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Case Series

Intraprosthetic Dislocation of Dual-Mobility Total Hip Arthroplasty: Analysis of a Case Series and Review of Literature

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Abstract

Introduction: Intraprosthetic dislocation is a rare and exclusive complication of hip prostheses with dual-mobility components, where the prosthetic femoral head separates from the polyethylene liner.

Materials and Methods: Descriptive study of a series of cases, from the period 2019 to 2023, with a diagnosis of intraprosthetic dislocation.

Results: Three clinical cases with intraprosthetic dislocation from our institution are described. All required open reduction and revision total hip arthroplasty. One of them, operated on six months after the event, showed signs of metallosis and wear; the polyethylene liner was not found during the intraoperative period.

Conclusion: In a hip prosthetic dislocation with dual-mobility components, intraprosthetic dislocation should be considered. The reduction is generally open.

Keywords: Dual-Mobility; Total Hip Arthroplasty; Dislocation; Intraprosthetic Dislocation; Acetabular Cup

Abbreviations

IPD: Intraprosthetic Dislocation; DM: Dual-Mobility; PE: Polyethylene; THA: Total Hip Arthroplasty

Introduction

The prosthesis with dual-mobility (DM) components consists of two joints: an internal joint that incorporates a capture mechanism between the femoral prosthetic head and the polyethylene (PE) liner; and a free external joint, which is between the PE liner and the metal shell [1].

Due to the presence of two joints, the DM prosthesis has a specific complication which is intraprosthetic dislocation (IPD), which consists of dislocation of the internal head and the PE liner [1]. This complication is difficult to control with closed reduction alone and often requires revision of the PE liner component [2].

If IPD is not identified, damage to the acetabular cup may occur due to direct articulation of the prosthetic femoral head and metal shell [3]. Therefore, when a prosthesis with DM components dislocates, it is important to consider the possibility of IPD.

Materials and Methods

Descriptive study of a series of cases (N = 3) with a diagnosis of IPD of a DM hip prosthesis. Patients with said diagnosis treated at our institution during the period 2019 to 2023 were used as inclusion criteria. Three clinical cases from our institution are presented and then a critical analysis of the updated literature.

Results

- **Case 1:** Male patient, 71 years old, with a history of stroke and THA with DM components for femoral neck fracture. He consulted in the emergency department two weeks after surgery after another fall, revealing dislocation of THA (Figure 1). A closed reduction was performed, which failed, so IPD was considered. It was decided to perform open reduction in the operating room, where the PE liner was found in the soft tissues, and the prosthetic femoral head articulating with the metal shell, without metallosis. In the same surgical procedure, the prosthesis was revised with a constrained system (Figure 2).
- **Case 2:** Female patient, 76 years old, with a history of stroke and THA with DM components for femoral neck fracture.

She consulted the emergency department three weeks after another fall, revealing dislocation of her total hip prosthesis (Figure 3). Closed reduction was performed, which was laborious. In the fluoroscopy of the procedure, an eccentric head was observed, so IPD was considered. It was decided to perform open reduction in the operating room, where the PE liner was found in the soft tissues, and the prosthetic femoral head articulating with the metal shell, without metallosis. In the same surgical procedure, the total hip prosthesis was revised with reorientation of the acetabular cup and new DM components (Figure 4).

- **Case 3:** Male patient, 69 years old, with a history of revision hip prosthesis with DM components for instability. One year after surgery, he consulted the emergency department after a fall on stairs, revealing dislocation of the THA (Figure 5). A closed reduction maneuver was performed, which was considered successful, so the patient was discharged home. In the outpatient follow-up, persistent pain and sound upon hip mobilization were investigated. Simple radiology showed an eccentric head in the acetabular cup (Figure 6). IPD was considered and open reduction was indicated, which was deferred for six months due to decompensated diabetes. Intraoperatively, significant metallosis was observed, with the prosthetic femoral head articulating with the metal shell. The PE liner was not found in the soft tissues, the computed tomography showed it in the gluteal region (Figure 7). In the same surgical procedure, a new DM system was installed. Additionally, a head adapter system was installed to obtain more length and offset (Figure 8).

Figure 1: AP pelvic x-ray showing dislocation of left hip prosthesis. The staples in the surgical wound show his recent surgery.

Figure 2: AP pelvis x-ray showing revision left THA with constrained system.

Figure 3: AP pelvic x-ray showing dislocation of left hip prosthesis. Above the dislocated prosthetic head there is a shadow that could correspond to the PE liner fixed to the prosthetic head.

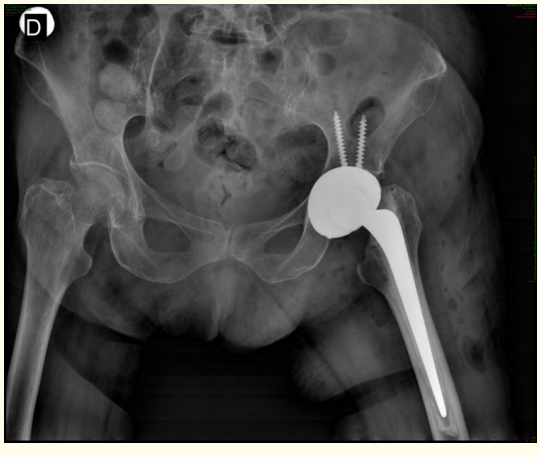

Figure 4: AP pelvis x-ray showing post revision left THA.

Figure 5: AP pelvis x-ray showing left THA dislocation.

Figure 6: AP pelvis x-ray showing left hip prosthesis with post-reduction eccentric head, suggestive of IPD.

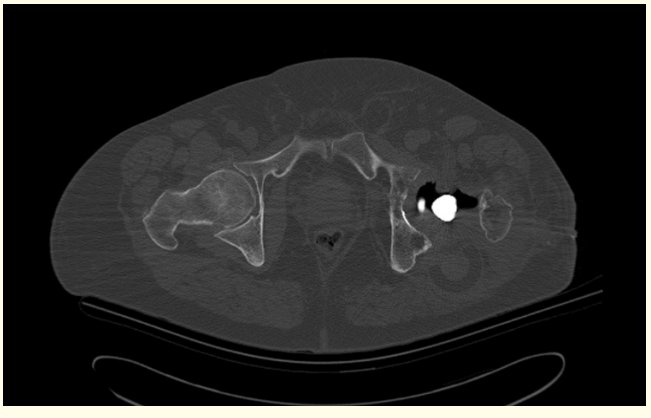

Figure 7: Axial section of computed tomography showing a circular image in the left gluteal region suggestive of lost polyethylene liner.

Figure 8: AP pelvic x-ray showing post-revision left THA. The head adapter system was used for more length and offset.

Discussion

Intraprosthetic dislocation (IPD) is a specific complication of prostheses with dual-mobility (DM) components [3]. Its incidence is less than 0.3% [4].

The mechanism occurs during closed reduction of dislocation of the PE liner and metal cup. The PE liner can become trapped on the edge of the metal cup or on a bony prominence during the reduction maneuver, which can cause dissociation of the capture mechanism of the PE liner from the prosthetic head, known as "bottle-opener effect" [2]. Risk factors are wear of the PE liner and multiple reduction attempts causing the "bottle-opener effect", so it recommends adequate sedation and muscle relaxation or general anesthesia is required to minimize the force required [5,6].

Philippot classified intraprosthetic dislocations into three types [6]: Type 1 was pure IPD without arthrofibrosis and without cup loosening, Type 2 was IPD secondary to blocking of the liner, and Type 3 was IPD associated with a cup loosening. However, this classification is useful in the context of dislocation resulting from wear of the PE liner and is not applicable for traumatic dislocation due to a "bottle-opener effect".

Late diagnosis of IPD can lead to damage to the acetabular cup due to direct articulation of the prosthetic femoral head and internal surface of the metal shell [3], which can lead to significant metallosis and elevated cobalt-chromium levels [7].

Therefore, when a prosthesis with DM components dislocates, it is important to consider the possibility of IPD [9].

Clinically it can present with shortening of the limb and sounds upon movement [7]. In the x-ray, an eccentric position of the prosthetic femoral head can be observed due to direct contact between the head and the metal shell. The dislocated PE liner can be visualized outside the cup as a "bubble sign" [2]. This PE liner may migrate deep into the pelvis and may not be recoverable [8]. Computed tomography is recommended for preoperative planning and evaluation of the position of the dislocated PE liner [1].

Treatment consists of open reduction to revise the PE liner and restore dual-mobility joints [9]. Signs of instability and wear should be observed in the metal cup, in which case a review should be carried out at the same stage. The head and neck of the prosthesis should also be evaluated, to identify signs of damage or wear that requires revision surgery. If the head and the acetabular shell are found intact, can be managed by only revising the PE liner [7].

To reduce a hip prosthesis dislocation with DM components, adequate sedation and muscle relaxation or general anesthesia is required to minimize the force required [5]; in addition, the use of fluoroscopy without leverage is recommended to avoid "bottle-opener effect" [2].

Conclusion

In a dislocation of a prosthesis with DM components, the possibility of IPD must be considered, which is a rare but specific complication of this system. The treatment is surgical, with open reduction and management of the PE liner.

Conflict of Interest

None of the authors have conflicts of interest.

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