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ABSTRACT

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Case Report: Here we report a case of 67-year-old male who presented with hip pain after bending forward. Polyethylene liner dissociation was found at urgent revision surgery that was not diagnosable by imaging alone.

Conclusion: Polyethylene liner dissociation needs to be considered alongside infection and aseptic loosening in all cases of late-onset pain following total hip arthroplasty. Surgeons and radiologists need to be aware of the condition and some diagnostic features.

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Keywords: Arthroplasty, Hip, Joint replacement, Polyethylene liner dissociation

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INTRODUCTION

The polyethylene liner is a plastic spacer inserted between the new femoral head and the acetabular socket to allow for a smooth gliding surface after hip replacement. When this plastic dissociates from the socket for any reason or is initially not fixed very well, polyethylene liner dissociation (PLD) can occur. Polyethylene liner dissociation is a serious complication of total hip arthroplasty (THA), and an unexpectedly high number of liner dissociations have been reported with certain implant designs such as DePuy Pinnacle (Warsaw, IN) [1]. A review of ten-year National Joint Registry (NJR) data suggests an overall PLD incidence of approximately 0.04% [2]. There are two types of PLD [3], acute and late, both of which mandate revision surgery. Dissociation must be identified early to prevent implant mobilization and avoid the difficulties associated with late revisions. Though PLD is a rare complication following THA, awareness of the typical signs, symptoms and, when possible, the radiological appearances will help to avoid misdiagnosis.

CASE REPORT

A 67-year-old male acute pain with an audible “creaking” sound in his right hip joint after bending forward while taking a shower. He had undergone an uncemented THA (Corail KLA15 stem, Pinnacle 100 Series 56 mm shell, 56/32 mm highly cross-linked polyethylene Marathon liner, 32 mm ceramic long-neck

femoral head: DePuy, Warsaw, IN) for severe arthritis six years previously. He had no other significant medical comorbidities but he had suffered a periprosthetic fracture of the femur on the same side after a fall while skiing that was treated by the cerclage wiring technique 12 months after the initial THA.

No significant limb length discrepancy or neurovascular deficit was noted, but the range of hip joint motion was limited by pain. His body mass index was 25.9 kg/m^2. There was no history of previous right hip dislocation. A radiograph showed that the femoral head was clearly and eccentrically displaced within the acetabular component (Figure 1). There was no apparent loosening of the THA components or signs of secondary fracture. Fracture of the ceramic head or polyethylene liner was suspected.

The patient was scheduled for urgent revision surgery. At operation, the polyethylene liner was seen to have completely dissociated from the shell and was displaced from the outer shell. There were no macroscopic signs of metal debris or metallosis. Both the femoral component and the acetabular socket were stable. The acetabular cup was revised with a 56/32 mm Marathon highly cross-linked polyethylene liner and a 32 mm stainless steel long neck femoral head (DePuy, Warsaw, IN). The femoral component was not revised. Postoperatively, he was maintained on partial weight bearing for four weeks. His inpatient stay was uncomplicated and he was discharged on postoperative day-7. A postoperative radiograph showed no abnormality (Figure 2). He reported no hip joint pain and he was fully ambulatory at his most recent outpatient follow-up appointment.

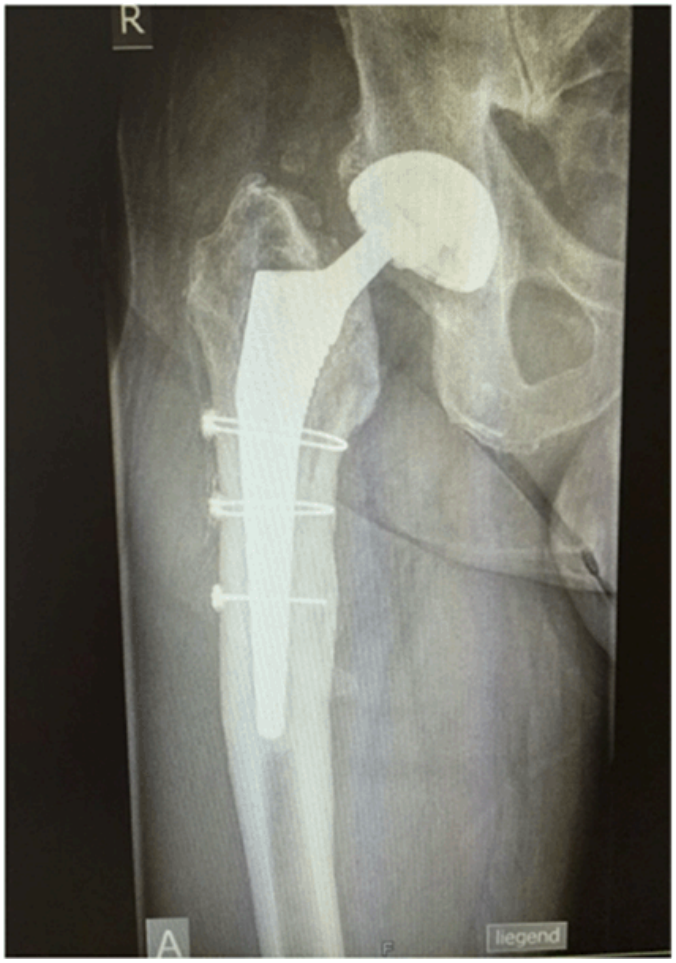

Figure 1: Preoperative anteroposterior radiograph showing a clearly eccentric head of the femoral prosthesis within the acetabular component. The polyethylene liner cannot be seen.

DISCUSSION

Polyethylene liner dissociation (PLD) is a rare complication of cement-free THA. Reports of this complication have recently increased. Although the failure mechanism is poorly understood, several hypotheses for the mechanism of dissociation have been proposed [3]. In acute dissociation of the polyethylene liner as a result of hip dislocation or in the acute postoperative situation with or without trauma [4], the failure is most likely due to rotation of the liner inside the metal shell and polyethylene destruction by the cutting edge of the metal. Since mechanical factors appear to be causal in these dissociations, technical surgical defects that prevent good initial fixation, abrupt intraoperative mobilizations, badly inserted screws with heads that impact on the liner, trauma to the metal shell (especially

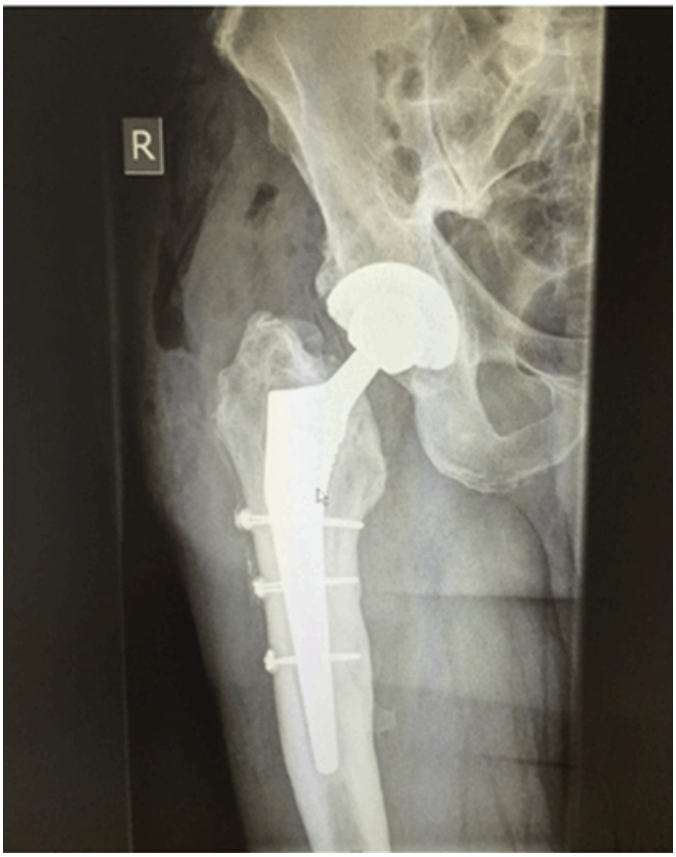

Figure 2: Postoperative radiograph showing good prosthesis positioning, with the head of the femoral prosthesis located centrally within the acetabular component.

when long necks are used), or the shell/liner interface being filled with soft tissue might also contribute to the pathogenesis. In contrast, late and chronic dissociation (≥4 years) may be associated with volumetric wear until fatigue failure occurs, inappropriate component orientation (e.g., excessive anteversion), the use of 32 mm heads, mobilization of the metal shell, polyethylene components that are too thin, or manufacturing defects. Deficient locking of the metal shell and polyethylene can result in micromotion between the two surfaces, leading to accelerated wear and, in some cases, dissociation. Mayer et al. [5] described the first case of late locking mechanism failure in an active patient nearly five years postoperatively. Early liner dissociation is more likely to be related to malseated components rather than true fatigue failure of the locking mechanism [6].

Plain radiography, especially with an anteroposterior view, is important in PLD diagnosis. The presence of an eccentric femoral head and the head abutting the acetabular cup in plain radiographs are highly suggestive of liner dissociation. However, these findings are similar to those seen in severe liner wear, and distinguishing these can be difficult on plain radiography alone. Retpen et al. [7] described the plain radiographic features of a displaced polyethylene liner as a dark curved shadow distal to the metal backing. In addition, the crescent sign (radiolucency medial to the femoral neck on radiographs suggesting a displaced radiolucent liner) has been reported to be useful in the diagnosis of PLD [8]. However, these radiographic findings were not seen in our case.

Niggemeyer et al. [4] and Ferenz et al. [9] both suggested that manufacturers should place radiopaque markers in polyethylene liners to facilitate radiographic diagnosis, especially when the femoral head remains within the acetabulum, albeit eccentrically in our case. With respect to this diagnostic difficulty, Jin et al. [10] confirmed the diagnosis of PLD with sonography by showing the presence of tram track–like curved echogenic lines in the anteromedial portion of the artificial hip joint. These lines were located anterior to the artificial femoral head and neck, and these features have been dubbed "the sonographic tram-track" sign. There is only one reported study in literature concerning the sonographic findings of polyethylene liner dissociation after THA, where the tram track sign showed 100% sensitivity, specificity, and diagnostic accuracy [11]. In our case, we believe the etiology was either related to locking mechanism fatigue or as a result of trauma (bending forward) rather than initial component malseating. However, we recognize that no firm causality can be established in this case and further studies are needed to establish the exact mechanism of PLD. Regardless, orthopedic surgeons and radiologists need to be aware of the presentation and features of PLD to initiate prompt and appropriate management.

CONCLUSION

In any sudden change in the clinical presentation of a total hip arthroplasty, radiographs should immediately be obtained. Eccentric displacement of the femoral head in the cup raises the possibility of fracture of the femoral head or polyethylene liner or, in rarer cases, dissociation of the polyethylene liner. Revision should be performed immediately due to the risk of further damage to the metal socket.

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Ghassan Almaimani – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Christoph Schreyer – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor
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Conflict of Interest
Authors declare no conflict of interest.

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