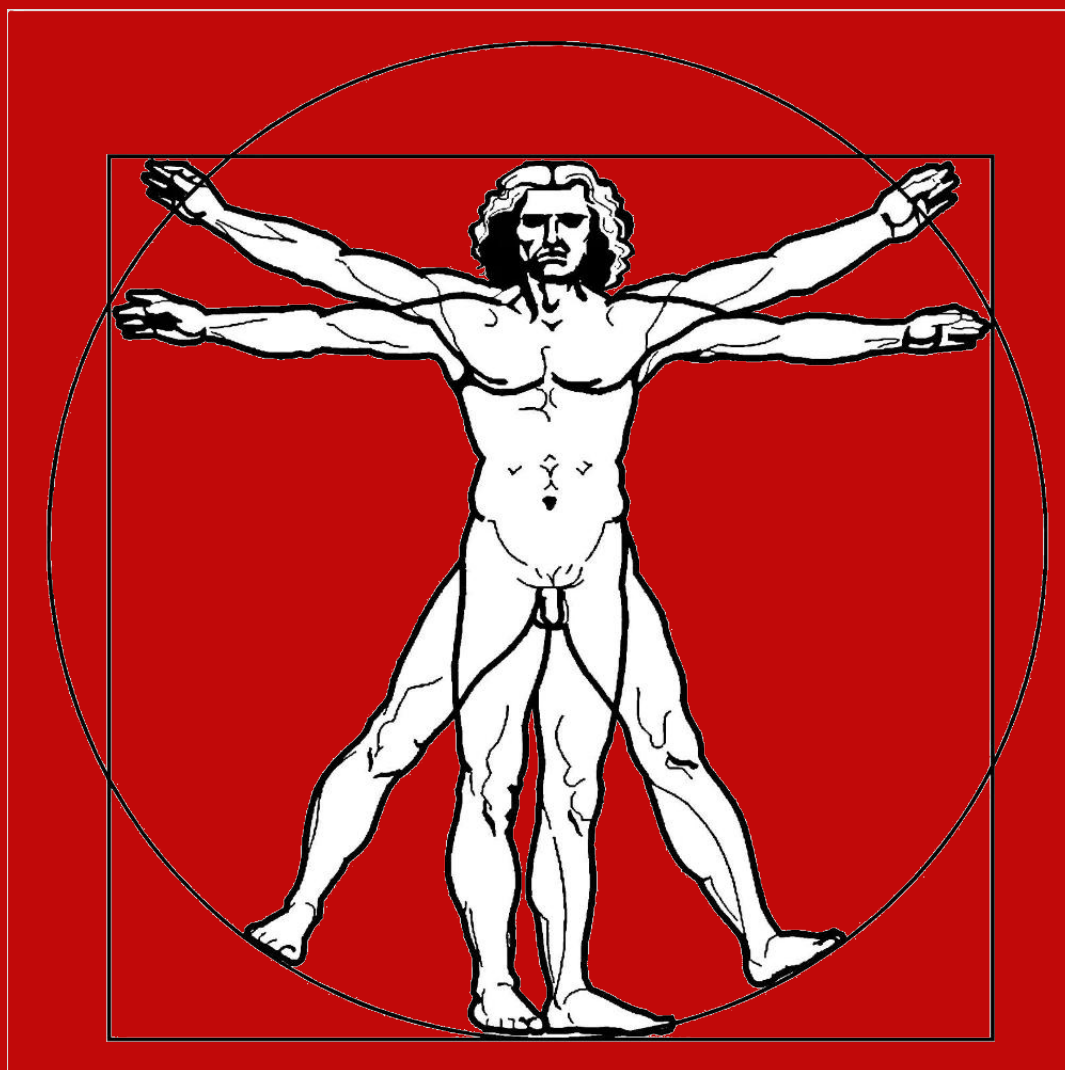


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PSEUDOTUMOR FOLLOWING METAL-ON-POLYETHYLENE TOTAL HIP ARTHROPLASTY: A REPORT OF THREE CASES

ПСЕВДОТУМОР ПОСЛЕ МЕТАЛ НА ПОЛИЕТИЛЕН ТОТАЛНА АРТРОПЛАСТИКА НА КОЛК: ПРИКАЗ НА ТРИ СЛУЧАИ

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АПСТРАКТ

Вовед: Една од ретките компликации кај тоталната артропластика на колкот се псевдотуморите. Тие се дефинираат како грануломатозни или цистични лезии кои немаат инфективно или неопластично потекло. Обично постои латентен период од 2 до 15 години од имплантирањето на ендопротезата до клиничка манифестација на лезијата. Најчести симптоми се болка, оток и нелагодност, но исто така разлабавување на компонентите на ендопротезата или компресивна симптоматологија може да се манифестира. Потенцијалните механизми за настанување на псевдотуморите се реакција на страното тело, хиперсензитивна реакција и реакција кон партиклите од прекумерно трошење на компонентите.

Приказ на случаи: Прикажуваме три случаи на псевдотумори кај метал-на-полиетилен тотална артропластика на колк. Првиот случај е 76-годишна жена со болка и ограничени движења во колкот, 18 години после татална артропластика на колкот. Вториот случај е 53-годишен маж кој презентира болка и оток во десната трохантерна регија, 21 година после тотална артропластика на колкот. Третиот случај е 55-годишна жена која презентира безболна, голема промена во проксималната надколеница, 13 години после тотална артропластика на колкот. Тројцата пациенти беа третирани оперативно со екстрипација на псевдотуморот.

Дискусија: Пациентите со болка во колкот или препоните, оток или колекција на течност после тотална артропластика на колкот треба внимателно да се евалуираат, посебно за присуство на инфекција. Незапознаеноста на клиничарите и радиолозите со псевдотуморите може да ги наведе на погрешно толкување на овие промени. Третманот на псевдотуморите е контраверзен бидејќи не постои јасен консензус за оптимален третман и надзор на оваа компликација.

Заклучок: Препознавањето на псевдотуморите е многу важно со оглед на зголемениот број на хируршки интервенции и последователно постоперативни компликации. Псевдотуморите се ретка, но важна компликација која се појавува кај сите типови на импланти кои се користат во артропластиката на колкот.

Клучни зборови: Псевдотумор, тотална артропластика на колк, метал-на-полиетилен

ABSTRACT

Introduction: One of the rare complications of the total hip arthroplasty are pseudotumors. They are defined as granulomatous or destructive cystic lesions with nonneoplastic and noninfective origin. Typically there is latent period of 2 to 15 years from the implantation of the endoprosthesis to the clinical manifestation of the lesion. Most common symptoms are pain, swelling and discomfort but also, loosening of the components of the endoprosthesis or compressive symptomatology can occur. Potential mechanisms of development of pseudotumors are foreign-body reaction, hypersensitivity reaction and excessive wear debris reaction.

Case reports: We report three cases of pseudotumors following metal-on-polyethylene total hip arthroplasty. The first case is 76-year-old woman presented with pain and limited motion of the right hip, 18 years after the hip arthroplasty. The second case is 53-year-old man presented with pain and swelling in the right trochanteric region, 21 years after the hip arthroplasty. The third case is 55-year-old woman presented with painless, large mass in the left proximal thigh, 13 years after the hip arthroplasty. All three patients were treated operatively with extirpation of the pseudotumor.

Discussion: Patients with hip or groin pain, a mass, or a fluid collection following total hip arthroplasty should be carefully evaluated, especially for the presence of infection. Unfamiliarity with pseudotumors may lead clinicians and radiologists to misinterpret these masses as worrisome for malignancy. The management of pseudotumors is controversial since there is no clear consensus for optimal treatment or surveillance.

Conclusion: The recognition of pseudotumor is very important considering the increasing number of surgical procedures and consequential postoperative complications. Pseudotumors are a rare but important complication occurring in hip replacement surgery using all different types of implants.

Key words: Pseudotumor, total hip arthroplasty, metal-on-polyethylene

INTRODUCTION

Total hip arthroplasty revolutionized the treatment of hip osteoarthritis. The advancement in technology of bioengineering, component materials, fixation of both cemented and uncemented endoprosthesis and minimal invasive surgery led to very good long-term results. Not accidentally total hip arthroplasty is considered for the operation of the century.[1] The number of total hip arthroplasties is increasing. Only in USA, 270 000 primary total hip arthroplasties are performed each year. [2,3] With the increasing number of performed interventions the number of postoperative complications is on the rise. One of the rare late postoperative complications is development of pseudotumor around the hip joint. Pseudotumors are defined as granulomatous or destructive cystic lesions with nonneoplastic and noninfective origin, presenting near the components of the endoprosthesis and resemble tumor. They can present as small or large, solid or fluid filled masses with or without communication with hip joint.[4] Usually there is a latent period of 2 to 15 years following the initial total

joint arthroplasty before the pseudotumor becomes clinically or radiologically apparent.[5] Most common symptoms caused by pseudotumors, regardless if it is metal-on-metal or metal-on-polyethylene are pain, swelling and discomfort but also loosening of the components, compressive symptomatology as neuropathy, venous compression, thrombosis or compression of other vital structures can occur.[4,6] Potential mechanisms of development of pseudotumors are foreign-body reaction, hypersensitivity reaction and excessive wear debris reaction. The pathogenesis of pseudotumors developed in total hip arthroplasties with metal-on-polyethylene bearing is considered to be result of the reaction of the macrophages. Polyethylene debris is taken up by macrophage giant cells that release prostaglandin E₂, which resorbs bone, causing the implant to loosen and leading to a vicious cycle of wear and loosening.[5,7,8] The pathogenesis of the pseudotumors developed in total hip arthroplasties with metal-on-metal bearing are explained with the delayed hypersensitivity reaction induced by metal, suggesting that a type-IV immune response plays a role in

Ipseudotumor pathogenesis.[9] The exact incidence and prevalence are not known Tallroth et al. obtained a lesion incidence rate of 4.6% in revision metal-on-polyethylene total hip arthroplasty with a predominance in males.[7] Some of the lesions are asymptomatic.

CASE REPORTS

Case 1

A 76-year-old woman was admitted to our clinic on February 2022 complaining of pain and loss of motion in the right hip. The pain started 2 years ago. 18 years ago she had undergone cemented total hip replacement because of fracture of the right hip using 28 mm metal-on-polyethylene femoral head. On physical examination pain during motion of the hip and shortening relative to the other leg was present. There was no suggestion of any sign of infection on physical examination. Laboratory analysis showed normal red cell counts, electrolytes and c-reactive protein. Plain radiographs showed signs of migration and loosening of the acetabular component of the endoprosthesis (figure 1). Osteolysis was also present. Computed tomographic (CT) scan revealed homogeneous, lobulated, mass surrounding the right acetabulum (figure 2). At the time of revision surgery, loosening and migration of the acetabular component was present and granulomatous tissue around the right acetabulum was encountered. Extripation of the mass was performed and reconstruction of the acetabulum with reconstruction cage was performed. New cemented polyethylene liner was implanted (figure 3). The patient had an uncomplicated postoperative course.



Figure 1: Preoperative plain radiography of the right hip

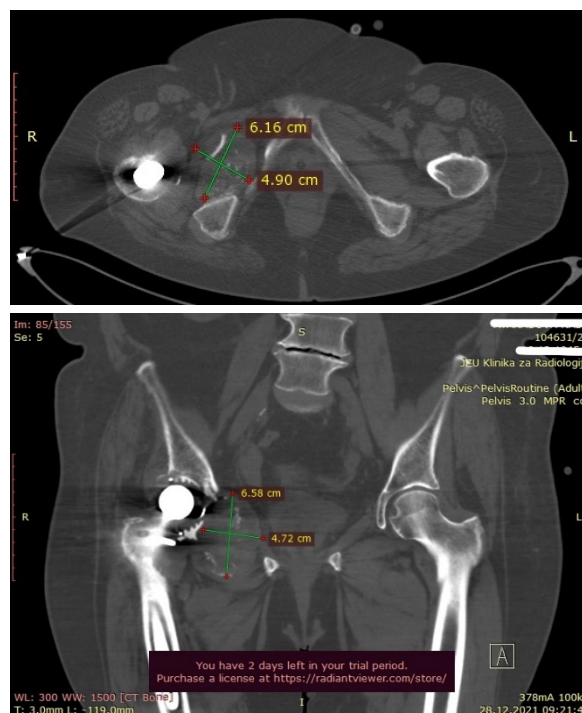


Figure 2: Computed tomography at the level of the lesion



Figure 3: Postoperative plain radiograph

Case 2

A 53-year-old man was admitted to our clinic on May 2021 complaining of pain and swelling of the left hip. He described his pain mild to moderate. 21 years ago he had undergone uncemented left total hip replacement because of osteoarthritis using 28 mm metal-on-polyethylene femoral head. The used liner was ultra high molecular weight polyethylene (UHMWPE). On physical examination, an obvious and tender soft tissue mass surrounding the left hip, the left trochanteric region and extending slightly in the left buttock was present (figure 4). There was no suggestion of any sign of infection on physical examination. The patient had history of kidney transplantation. Laboratory analysis showed normal red cell counts and electrolytes. C-reactive protein was

elevated at 61.04 mg/L (normal value up to 6 mg/L). Serum urea was 10.39 mmol/L (normal 2.7-7.8mmol/L), serum creatinine was 144.74 mmol/L (normal 45-109 mmol/L) and serum uric acid was 591.03 mmol/L (normal 150-450mmol/L). D-dimer was 669.9 ngr/mL (normal 0-500 ngr/mL). Plain radiographs showed no signs of migration or loosening of the components of the endoprosthesis (figure5). Computed tomographic (CT) scan revealed homogeneous, lobulated, fluid filled mass surrounding the left trochanter (figure 6). The measured size of the mass was 14 cm x 9 cm x 7 cm. At the time of revision surgery, thick granulomatous tissue around the left trochanter was encountered with no communication with the hip joint (figure 7). Extripation of the mass was performed and the tissue was sent to histologic examination. Histologic results confirmed the diagnosis of inflammatory pseudotumor. The patient had an uncomplicated postoperative course.



Figure 4: Preoperative site of the lesion

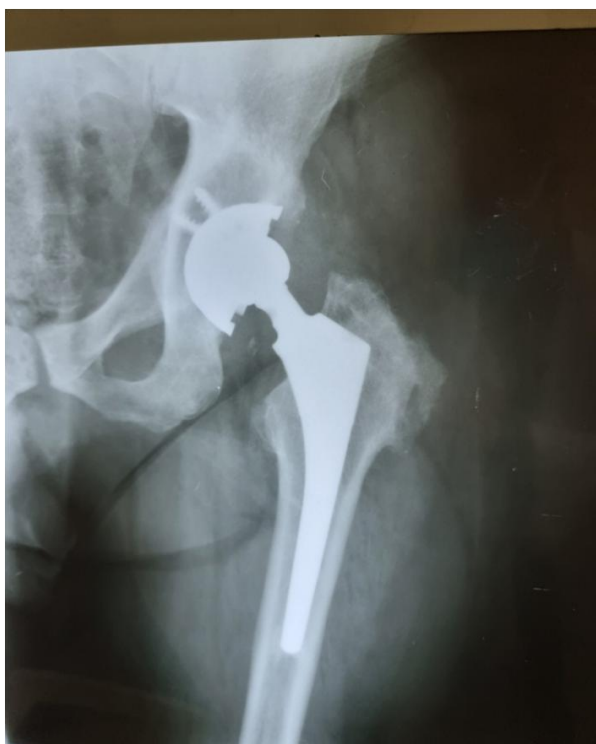


Figure 5: Preoperative plain radiography of the left hip

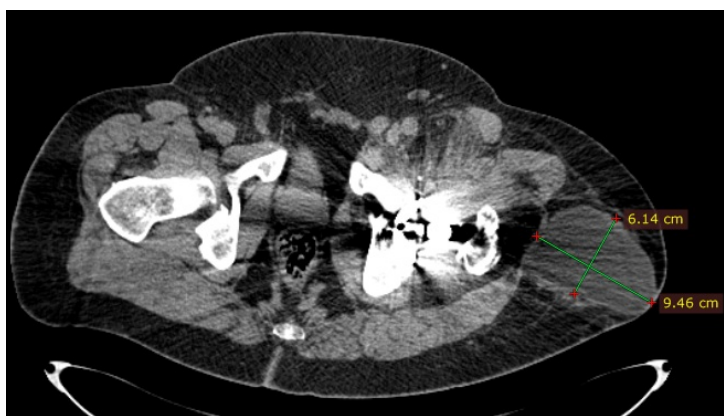


Figure 6: Computed tomography at the level of the lesion



Figure 7: Intraoperative image before extripation of the lesion

Case 3

A 55-year-old women presented in 2019 in our clinic with a painless, large mass expanding the anterior and lateral aspect of the left proximal thigh. 13 years ago she had undergone left total hip arthroplasty because of osteoarthritis using 28 mm metal-on-polyethylene femoral head. The used liner was standard high density polyethylene. She had no history of wound problems, local warmth, fever or other symptoms possibly suggesting infection. Past medical history was essentially unremarkable. The physical examination at the time of admission showed painless, firm tissue mass filling the

anterior and lateral aspect of the proximal thigh. Plain radiographs showed no signs of migration or loosening of the components of the endoprosthesis. The computed tomography revealed massive homogeneous lobulated soft tissue mass expanding around the anterior and lateral region of the proximal femur and hip joint. At the time of revision surgery, the thick granulomatous tissue connected with the hip joint was encountered (figure 8). Extripation of the mass was performed and the tissue was sent to histologic examination. Histologic results confirmed the diagnosis of pseudotumor. The patient had an uncomplicated postoperative course.

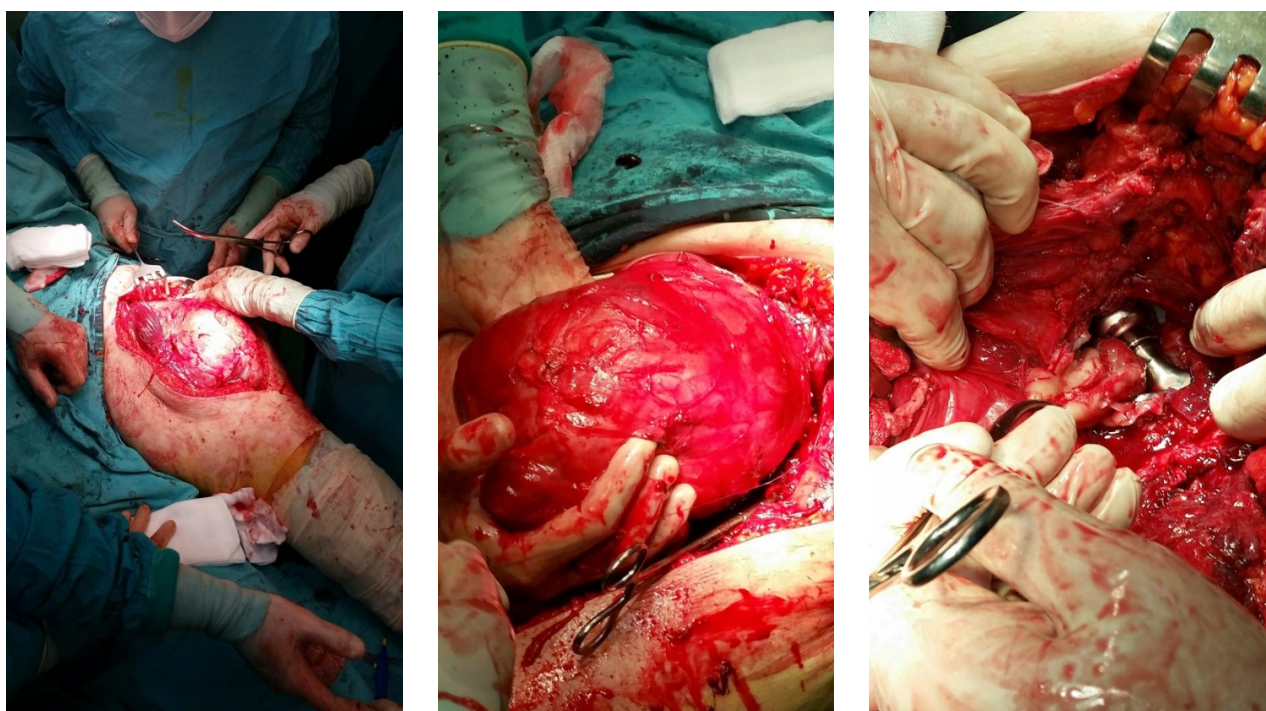


Figure 8" Intraoperative images before and after the extripation of the lesion

DISCUSSION

Pseudotumors are relatively rare complication following total hip arthroplasty. The clinical appearance may vary from asymptomatic to massive soft tissue masses accompanied with osteolysis and aseptic loosening of the endoprosthesis which requires revision.[10] Patients with constant hip or groin pain, a mass, or a fluid collection following total hip arthroplasty should be carefully evaluated, especially for the presence of infection. The histological characteristics of an infection are distinctly different from those of an adverse immune reaction or an inflammatory foreign-body response. Up to now, there is no reliable blood or other screening test that offers a high predictive value for subsequent pseudotumor development.[11] Radiographic investigations are

significant in visualizing pseudotumor size, location, communication with the joint and assessment of the stability of the implant. Plain radiographs have low sensitivity in detection of the pseudotumors compared to magnetic resonance imaging (MRI) which provides excellent evaluation of the periarticular soft tissues.[12] Anatomical classification system has been developed based on MRI findings on pseudotumors, consisted of three groups. Type I are thin-walled cystic masses (cyst wall <3 mm), Type II are thick-walled cystic masses (cyst wall >3 mm, but less than the diameter of the cystic component), and Type III are predominantly solid masses. [13] Computed tomography (CT) has advantages in visualizing bones, implants, bone cement as well as presence of heterotopic ossification, osteolysis, periprosthetic fracture and metallosis.[14] All types of

total hip arthroplasty (metal-on-metal, metal-on-polyethylene, ceramic-on-polyethylene) are associated with development of pseudotumors.[15,16,17,18] Pseudotumor formation has been even reported after unipolar hemiarthroplasty [19] The etiopathogenesis of the pseudotumors is not confirmed entirely but there are factors that are associated with their development. Those are excessive wear debris, foreign-body reaction and metal hypersensitivity.[4] Wear debris is significant cause for development of pseudotumors. Wear debris is generated by mechanical wear, surface corrosion or combination of both and consists of both particulate and soluble form. Metal-on-metal articulations generate approximately 6.7×10^{12} to 2.5×10^{14} particles every year, which is 13,500 times the number of polyethylene particles produced from a typical metal-on-polyethylene bearing. Despite this finding, the actual volumetric wear of a metal-on-metal articulation is lower because of the very small size of the particles (generally <50 nm) compared with polyethylene particles, which are rarely <0.1 μm . [20] Howie et al. explored bursal masses and identified excessive wear of the polyethylene component as the cause of the masses. [21] Santavirta et al. and Austin and Stoney recognized excessive polyethylene debris as the primary factor in the causation of granulomatous reactions.[8,22,23] Willert et al. Also found that polyethylene wear products alone can cause massive osteolysis by triggering foreign-body granuloma formation at the bone-cement interface.[24] Pseudotumors may be caused by a foreign-body reaction to methylmethacrylate, polyethylene, or metal adjacent to a total joint implant. Polyethylene debris is taken up by macrophage giant cells that release prostaglandin E₂, which resorbs bone, causing the implant to loosen and leading to a vicious cycle of wear and loosening.[4,5] Metal hypersensitivity reaction has been identified as one potential cause of pseudotumor development. There is an ongoing debate on whether the immune-mediated response is an adaptive response to excessive debris from high wear and is dose-dependent, or whether it is an innate hypersensitivity response, which is independent of dosage and is initiated at low levels of wear.[4] Histological analysis of the tissue specimens in the study by Willert et al. revealed an active cellular reaction with diffuse and perivascular infiltrates of lymphocytes and plasma cells, increased endothelial venules, fibrin exudation, accumulation of macrophages with drop-like inclusions, and infiltrates of eosinophilic granulocytes and necrosis. These histological findings were described as aseptic lymphocyte-dominated vasculitis associated lesion (ALVAL).[25] The absence of a metal-on-metal

bearing does not preclude the formation of a pseudotumor in the hip. Additional sites of metal-on-metal contact for hip prostheses are the head-neck taper junction and neck-stem junction of the femoral component of hip prostheses.[26] Pseudotumors may represent differential diagnostic dilemma. They must be differentiated from malignant, benign and tumor-like lesions of bones and soft tissues. Despite the fact that periprosthetic primary malignant tumors are rare in the setting of hip arthroplasty, with an estimated incidence of 1.43/100,000, unfamiliarity with pseudotumors may lead radiologists and clinicians to misinterpret these masses as worrisome for malignancy. This situation not uncommonly leads clinicians to request biopsy. However, biopsy is not without risk, since pathologists unfamiliar with pseudotumors may be confused by the histology or may misinterpret tissue specimens as suspicious for malignancy.[27,28] Seroma and hematoma are differentiated from a pseudotumor by their development in the immediate postoperative period and subsequent resolution over time.[29] Soft tissue abscess is an additional periarticular mass which must be distinguished from pseudotumor. Local or systemic symptoms and signs related to pain, erythema, fever, malaise, and palpable mass prompt a clinical work up to rule out this diagnosis.[30] The management of pseudotumors is controversial since there is no clear consensus for optimal treatment or surveillance.[12] Treatment for pseudotumors in patients with metal-on-polyethylene implants varies. Pseudotumors in patients with a cemented total hip replacement can be satisfactorily treated with a cementless revision prosthesis combined with cancellous bone-grafting.[31,32] Surgeons can proceed to revision arthroplasty using techniques appropriate for aseptic loosening.[21] If there is no loosening of the components only extirpation of the lesion is performed.

CONCLUSION

The recognition of pseudotumor is very important considering the increasing number of surgical procedures and consequential postoperative complications. Pseudotumors are a rare but important complication occurring with all types of hip replacements. Potential causes of pseudotumors may include foreign-body reaction, hypersensitivity, and wear debris. There is no

clear consensus for optimal treatment, it may depend on the extent of lesion or the loosening of the endoprosthesis.

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