PARTICLE DISEASE - A MIMICKER

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PJR January - March 2017; 27(1): 63-66

ABSTRACT

Particle disease also known as aggressive granulomatosis is a well-known complication of total hip replacement. It is characterized by osteolytic areas in bone surrounding joint prosthesis. There is agranulomatous inflammatory response to particles of hip implant released due to constant wear over years. Our patient presented with extensive osteolytic areas and large soft tissue components around left hip prosthesis. He was worked up for metastatic and infective bone etiology but on histopathological biopsy it turned out to be particle disease. Our aim to report this particular case is to raise awareness among radiologists and surgeons that aggressive osteolytic bone pattern in setting of hip prosthesis can be due to aggressive inflammatory response to foreign particles of implant.

Key words: Particle disease, hip arthroplasty, implants failure.

Introduction

Particle disease also known as giant cell granulomatous response is one of the uncommon but significant complication of total hip replacement leading to joint loosening and implant failure and hence surgical revision.[1] It is a histiocytic response that occurs as a result of macrophage reaction to any of the components that are shed of the surface of the implant. Of all components acetabular polyethylene (PE) is the most common source.[2] The condition tends to occur 5-10 years after surgery.[3]

Radiologically, it often results in well-defined osteolytic lesions surrounding the prosthesis. Osteolysis can also be seen distant from prosthetic components due to migration of wear debris along fixation screws or wires and due to joint effusion.[4,5]

Although radiography is the mainstay of the imaging evaluation of the prosthetic hip, sonography, arthrography, computed tomography (CT), scintigraphy and magnetic resonance (MR) imaging all have roles in the evaluation of the painful prosthesis.[6]

Case Report

A 59 year old male patient was referred to radiology department for evaluation of left hip prosthesis, which was implanted in 1988. According to patient he suffered from septic arthritis of left hip during childhood which ultimately lead to joint destruction and limping. However he had no documentary prove. Presently he complained of pain left hip joint, limping and unable to bear weight on left lower limb. Detailed history revealed that he was a nonsmoker with insignificant past medical history. Blood complete picture, liver function tests and renal function tests were all within range. C-reactive protein, prostate specific antigen and carcinoembryonic antigen were also unremarkable.

Ultrasound abdomen, pelvis and scrotum were normal. Radiograph AP (Fig. 1) and frog leg views of left hip joint revealed a bipolar hip prosthesis comprising of acetabular cup (metallic, cement less, porous with polyethylene liner) and femoral stem (metallic, cement less, porous). It demonstrated malalignment of femoral

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Submitted 15 September 2016, Accepted 5 November 2016

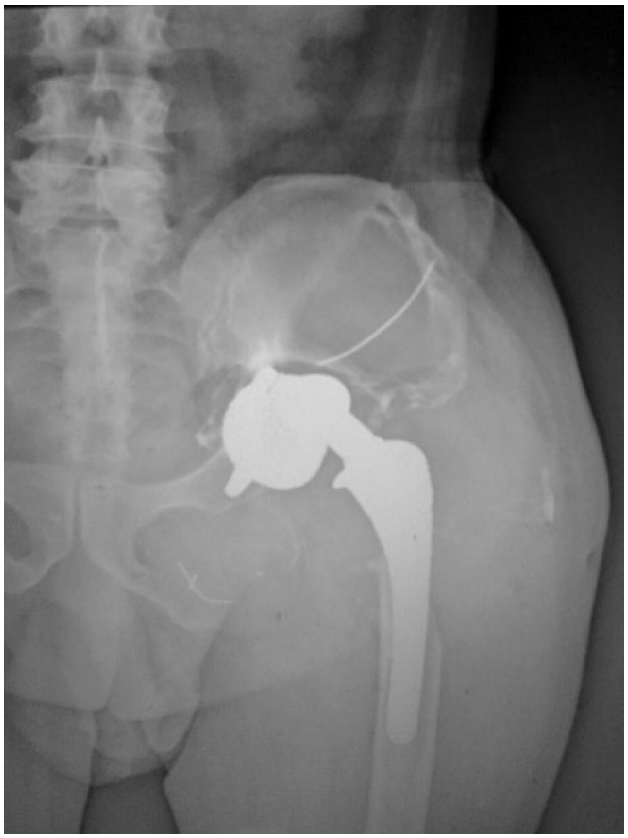

Figure 1: X-ray AP view of left hip reveals large destructive lytic areas with soft tissue components in iliac wing, acetabulum, ischium and proximal femoral end surrounding malaligned hip prosthesis. Note large soft tissue mass in left thigh displacing fat lines laterally.

head with respect to acetabular cup. Moreover, large expansile osteolytic areas were seen in left iliac blade, ischium and pubic bone extending into acetabulum. There was extensive bony destruction with disrupted overlying cortex and associated large soft tissue component evident by displacement of fat planes. Interestingly, these destructive lytic areas were present around fragmented metallic wires, installed in place to fix arthroplastic prosthesis. Another large destructive osteolytic area with soft tissue component was noted replacing proximal end of femoral shaft surrounding the femoral stem. Visualized part of femoral shaft revealed osteopenia with peiprosthetic lucency of more than 2mm suggesting prosthetic loosening. Similar findings were observed on CT scan as well (Fig. 2). These large destructive osteolytic areas with large soft tissue components likely suggested aggressive bony metastases, however multifocal aggressive primary bone neoplasm and extensive septic osteolysis were included in differentials.

Ultrasound guided core biopsy of left iliac blade soft tissue component was performed and sent for histopathology, which revealed foreign body type multinucleated giant cells and foamy histiocytes. No evidence of atypical cells or malignancy was seen in material examined.

Final diagnosis of particle disease was made.

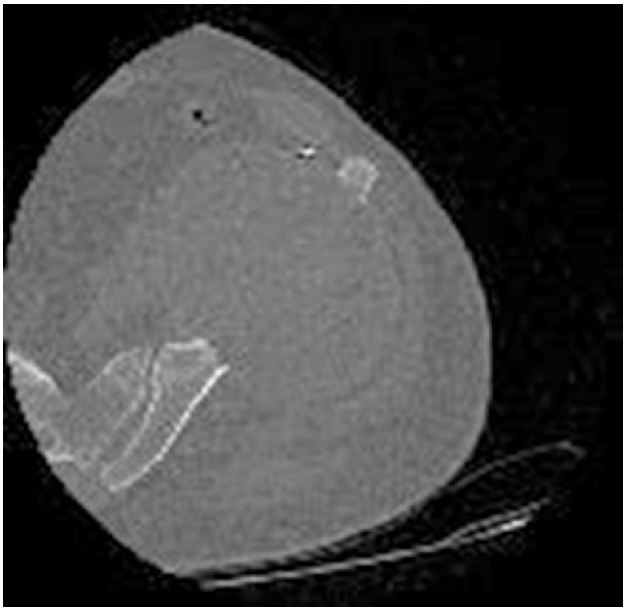

Figure 2: CT scan axial cut through left SI joint, bone window, reveals a large soft tissue mass causing destruction of iliac blade. Note a metallic density focus anterolateral to mass representing fixation wire.

Discussion

Total hip replacement is one of the commonly performed orthopedic surgery with a higher success rate of about 85% 25 years after surgery.[7,8] Variety of materials have been used to make prosthetic implants but the most widely accepted one is metal-on-polyethylene (MOP) prostheses.[9] Others include metal-on-metal (MOM) and ceramic-on-ceramic (COC) prostheses. Total hip prosthesis is subjected to a number of complications of which the most significant and unusual is aseptic loosening of implant secondary to particle disease, which induces inflammation mediated bone loss, osteolysis. It is the most common reason for revision surgery.[1,8] Continuous and excessive use of hip prosthesis by an active individual subjects the implant to wear and micro

abrasion, which results in release of prosthetic particles into joint space. These particles are biologically active and result in an inflammatory response.The particles are engulfed by macrophages, forming multinucleated giant cells, which then release various factors and cytokines, such as interleukins, prostaglandins, and tumor necrosis factor. The cytokines attract other inflammatory cells and stimulate osteoclastic activity, leading to osteolysis.[2,10] Any of the components of a hip replacement, such as the metal, polyethylene (PE) liner, or cement, can become microscopically fragmented and induce a histiocytic granulomatous inflammatory reaction.[2,6]

Osteolysis related to particle disease is suggested radiographically by focal well-defined radiolucencies around either the acetabularor femoral components. The presence of osteolysis at sites away from the actual articulating surfaces of the arthroplasty is explained by migration of wear debris along tracks of fixation screws and wires as a result of insinuation of joint effusion.[4,5]

Osteolysis in patients following hip arthroplasty may be confused with infection or malignancy, as was the case with our patient, who had extensive osteolytic lesions in left iliac, pubic, ischial and proximal femoral bones with large soft tissue component.

A distinction between infectious osteolysis and aseptic osteolysis related particle disease often cannot be made on a single radiograph. Previous radiographs are necessary for comparison, with aseptic loosening and histiocytic response usually taking a slowly progressive course, whereas an acute infection occurs with more rapid time course and more aggressive appearance. However, even this feature is not always reliable because infections can be subclinical and smoldering, leading to slowly progressive loosening in an afebrile patient. Erythrocyte sedimentation level above 32 mm/hr and peripheral white blood cell level are also not perfect predictors of infection.[11] Although the appearance of osteolysis per se cannot distinguish infectious from noninfectious loosening,the presence of periosteal reaction, demonstrated with either radiographs or CT, is highly predictive of infection.[12,13] None of the above findings suggesting infection were present in our case.

However distinction from a malignant cause was a challenge. Age and radiological features were very suggestive of metastasis from unknown primary. A thorough workup for identification of primary was done which turned out to be negative, as already discussed above. Finally the patient was subjects to ultrasound guided biopsy, which revealed foreign body multinucleated giant cell granulomatous reaction-particle disease.

Treatment of particle induced osteolysis leading to implant loosening is revision of total hip arthroplasty with or without bone allografts to fill in deficient bone areas. Our patient was referred back to orthopedic surgeon with the final diagnosis of particle disease. Surgeons planned a revision of hip prosthesis and filling in of osteolytic areas with synthetic bone grafts.

Conclusion

Although particle disease is one of the known complication of hip prosthesis, but this particular case presenting with extensive osteolysis and large soft tissue components around left hip implant, mimicking aggressive neoplastic lesion, prompted us to report this case.

References

1. Clohisy JC, Calvert G, Tull F, Mc Donald D, Maloney WJ. Reasons for revision hip surgery : a retrospective review. ClinOrthopRelat Res. 2004; **429:** 188-92.

2. Konttinen YT, Zhao D, Beklen A, et al. The microenvironment around total hip replacement prosthesis. ClinOrthopRelat Res. 2005; **430:** 28-38.

3. Jonathan K, Cameron F, David S. Particle Disease on Fluoride-18 (NaF) PET/CT Imaging. J Radiol Case Rep. 2011; **5(5):** 24-30.

4. Keogh C, Munk PL, Gee R, et al. Imaging of the painful hip arthroplasty. AJR Am J Roentgenol. 2003; **180:** 115-20.

5. Schmalzried TP, Jasty M, Harris WH. Perprosthetic bone loss in total hip arthroplasty. J Bone Joint Surg Am. 1992; **74:** 849-63.

6. Theodore T. Miller, MD. Imaging of hip arthroplasty. Seminars in Musculoskeletal Radiology. 2006; **10(1)**.

7. Berry DJ, Harmsen WS, Cabanela ME, Morrey BF. Twenty five years survivorship of two thousand consecutive primary Charnley total hip replacement: factors affecting survivorship of acetabular and femoral components. J Bone Joint Surg Am. 2002; **84:** 171-7.

8. Griffith HJ, Priest DR, Kusher D. Total hip replacement and other orthopedic hip procedures. RadiolClin North Am. 1995; **33:** 267-87.

9. Charnley J. The long term results of low friction athroplasty of the hip performed as primary intervention. J Bone Joint Surg Br. 1972; **54:** 61-6.

10. Parwani AV, Yang B, Clark DP, Ali SZ. Particle Disease: Cytopathologic findings of an unusual case. DiagnCytopathol. 2004; **31:** 259-62.

11. Lachiewicz PF, Rogers GD, Thomason HC. Aspiration of the hip joint before revision total hip arthroplasty. Clinical and laboratory factors influencing attainment of a positive culture. J Bone Joint Surg Am. 1996; **78:** 749-54.

12. Tigges S, Stiles RG, Roberson JR. Appearance of septic hip prosthesis on plain radiographs. AJR Am J Roentgenol. 1994; **163:** 377-80.

13. Cyteval C, Hamm V, Sarrabere MP, et al. Painful infection at the site of hip prosthesis: CT imaging Radiology. 2002; **224:** 477-83.