BRIEF REPORT

Treatment for Periprosthetic Cyst after Total Hip Arthroplasty: Analysis of Six Cases

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The present study investigates the pathogenesis of periprosthetic cysts after total hip replacement, and explores appropriate treatment approaches. Six patients with periprosthetic cysts after total hip arthroplasty were treated at the First Affiliated Hospital of Nanjing Medical University between 2009 and 2014. During surgery, it was found that all cysts communicated with the hip and the hip prosthesis could be seen after cyst excision. Four patients simply underwent cyst excision, and light red liquid was found in the cyst. Among them, radiological examination revealed that a part of the hip prosthesis projected from the bone bed in one case. Postoperative pathology revealed a synovial cyst with inflammatory cell infiltration. Prostheses were loosened in two cases, so cystectomy and revision of the prosthesis were performed at the same time. Among the six patients, polyethylene wear particles could be seen in five patients through a pathological polarizing microscope. Out of the four patients who underwent simple cyst excision, two patients experienced cyst recurrence within 1 year after surgery; however, there was no cyst recurrence in the two patients who underwent cyst excision and revision of the prosthesis. The formation of a periprosthetic cyst after hip replacement is likely to be related to polyethylene wear and undesirable prosthesis position; in addition, when treated by simple cyst excision, the rate of recurrence was higher.

Key words: Cystectomy; Periprosthetic cyst; Total hip arthroplasty

Introduction

It is uncommon for total hip arthroplasty to be complicated by a periprosthetic cyst, and only some case reports exist at present. In previous reports the authors believed that the formation of the cyst was likely to be related to wear particles and prosthesis friction. If prosthesis position is undesirable or a prosthesis is too large after hip replacement, hydrops articuli could be caused by the friction between the prosthesis projecting from the bony acetabulum and the articular peripheral soft tissues, especially the iliopsoas, while an inflammatory reaction in the joint resulting from polyethylene wear particles liberated through joint friction could increase hydrops articuli, which, as a result of increased intra-articular pressure, then projects to weak areas to form a cyst. Howell reports on a case of a 77-year-old woman patient with a pelvic cyst, where radiography showed that the cyst was caused by the screw used for fixing the cup which had penetrated the pelvic quadrilateral plate¹. Thienpont *et al.* found that polyethylene particles stimulated formation of a pelvic cyst, while revision of the prosthesis was necessary due to loosening².

It is difficult to systematically summarize the causes and treatments of cysts based only on case reports. Six patients with a periprosthetic cyst after hip replacement were treated in our hospital between 2009 and 2014. Here, we have summarized their causes and treatment to help shed light on the ideal treatment for periprosthetic cysts.

Case Reports

Patient 1

Left total hip arthroplasty was performed in December 2000 on a 59-year-old woman because of a left femoral neck fracture (Garden's IV). The prosthesis was the Aesculap Hip System (Tuttlingen, Germany). The patient reported good recovery of joint function after the operation, but experienced slight pain in the inguinal region when she bent her body at the hips, which did not influence her daily life. The patient underwent cyst excision twice due to development of a left ovarian cyst, first in 1985 and again in 1993. The pain originated from her left lower abdomen without apparent cause in April 2009, and then radiated to

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the inguinal region. Upon type-B ultrasonic examination, a cystic mass could be seen in the left pelvic cavity (8 cm × 7 cm × 4 cm), which was diagnosed as recurrence of a left ovarian cyst. This was treated in the department of gynecology at our hospital. On 30 April 2009, the patient underwent exploratory laparotomy under general anesthesia via a median incision in the lower abdomen. During the operation, a cyst with dimensions of 7 cm × 6 cm × 4 cm was found adhering to the left pelvic wall, extending from the deep layer of the iliopsoas and the back of the inguinal ligament to the left hip joint. The cyst could not be removed completely via a lower abdomen median incision, so after consultation, the orthopedic surgeon removed the cyst completely via an ilioinguinal incision, and found that the cyst communicated with the hip joint capsule. The hip prosthesis could be seen after the cyst was removed. In May 2010, the cyst recurred, and was excised again. It was found that the cyst had a complete capsule, containing old bloody fluid. Pathological examination indicated that a synovial cyst surrounded the hip prosthesis, and that the cyst wall consisted of a fibrous connective tissue structure which was lined with a layer of synovial cells. A small number of polyethylene wear particles were observed through a polarizing microscope (Fig. 1).

Patient 2

A 64-year-old woman had undergone left biological hip replacement (unknown type) in 2005 because of left femoral head necrosis. Joint function recovered well after the operation; however, in February 2014, a mass was found in the left inguinal region accompanied by local pain. The patient was admitted to the department of general surgery at the First Affiliated Hospital of Nanjing Medical University. Type B ultrasonic examination showed the presence of a cystic mass (9 cm × 6 cm × 3 cm) in the left inguinal region, which pressed on the left femoral vein. On 2 May 2014, the patient was treated by cystectomy under general anesthesia, during which a mass was found under the inguinal ligament, extending to the hip joint. Part of the cyst was removed and the hip prosthesis was seen. The cyst contained light red bloody hydatid fluid. Pathologic diagnosis showed a left groin synovial cyst with inflammatory cell infiltration. No polyethylene wear particles could be observed through a polarizing microscope. A local recurrence of the cyst appeared 6 months after surgery. X-ray examination showed that the hip prosthesis was too large, and part of the prosthesis protruded from the bony acetabulum (Fig. 2).

Patient 3

Left hip replacement (unknown type) was performed on a 63-year-old woman in 2003 because of left caput femoris necrosis. Joint function recovered well after the operation. Left lower abdominal pain developed in 2008, and no effect of symptomatic treatment was apparent. Outpatient examination in the bone tumor department revealed the presence of a cyst in the left pelvic cavity. Type B

ultrasonic examination, computed tomography, and magnetic resonance imaging also showed a cyst in the left pelvic cavity with dimensions of 8 cm × 5 cm × 3 cm. It was not known that the cyst was related to the joint prosthesis before the operation, so a simple cystectomy was performed, during which a cystic mass was seen, located in the deep layer of the iliopsoas, communicating with the hip joint capsule and containing light red bloody fluid. After surgery, pathologic diagnosis revealed a left pelvic cavity periprosthetic synovial cyst. Polyethylene wear particles could be observed through a polarizing microscope. X-ray examination indicated eccentric wear of the polyethylene inner lining of the acetabulum without apparent acetabulum prosthesis loosening (Fig. 3).

Patient 4

A 78-year-old man underwent right total hip arthroplasty (Ribbed, Link, Germany) in 2009 because of a right femoral neck fracture. Joint function recovered acceptably after the operation. In 2013, a mass was found in the right groin and was growing gradually. Type-B ultrasonic and CT scans showed a cyst in the right groin and iliac fossa with dimensions of 8 cm × 5 cm × 4 cm. X-ray examination indicated that the prosthesis was well positioned without obvious wear of the polyethylene inner lining. Cystectomy was carried out under general anesthesia on 2 November 2014, because there was no loosening of the prosthesis, and the hip joint functioned well. It was seen that the cyst clung to the surface of the iliopsoas. The prosthesis was exposed after the cyst was removed, which contained light red fluid. After the operation, pathologic diagnosis showed a hip joint synovial cyst with foreign macrophages. Polyethylene wear particles could be observed through a polarizing microscope (Fig. 4).

Patient 5

A 62-year-old woman underwent left hip replacement in 2001 because of left hip joint dysplasia. The prosthesis was the XRBEST type, made in Suzhou, Jiangsu, China, and joint function recovered well after the operation. In 2011, left hip joint pain gradually appeared. In March 2014, a mass was found in the groin with right lower extremity edema. Type-B ultrasonic and CT examination showed a cyst in the left groin and iliac fossa with dimensions of 9 cm × 7 cm × 5 cm. Lower extremity venous ultrasound revealed deep venous thrombosis in the patient's left calf. X-ray examination showed wear of the polyethylene inner lining in the acetabulum with prosthesis loosening. Cystectomy and revision of the prosthesis were performed after an inferior vena cava filter was fitted in the department of vascular surgery. During surgery, the cyst was seen to communicate with the acetabulum prosthesis, and was found to contain a large amount of necrotic granulation tissue and a little viscous yellow fluid. Pathologic diagnosis showed a hip periprosthetic synovial cyst and many proliferating macrophages. A large number of polyethylene particles could also be observed through a polarizing microscope.

Fig. 1 Female, 59 years old. Left total hip arthroplasty was performed in December 2000 because of left femoral neck fracture. The patient underwent cyst excision twice due to development of a left ovarian cyst, first in 1985 and again in 1993. The pain originated from her left lower abdomen without apparent cause in April 2009, and then radiated to the inguinal region. (A) Cyst in left pelvic cavity detected by type-B ultrasonic examination. (B) X-ray indicated eccentric wear of the polyethylene inner. (C–E) Cyst with dimensions of 7 cm × 6 cm × 4 cm was found adhering to left pelvic wall, extending from the deep layer of the iliopsoas and the back of the inguinal ligament to the left hip joint. (F) Pathological examination indicated that a synovial cyst surrounded the hip prosthesis, and that the cyst wall consisted of a fibrous connective tissue structure that was lined with a layer of synovial cells (HE staining ×200). (G) Polyethylene wear particles could be observed through a polarizing microscope.

Fig. 2 Female, 64 years old, who underwent left biological hip replacement in 2005 because of left caput femoris necrosis. Joint function recovered well after the operation; however in February 2014, a mass was found in the left inguinal region accompanied by local pain. (A) Type-B ultrasonographic examination showed the presence of a cystic mass in the left inguinal region, which pressed on the left femoral vein. (B) X-ray showed that the hip prosthesis was so large that a part of the prosthesis protruded from the bony acetabulum. (C) Pathologic diagnosis showed a left groin synovial cyst with inflammatory cell infiltration (HE staining $\times 100$).

Fig. 3 Female, 63 years old. Left hip replacement was performed in 2003 because of left caput femoris necrosis. Left lower abdominal pain developed in 2008, and no effect of symptomatic treatment was apparent. Outpatient examination in the bone tumor department revealed the presence of a cyst in the left pelvic cavity. (A) X-ray examination indicated eccentric wear of the polyethylene inner lining of the acetabulum without apparent acetabulum prosthesis loosening. (B, C) Computed tomography and magnetic resonance imaging showed a cyst in the left pelvic cavity. (D) Pathologic diagnosis revealed a periprosthetic synovial cyst (HE staining $\times 200$). (E) Polyethylene wear particles could be observed through a polarizing microscope.

Fig. 4 Male, 78 years old, who underwent right total hip arthroplasty in 2009 because of right femoral neck fracture. In 2013, a mass was found in the right groin which grew gradually. (A) X-ray examination indicated that the prosthesis was well positioned without obvious wear of the polyethylene inner lining. (B) Computed tomography scans showed a cyst in the right groin and iliac fossa. (C–E) Cyst clung to the surface of the iliopsoas. The prosthesis was exposed after the cyst was removed, which contained light red fluid. (F) Pathologic diagnosis showed a hip joint synovial cyst with foreign macrophages (HE staining $\times 400$). (G) Polyethylene wear particles could be observed through a polarizing microscope.

After the operation, X-ray examination showed that the prosthesis was fixed well and in good condition (Fig. 5).

Patient 6

Left hip replacement was performed on a 79-year-old man in 2001 because of a femoral neck fracture, and intermittent pain had been experienced for 2 years from 2012. He was

admitted to hospital and physical examination showed a cyst in the left groin with dimensions of 5 cm $\times$ 10 cm and no obvious edema in the lower extremities. Before surgery, radiological examination indicated that the left acetabulum prosthesis had become loosened, with an acetabular fixing screw projecting into the pelvic cavity, in which a cystic mass developed without damaging the internal iliac artery. In

Fig. 5 Female, 62 years old, who underwent left hip replacement in 2001 because of left hip joint dysplasia. In 2011, left hip joint pain appeared gradually. In March 2014, a mass was found in the groin with right lower extremity edema. (A) X-ray examination showed wear of the polyethylene inner lining in the acetabulum with prosthesis loosening. (B) Computed tomography examination showed a cyst in the left groin and iliac fossa. (C) The cyst contained lots of granulation necrotic tissue and some viscous yellow fluid. (D) X-ray examination showed that the prosthesis was fixed well and in good condition after hip revision. (E) Pathologic diagnosis showed a hip periprosthetic synovial cyst and many proliferating macrophages (HE staining $\times 400$). (F) A large number of polyethylene particles could be observed through a polarizing microscope.

November 2014, hip replacement was performed to remove the acetabulum prosthesis, with findings of a bony defect in the acetabular floor, communicating with the pelvic cavity, and a large quantity of osteolytic necrotic tissue extending from it. Bone cement was used for a bone graft in the acetabular floor. Pathologic diagnosis showed a hip periprosthetic synovial cyst. A large number of polyethylene particles could also be observed through a polarizing microscope (Fig. 6).

Discussion

Hip joint synovial cysts are clinically uncommon, but periprosthetic cysts after total hip arthroplasty are far more uncommon, and few case reports exist. Some periprosthetic cysts are related to the iliopsoas bursa, which is anterior to the hip joint with a size of 6 cm $\times$ 3 cm. Under normal conditions, 15% of the iliopsoas bursae communicate with the hip joint capsule. As for combined osteoarthritis, the incidence of the iliopsoas bursa communicating with the joint capsule is 40%. Bursae extend to the anterior or

posterior hip joint when enlarging, and a minority of bursae stretch into the pelvic cavity along the iliopsoas through the posterior inguinal ligament and compress the corresponding structures, giving rise to different clinical symptoms, including groin pain, radiating pain in the lower extremity, edema of the lower extremity, and even venous thrombosis of the lower extremity³.

It was previously reported that the causes of periprosthetic cysts were various, and the corresponding pressure symptoms were caused by the different sites of the cyst. Bystrom *et al.* reported that a cyst in the femoral triangle compressed the femoral vessels, which can result in cold feet for patients, and the symptoms disappeared after cyst drainage⁴. Matsumoto *et al.* report on a case in which an iliopsoas bursa communicating with the articular cavity enlarged and extended into the pelvic cavity to form a mass in the ileocecal region as a result of polyethylene wear and increased synovial fluid secretion 20 years after total hip arthroplasty⁵. DeFrang *et al.* report on a case in which polyethylene wear

Fig. 6 Male, 79 years old. Left hip replacement was performed in 2001 because of femoral neck fracture, and intermittent pain was experienced for 2 years from 2012. He was admitted to hospital and physical examination showed a cyst in the left groin with dimensions of 5 cm × 10 cm and no obvious edema in the lower extremities. (A) Radiological examination indicated that the left acetabulum prosthesis had become loosened, with an acetabular fixing screw projecting into the pelvic cavity. (B) Bony defect was found in the acetabular floor, communicating with the pelvic cavity, and a large quantity of osteolytic necrotic tissue extending from it. (C) X-ray showed the prosthesis after revision. (D) Pathologic diagnosis showed a hip periprosthetic synovial cyst (HE staining ×400). (E) A large number of polyethylene particles could be observed through a polarizing microscope.

caused an iliopsoas bursa to enlarge to form an inguinal cyst, which compressed the femoral vein, resulting in edema of the lower extremity and pain in the hip 3 years after total hip arthroplasty⁶. Nehme *et al.* report on a case of an inguinal synovial cyst that compressed the femoral vein, resulting in edema of the lower extremity 3 years after total hip arthroplasty⁷. The authors found that the outer and upper metallic acetabular edge sprayed with hydroxyapatite projected from the bone bed, and hydroxyapatite particles detached, leading to three-body abrasion and causing the synovial cyst.

The fact that in six cases cysts formed after hip replacement, and that the joint prosthesis could be seen after cyst excision, showed that the cysts originated from the hip joints. This means that cysts in our patients were different from the enlargement of iliopsoas bursa. No polyethylene particles could be observed through a polarizing microscope in one case after surgery, but the patient's metallic hip

prostheses were larger, partly projecting from the bony acetabula and creating friction around the peripheral soft tissues, which could explain the dull pain reported in the patient's inguinal regions during hip flexion and extension. Polyethylene particles could be observed through a polarizing microscope in the remaining five cases after surgery, among which two cases clearly displayed eccentric polyethylene wear before surgery, proving that formation of the cysts was related to the inflammatory reaction caused by polyethylene wear particles.

Currently, opinion differs over the optimal treatment for periprosthetic cysts, with the options including cystectomy, cyst paracentesis, and cystectomy with revision of prosthesis^{8–13}. Among our six patients, three were treated in other departments first, and because they did not follow standardized recommendations for the treatment of periprosthetic cysts, the treatments in these cases were not the same. Among the four patients who underwent simple cyst

excision, two cases showed eccentric wear of the polyethylene inner lining before surgery, indicated through X-ray, and one case was treated by simple cyst excision because of the unclear relationship between the cyst and prosthesis replacement before surgery. In this case the 78-year-old male patient refused revision of the prosthesis and only underwent cyst excision, as the joint functioned well ordinarily without obvious pain or apparent wear of the polyethylene inner lining. However, among these four cases, the cyst recurred in two, because the disease was not eliminated by simple cyst excision. Morrison *et al.* report on a similar case to ours in which simple cyst drainage was not able to cure the disease. After revision of the prosthesis, the patient was followed up for 1 year and the cyst did not relapse¹⁴. In a patient with an unusual presentation of a pelvic mass 20 years after he underwent total arthroplasty of his left hip, ultrasound-guided fine-needle aspiration and drainage of the cyst were performed; the abdominal mass subsequently reaccumulated.

Then, revision total hip arthroplasty was performed. At his last follow-up examination 12 months after hip revision, the pelvic mass was no longer present¹⁵. The curative effects of cyst excision together with revision of the prosthesis are evident in patients whose prostheses are obviously loosened.

Thus, in our opinion, the formation of a periprosthetic cyst after total hip replacement is mainly related to the presence of polyethylene wear particles. As regards the best treatment for a periprosthetic cyst, it is workable to combine revision of the prosthesis with concurrent cystectomy if the prosthesis becomes loose, otherwise cyst excision together with renewal of the polyethylene inner lining are suggested.

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References

1. Howell GE. Pelvic synovial cyst formation secondary to perforation of the quadrilateral plate: a case report. *J R Nav Med Serv*, 1999, 85: 172–173.
2. Thienpont E, Vernaev H. Reactive pelvic cyst following total hip arthroplasty. A case report. *Acta Orthop Belg*, 2003, 69: 292–294.
3. Yang SS, Bronson MJ. Cystic enlargement of the iliopsoas bursa causing venous obstruction as a complication of total hip arthroplasty. A case report. *J Arthroplasty*, 1993, 8: 657–661.
4. Bystrom S, Adalberth G, Milbrink J. Giant synovial cyst of the hip: an unusual presentation with compression of the femoral vessels. *Can J Surg*, 1995, 38: 368–370.
5. Matsumoto K, Hukuda S, Nishioka J, Fujita T. Iliopsoas bursal distension caused by acetabular loosening after total hip arthroplasty. A rare complication of total hip arthroplasty. *Clin Orthop Relat Res*, 1992, 279: 144–148.
6. DeFrang RD, Guyer WD, Porter JM, Duwelius PJ. Synovial cyst formation complicating total hip arthroplasty: a case report. *Clin Orthop Relat Res*, 1996, 325: 163–167.
7. Nehme A, Oakes DA, Marcheix B, Gomez-Bouchet A, Puget J. Compressive intrapelvic synovial cysts: an early complication of an HA-coated cup. *Clin Orthop Relat Res*, 2005, 430: 232–236.
8. Leigh W, O'Grady P, Lawson EM, Hung NA, Theis JC, Matheson J. Pelvic pseudotumor: an unusual presentation of an extra-articular granuloma in a well-fixed total hip arthroplasty. *J Arthroplasty*, 2008, 23: 934–938.
9. Nazarian DG, Zeni JJ. Management of a pelvic mass following a worn uncemented total hip arthroplasty. *J Arthroplasty*, 2012, 27: 317–323.
10. Walsh AJ, Nikolaou VS, Antoniou J. Inflammatory pseudotumor complicating metal-on-highly cross-linked polyethylene total hip arthroplasty. *J Arthroplasty*, 2012, 27: 324–325.
11. Van Mourik JB, Josaputra HA, Axler A. Giant synovial cyst causing deep venous thrombosis: brief report. *J Bone Joint Surg Br*, 1988, 70: 841.
12. Mert M, Ozturkmen Y, Unkar EA, Erdogan S, Uzumcugil O. Sciatic nerve compression by an extrapelvic cyst secondary to wear debris after a cementless total hip arthroplasty: a case report and literature review. *Int J Surg Case Rep*, 2013, 4: 805–808.
13. Mao X, Tay GH, Godbolt DB, Crawford RW. Pseudotumor in a well-fixed metal-on-polyethylene uncemented hip arthroplasty. *J Arthroplasty*, 2012, 27: 413–493.
14. Morrison KM, Apeltgren KN, Mahany BD. Back pain, femoral vein thrombosis, and an iliopsoas cyst: unusual presentation of a loose total hip arthroplasty. *Orthopedics*, 1997, 20: 347–348.
15. Lin KH, Lo NN. Failure of polyethylene in total hip arthroplasty presenting as a pelvic mass. *J Arthroplasty*, 2009, 24: 1113–1144.