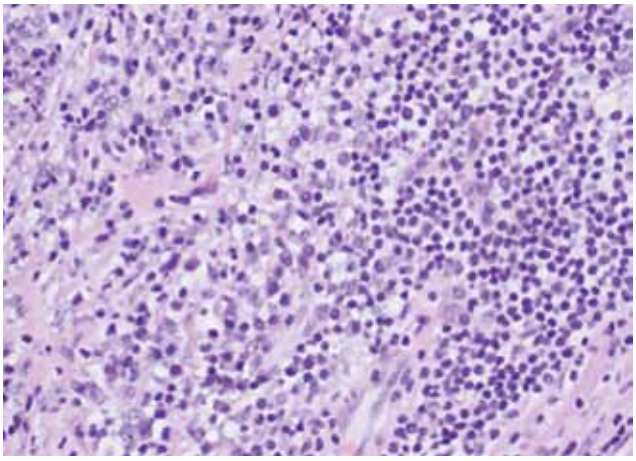

Figure 2. Histopathology shows lymphocytes consistent with type IV hypersensitivity.

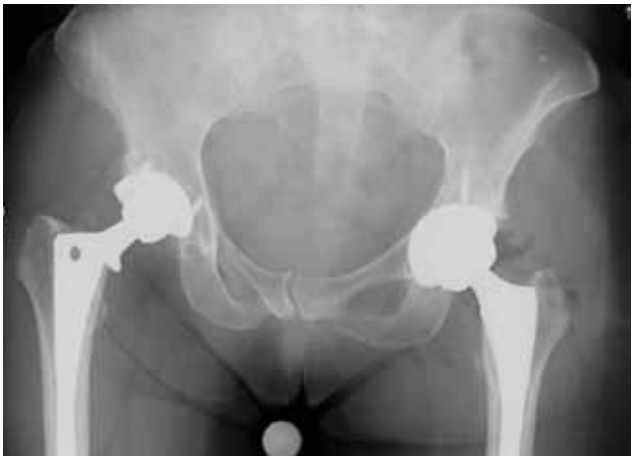

Figure 3. Postrevision radiograph.

to be related to iliopsoas tendinitis. At the time, the patient rated her pain as mild to moderate. She did not require any analgesics. Six months after surgery, however, she made an unscheduled office visit with the complaint of increasingly severe left buttock, groin, and low back pain. Physical examination was unremarkable other than for antalgic gait and nonspecific hip pain with range of motion (ROM). The patient was thought to have a lumbar radiculopathy and was prescribed analgesics. Findings of magnetic resonance imaging of the lumbar spine and an electromyogram were interpreted as being within normal limits for the patient's age, but there was no diagnostic explanation of her pain.

By 8 months after surgery, she had not responded to the analgesics and had become increasingly unable to walk, such that she could not walk without use of ambulatory aids. She presented to the office complaining of increasing buttock pain, swelling, pain with ROM, and inability to walk. Physical examination revealed significantly deteriorated antalgic gait with severe hip pain on ROM and posterior gluteal swelling with tenderness to palpation. Radiographs showed the femoral component osseointegrated with calcar atrophy. There was no evidence of radiolucency or osteolysis around the acetabular component; the component was considered well fixed. Triphasic bone scan and indium bone scan were nonspecific, with mild uptake in the region of the last acetabulum, but were considered nonspecific and nondiagnostic. Given the complaint of a mass, computed tomography was ordered; it showed a soft-tissue mass in the posterior hip, which was interpreted as a possible hematoma rather than postoperative swelling.

Because of the patient's deteriorating condition, unusual presentation, and lack of diagnostic information, a formal allergy consult was obtained. Metal patch testing was performed, in a standard fashion, to rule out metal sensitivity. Patch test results revealed sensitivity to cobalt, and the allergist prescribed methylprednisolone and cyclosporine for delayed type IV hypersensitivity reaction to the cobalt in the left hip implant. The patient initially responded to this treatment, but her left hip pain continued, and she was still unable to walk without ambulatory aids. As no other cause for the hip pain could be found, and as her condition was progressively disabling, the decision was made to proceed with hip revision.

During surgery, a soft-tissue mass was identified and biopsied. The specimen was found to have metallic debris and a lymphocytic infiltration with no evidence of infection (Figure 2). The acetabular component, which had looked normal radiographically, was found to be loose, but there was no evidence of osteointegration. The femoral component was well fixed, and there was no evidence of abnormalities. The acetabular component was revised to a modular cup with a titanium shell, a polyethylene liner, and a 36 delta ceramic head.

The patient's preoperative pain dissipated, and she was discharged home on hospital day 3 (postoperative day 2). Her postoperative course was unremarkable, her symptoms resolved (Figure 3), and there was no recurrence of the preoperative pain within 1 year after surgery.

Discussion

Metal sensitivity leading to implant failure and revision remains a very rare problem in spite of the increasing number of THAs being performed.[4] Use of patch testing and clinical history appears to be an unreliable screening method for determining tolerance to metal implants and predicting which patients will develop a metal allergy after surgery.[5] Our patient developed an allergy to cobalt after receiving a large-head metal-on-metal implant with cobalt-chrome articular surfaces, even though her contralateral-side cobalt-chrome cementless femoral prosthesis (with cobalt-chrome head and ultra-high-micro-polyethylene liner and titanium shell) had performed well for 5 years. Furthermore, the right hip remained asymptomatic

during the entire clinical course. Her clinical course is consistent with development of type IV delayed hypersensitivity to a new prosthesis with a 3-month delayed onset of symptoms, development of a local soft-tissue mass, and, ultimately, acetabular loosening. Patch testing revealed sensitivity to cobalt, and intraoperative histology revealed granulomatous formation and lymphocytic responses consistent with delayed type IV hypersensitivity reaction.

Conclusions

This is the first report of a case of delayed type IV cobalt hypersensitivity reaction that developed in a patient with a previously well-functioning contralateral-side THA made of similar materials. With the advent of hard bearing surfaces, we may begin to see this phenomenon more frequently. As the diagnosis of metal sensitivity is one of exclusion, a high index of suspicion is needed for recognition of the condition and timely treatment.

Authors' Disclosure Statement

Dr. Swank wishes to note that he is a consultant for computer-assisted surgery for DePuy Orthopaedics, Inc. The other authors report no actual or potential conflict of interest in relation to this article.

References

1. Halpin DS. An unusual reaction in muscle in association with Vitallium plate: a report of possible metal hypersensitivity. *J Bone Joint Surg Br.* 1975;57(4):451-453.
2. Willert HG, Buchhorn GH, Fayyazi A, et al. Metal-on-metal bearings and hypersensitivity in patients with artificial hip joints. A clinical and histomorphological study. *J Bone Joint Surg Am.* 2005;87(1):28-36.
3. Rostoker G, Robin J, Binet O, et al. Dermatitis due to orthopaedic implants. A review of the literature and report of three cases. *J Bone Joint Surg Am.* 1987;69(9):1408-1412.
4. Hallab N, Merritt K, Jacobs JJ. Metal sensitivity in patients with orthopaedic implants. *J Bone Joint Surg Am.* 2001;83(3):428-436.
5. Hallab NJ, Mikecz K, Jacobs JJ. A triple assay technique for the evaluation of metal-induced, delayed-type hypersensitivity responses in patients with or receiving total joint arthroplasty. *J Biomed Mater Res.* 2000;53(5):480-488.