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CASE REPORT

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# Trunnionosis: A Rare Cause of surgical Revision of THA. A Case Report

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## Introduction

A rare cause of mobilization of the total hip arthroplasty (THA) is Trunnionosis. That is the wear of the neck-head interface of the prosthesis (trunnion), and it is correlated to risk factors such as the use of metal prosthetic texts with a diameter greater than 36 mm . We present a clinical case in which this phenomenon is present despite the small size of the prosthetic head.

## Case presentation

We report the case of a patient suffering from aseptic loosening of a revision cup in THA associated with the formation of endopelvic pseudotumor. A prosthetic revision surgery was performed: the implant had a metal head of small diameter (28mm) and length XL (extra-large) with evidence of wear of the neck-head interface (trunnion), loosening of the cup, wear of the polyethylene insert, metallosis, loss of substance on the bottom of the acetabulum and endopelvic pseudotumor. It was therefore necessary to remove the inflammatory tissue, to replace the acetabular component with a new revision cup, after using bone graft and augment to reconstruct the acetabular anatomy. The polyethylene insert has been replaced. In addition, the metal head has been replaced with a ceramic head of the same diameter but of reduced length (Large).

## Discussion

The presence of aseptic mobilization of PTA, even in the face of an evident biomechanical failure, should suggest possible rare causes of implant failure such as Trunnionosis. In this case, despite the use of a small diameter head, we found the wear of the trunnion, such as to suggest that at the base of this there may be the length of the head (XL) as a causal factor.

## Conclusions

In the case of aseptic mobilization of THA, trunnionosis must always be considered as a possible cause. Although this phenomenon is related to the use of large metal heads, it is also important to take into account the length of the head or the presence of modularity of the implant. Trunnionosis requires further analysis to be fully understood and prevented in order to produce more performing implants and less prone to corrosion and early failure.

## Introduction

Wear of the neck-head interface is called trunnionosis. It is estimated to account for up to 3% of all THA revision surgeries. It is therefore important to consider trunnionosis in the clinical-radiographic pictures of mobilization of total hip prosthesis in which it is not possible to identify a certain cause of failure [1].

The exact cause of trunnionosis, which is likely multifactorial, currently remains poorly understood. This neck-head interface disorder appears to be associated with several risk factors [2]. These can be divided into patient-related risk factors such as a high body mass index or prosthesis-related risk factors such as use of metal heads, especially their size and the design of trunnion. The reaction induced by the release of metal ions in the articular and periarticular tissues would cause inflammatory reactions with a predominant lymphocytic component and similar to vasculitic phenomena, while at the macroscopic level it can present itself under aggressive forms of prosthetic mobilization due to an important loss of substance and with formation of pseudotumor [3-6].

We present a clinical case in which this phenomenon is present despite the small size of the prosthetic head.

## Case presentation

We report the case of a patient suffering from aseptic loosening of acetabular component from revision in PTA (total hip arthroplasty). This is a 67-year-old overweight woman (BMI 29,24), smoker (20 cigar/day) with bilateral arthritis of the hip. She underwent bilateral PTA surgery and 3 years later a revision of the acetabular component of the right prosthesis for aseptic loosening, in other centers. She came to our observation for pain and functional limitation of the right hip. She suffered from groin pain and she had a range of motion of the hip from 10° to 70° of flexion, with pain at the maximum degrees of flexion. The patient had a slight trendelemburg and had a shortening of the right lower limb of 0.5 cm.

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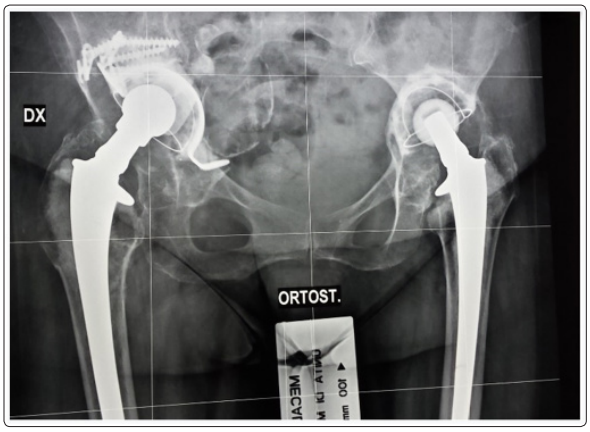
We noticed radiographically evident mobilization characteristics with the presence of a calcified endopelvic cystic neoformation with appreciable magnetic resonance liquid content, similar to a pseudotumor. In fact this formation had characteristics isointense to muscle on T1W images and on T2W images, the cystic content was hyperintense and enclosed by a thick irregular pseudocapsule, which is intense on T1W [7]. Therefore, a revision surgery was performed: the hip prosthesis had a small diameter metal head (28mm) and an XL size with a clear evidence of wear on the neck-head interface (trunnion), cup mobilization, wear of the PE insert, metallosis, acetabular loss of substance and endopelvic pseudotumor.

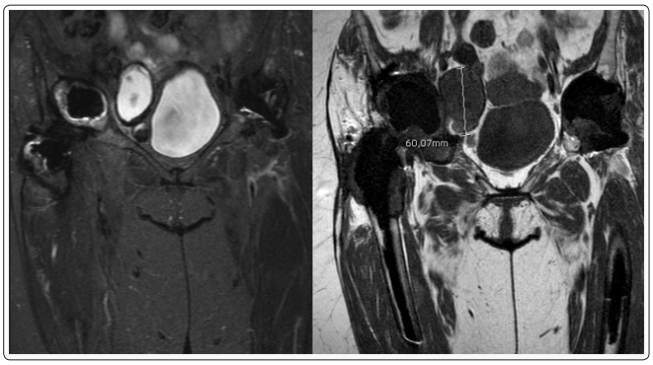



Pre-op X-Rays

## Discussion

The peculiarity of the clinical case shown is the presence of important trunionosis despite the use of a small diameter head. Furthermore, the consumption of the head-neck interface led to the release of a large amount of metal particulate debris and the consequent development of adverse reactions to metal debris (ARMD) causing the failure of the prosthetic implant. The occurrence of such a massive trunionosis in an implant with a 28 mm femoral head is a relatively rare event. Historically, large diameter femoral heads have been considered responsible of wear of the neck-head interface. As demonstrated by Langton et al. larger heads increase the horizontal lever arm, which gives greater torsional forces to the head-neck junction [8]. Also Bolland et al. published a study about high failure rates in a cohort of 199 hips (185 patients) with large-diameter (38 mm) hybrid THAs. All hips that were revised or awaiting revision, the mean femoral head diameter was 46 mm (range 40–54 mm). Moreover during revision surgery, surgeons discovered corrosion of the stem surface as well as increased wear at the head–neck junction [9].

Our clinical case with 28 mm femoral head is in stark contrast to the study by Dyrkacz et al. [10]. They found a significant correlation between the size of the femoral head (> 36 mm) and the development of trunionosis. In fact comparing the relationship between head and neck for corrosion damage, the 36 mm group showed a greater correlation than the 28 mm group (0.975 vs 0.502). De Balso et al. proved that the increase of femoral head diameter may produce greater fretting damage owing to and increased head-neck moment arm. There is no associated increase in corrosion with 28-mm and 32-mm heads of this taper design [11]. Matharu et al. showed that the relative risk of ARMD revision is 2.8 times higher in 36 mm MoP bearings compared with those of 28 mm and 32 mm [12]. On the contrary, a retrieval analysis conducted by Triantafyllopoulos et al found no association between the size of the femoral heads and the development of trunionosis [13]. Therefore, the association between large-diameter femoral heads and increased trunnion wear is not clear, but large femoral head ( particularly >36 mm) may cause elevated trunnion stresses and the consequent development of ARMD. In addition to the size of the head, another factor that can influence the degree of wear of the trunnion is the type of metal of which the prosthesis is made and mixed metal combinations at the head-neck junction. Gilbert et al. demonstrated that SS/CoCr couples were more susceptible to fretting corrosion than CoCr/CoCr couples [14].




ARMD visualization MRI

For the same size of the femoral head, greater corrosion (42%) was found in the heads of mixed alloy couples than in heads with similar alloy couples (28%) (15). Panagiotidou et al made a comparison between three types of couples 1) CoCr heads on CoCr stems 2) CoCr heads on titanium alloy stems and 3) ceramic heads on CoCr stems. Titanium stems showed the highest fretting corrosion at the head-neck junction, generally they performed worse than CoCr stems. Ceramic heads on CoCr stems presented lower wear of the neck-head interface. Using ceramic heads did not prevent corrosion, but reduced it significantly [16]. With ceramic femoral head CoCr fretting and corrosion from the modular head-neck taper may be mitigated but not eliminated [17]. Also according to Kocagoz et al. ceramic femoral heads may be an effective means by which to reduce metal release caused by taper fretting and corrosion at the head bore-stem cone modular interface in THAs [18]. Studies in this area are varied but it can be said that ceramic heads can reduce the risk of corrosion damage and that the heads of mixed alloy couples may predispose to trunnionosis.

An additional element that can influence the development of trunnionosis is the design of the trunnion. Corrosion does not occur equally throughout the taper but especially at the base. The base zone is subject to higher mechanical loading and greater torque forces compared to other regions, this exposes the shorter trunnions to a greater risk of wear, in fact their base sits within the taper of the femoral head, as demonstrated by Tan et al. In a study of 44 implants [19]. In the study conducted by Brock et al design variation appears to play an important role in taper-trunnion junction failure. They described higher rates of volumetric wear with the shorter, threaded 12-mm/14-mm trunnions compared to the longer, smooth 11-mm/13-mm trunnions [20]. Over time the size of the trunnion has changed, favoring the smaller ones, in order to reduce the risk of impigement. The reduction of the trunnion diameter leads to a decrease of the contact surface between the neck-head interface and the mechanical forces concentrating on a smaller surface lead to a higher wear [21]. A

retrospective retrieval study by Nassif et al instead found higher fretting scores in the 11/13 trunnions rather than the smaller ones. However, this study has a limit in the small group of failed implants examined and in the very heterogeneous cohort [22].

It is important to remember that among the risk factors related to the corrosion of the trunnion, those relating to the patient play a central role and in particular the body index mass especially if > 30 kg / m2 [23]. Laboratory studies have demonstrated increased micromotion at the head-neck junction with increasing weight [24].

Although all of these possible risk factors, the exact cause of trunnionosis is currently unknown. But the complications related to the wear of head-neck interface can lead to a serious release of metallic debris and consequently can become the cause of implant revision. It is estimated that trunnionosis accounts for up to 3% of all THA revision surgeries. Metallic debris induce histological changes in the periprosthetic tissues caused by the development of an immunological response. The characteristic histological features were diffuse and perivascular infiltrates of T and B lymphocytes and plasma cells, high endothelial venules, massive fibrin exudation, accumulation of macrophages with droplike inclusions, and infiltrates of eosinophilic granulocytes [25]. Adverse biologic reactions related to metal debris include necrosis, lymphocytosis, vasculitis, and pseudotumors [26]. In the case reported, the tissue reaction was such as to determine a mobilization of the cup, a severe bone resorption at the acetabular level up to provoking a migration of the prosthesis inside the abdominal cavity. It is therefore a serious case of ARMD like those found in implants with metal-on-metal bearings, but rare if associated with trunnionosis and even rarer in the case of small prosthetic head sizes. These tissue abnormal destructive reactions have been termed with several terms, but the most used are adverse reaction to metal debris (ARMD) or aseptic lymphocyte-dominated vasculitis-associated lesions (ALVAL) The clinical and histological appearance seen in periprosthetic tissue reactions surrounding corroded trunnions can be similar to that of adverse local tissue reactions seen in defective metal-on-metal prosthesis. In the literature there are a large number of studies that have described ARMD related totrunnion wear but it remains a rare occurrence. The rarity of our clinical case is given by the presence of a very serious case of ARMD with extreme tissue damage but in the absence of the main risk factors exposed, in particular the size of the femoral head [27,28].

## Conclusion

Trunnionosis is a relatively rare but not negligible cause of THA revision surgery. Studies currently calculate around 3% of total revision causes. It is therefore important for the surgeon to take it into consideration when faced with a picture of ARMD in the absence of metal-on-metal prosthesis. Despite many studies on the subject, the exact cause of trunnionosis, which is multifactorial, is currently poorly understood. The characteristics of the clinical case presented by us underline this concept.

Among the most studied risk factors that can cause the wear of the neck-head interface is the size of the femoral head. Large heads appear to be an important predisposing factor for trunnionosis but our clinical case demonstrates how the association between large-diameter femoral heads and increased trunnion wear is not clear and that rarely even in the case of small femoral heads the pathology can however arise.

E' importante non dimenticare i fattori di rischio legati alle caratteristiche del paziente in particular the overweight (especially if BMI> 30 kg / m2). This clinical case demonstrates how trunnionosis can cause very serious cases of ARMD with significant tissue damage, bone resorption, pseudotumor and implant mobilization with migration of the prosthesis into the abdominal cavity.

Our clinical case shows moreover that trunnionosis is a relatively frequent pathology, very underdiagnosed and still little studied, which requires further analysis to be fully understood, to be able to know the triggering causes and to be able to prevent it in order to produce more performing implants. and less prone to corrosion and early failure.

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