Case Report

Femoral Neuropathy Secondary to Total Hip Arthroplasty Wear Debris

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Abstract Femoral nerve palsy after THA is well known, but delayed palsy is rare. We describe a 58-year-old man who had progressive thigh pain, weakness, and numbness develop 13 years after cementless arthroplasty of his left hip. Plain radiographs showed substantial liner wear. MRI of the lumbar spine was unrevealing and EMG showed a peripheral neurogenic process involving the left femoral nerve. The large intrapelvic cystic mass was confirmed by an abdominopelvic CT scan. Percutaneous aspiration of the cyst was performed. Cultures of the fluid were negative and cytopathologic examination showed necrotic debris without malignant cells. Biopsy revealed necrosis and abundant foreign body granulation tissue with polarizable debris. During surgical removal of the cyst, a defect of the inner acetabular wall was noted. After subsequent revision

arthroplasty with allograft bone, the patient's clinical symptoms improved and his EMG returned to normal.

Introduction

Most cases of femoral nerve palsy complicating THA occur intraoperatively [19]. The literature contains a few reports of wear debris from THA producing a clinically detectable mass effect that can provoke delayed nerve palsy [5, 10, 11, 13, 17]. Harvie et al. recently reported two cases of femoral neuropathy attributable to pseudo-tumor masses caused by metal-on-metal resurfacing arthroplasty [7].

We present a case in which a mass containing wear debris originating from a failed fully-modular cementless THA with a polyethylene liner and metal head produced intrapelvic compression of the femoral nerve.

Case Report

A 58-year-old male farmer presented 13 years after THA for osteoarthritis of his left hip. An uncemented titanium alloy acetabular shell (RCM; Cremascoli Ortho, Milan, Italy) and uncemented fully modular titanium alloy stem (GSP, Cremascoli Ortho) with a 32-mm stainless steel head had been implanted, and the defect in the lateral acetabular margin also was grafted with a structured autologous bone graft. The patient did well for approximately 9 years but then had pain develop in the left groin and thigh. During the ensuing 4 years, he had worsening pain with radiation to the knee and below. He noted loss of strength in his left thigh. On physical examination, the patient had diminished

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Each author certifies that his or her institution approved the reporting of this case report, that all investigations were conducted in conformity with ethical principles of research.

This work was performed at Celje General Hospital, Celje, Slovenia.

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quadriceps motor function, hypoesthesia in the anteromedial aspect of his thigh, and absent patellar reflex on the left side. A plain film of the left hip (Fig. 1) showed the eccentric location of the femoral head in the shell consistent with liner wear. MRI of the lumbosacral spine was interpreted as normal. An EMG showed a lesion of the left lumbosacral plexus with denervation predominantly of muscles innervated by the femoral nerve. An abdominopelvic CT scan showed a large intrapelvic cyst measuring 13 cm in diameter (Fig. 2). Percutaneous aspiration of the fluid was performed under ultrasound guidance. Eighty milliliters of thick, grayish-green fluid was removed. Cultures of the fluid were negative. Cytopathologic examination showed necrotic debris without malignant cells. Also, the aspirate contained scarce polarizable particles and the findings were consistent with a large cyst resulting from THA wear debris. The patient's general health and activity level were otherwise excellent. Revision of the worn components was indicated.

A two-stage procedure was planned. The cyst was approached by a lower middle laparotomy. During surgical removal, a defect was observed on the medial acetabular wall measuring 2×1 cm, showing the acetabular component. The hip was approached 4 weeks later through a direct lateral incision. On incising the pseudocapsule, we observed large thick black masses around the neck of the prosthesis. The polyethylene liner was fractured, and the

articular surface of the titanium alloy socket was burnished (Fig. 3). The components remained securely fixed. After removal of the acetabular component, osteolytic defects were filled with massive morselized allograft bone. We exchanged the modular neck and modular head but did not remove the femoral stem. The acetabular shell was replaced with an uncemented hemispheric acetabular component additionally fixed with screws. Histologic analysis of the resected tissue revealed foreign-body giant cells in the hyperplastic synovial lining. Abundant titanium deposits and polarizing polyethylene particles were observed which was in agreement with cytologic findings in the aspirate. Intraoperative cultures were negative. A week after surgery, the patient received pamidronate 30 mg (Aredia®; Novartis Pharma AG, Basel, Switzerland) intravenously to prevent allograft resorption.

Fig. 1 An anteroposterior radiograph taken 13 years after the index procedure shows eccentric wear of the acetabular liner and osteolytic lesions of the pelvis.

Fig. 2 A CT scan of the pelvis shows a left iliac cyst.

Fig. 3 A photograph shows the acetabular components retrieved at revision surgery.

The pain from femoral nerve irritation improved postoperatively, and the patient was weaned from walking assists at 12 weeks. On followup at 6 months, the symptoms of femoral nerve compression had almost completely resolved. The patient had regained full quadriceps motor power, had 95° active hip flexion, ambulated independently without pain, and had only a minor residual sensory loss. Followup EMG 10 months postoperatively showed neurophysiologic improvement without any substantial denervation. No fluid collection was seen with ultrasound examination of the pelvis and the prosthesis remained securely stable on radiographs at the 12-month followup.

Discussion

The incidence of acute nerve palsy after THA reportedly ranges from 0.6% to 3.7% [16]. The sciatic nerve or peroneal division of the sciatic nerve is involved in greater than 80% of these injuries, and the reported incidence of femoral nerve palsy ranges from 0.1% to 0.4%. The proposed causes for neuropathy after THA include direct trauma, excessive tension attributable to lengthening of the extremity, ischemia, intraneural hemorrhage, extrusion of methylmethacrylate or the heat of its polymerization, constriction by a trochanteric wire, dislocation of the femoral component, and compression by a hematoma; however, in most patients the actual cause has not been determined [9].

Delayed onset of nerve palsy after THA is rare (Table 1). Documented cases for late sciatic nerve palsy also have included entrapment of methylmethacrylate fragments, migrating trochanteric wires, dislocation of the hip, hemorrhage, migration of the acetabular cup, and wear debris containing a mass [1, 3, 5]. Among 50 cases in a meta-analysis of the English literature regarding intrapelvic complications after THA failure, Bach et al. [2] identified only three cases of sciatic nerve injury [5, 18] and two cases involving intrapelvic mass formation [10, 13].

However, intrapelvic vessel, urogenital tract, and intestinal tract complications were more common [2]. In a thorough recent report, Hananouchi et al. [6] described a huge pelvic mass causing severe ureteral obstruction and found 18 additional cases of pelvic masses caused by particle debris after THA. No other intrapelvic complications were noted in our patient except the femoral nerve palsy attributable to large particulate debris containing a pelvic mass.

Regarding wear debris masses and back pain, we are aware of only one previous report additionally describing femoral vein thrombosis [14]. In that case, distention of the iliopsoas bursa attributable to loosening of a cemented THA resulted in dissection along the iliac muscle and progressive enlargement of a retroperitoneal iliac cyst. The fluid in the cyst was under sufficient pressure to result in compression of the common femoral vein with secondary thrombosis. In addition to mentioning flank pain on the involved side, the authors gave no description of any neural compromise. However, iliopsoas bursal enlargement resulting in femoral nerve compression has been reported in other disorders of the hip [12].

Titanium alloy particles have been reported to cause a particularly aggressive response [8]. Also, the rate of polyethylene wear may be affected by the design of the locking mechanism of the polyethylene liner in the acetabular shell and conformity of the nonarticulating mating surfaces [15]. The RCM shell was designed with multiple holes, creating a considerable amount of “unsupported polyethylene.” Suboptimal locking mechanisms may hold the polyethylene liner proud, prohibiting intimate contact with the shell and increasing the amount of unsupported polyethylene [15]. Micromotion at the nonarticular interface also has been documented to generate wear debris that may be retained in unfilled holes, causing periacetabular osteolysis [4]. Although the primary cause of failure of this THA is not clear, it is likely that the size and wear characteristics of the polyethylene and titanium alloy socket, nonarticular wear at the metal-polyethylene interface in the acetabular component, and the high demands in this active, relatively young patient were contributing factors.

Table 1. Delayed onset of nerve palsy after THA

Study	Type of THA	Nerve involved	Duration from primary operation to diagnosis (years)	Outcome time (months)
Fischer et al. [5]	Hybrid	Sciatic	7	8
Stiehl and Stewart [18]	Cemented with pelvic reconstruction plate	Sciatic	< 1	6
Leinung et al. [11]	NA	Femoral	10	NA
Schuh et al. [17]	Cementless with Burch-Schneider plate	Femoral	13	5
Current authors	Fully modular cementless	Femoral	13	12

NA = not available.

We suggest looking carefully for signs and symptoms of nerve involvement in addition to radiographic signs of polyethylene wear and osteolysis during followups of patients who have had THAs. A foreign-body reaction to wear debris may produce an intrapelvic mass and disturb femoral nerve function that could be confirmed easily with pelvic CT and EMG analysis, respectively. If so, timely removal of the pseudotumor and reconstruction of the hip could save the femoral nerve function.

References

- Adelman SC, Urquhart AG, Sondak V, Biermann JS, Freiberg AA. Polyethylene wear debris presenting as a retroperitoneal tumor. *Surgery*. 1998;123:111–112.
- Bach CM, Steingruber E, Ogon M, Maurer H, Nogler M, Wimmer C. Intrapelvic complications after total hip arthroplasty failure. *Am J Surg*. 2002;183:75–79.
- Brand RA, Marsh JL. Particulate debris osteolysis simulating malignant tumor. *Iowa Orthop J*. 2004;24:111–114.
- Chen PC, Mead EH, Pinto JG, Colwell CW. Polyethylene wear debris in modular acetabular prostheses. *Clin Orthop Relat Res*. 1995;317:44–56.
- Fischer SR, Christ DJ, Roehr BA. Sciatic neuropathy secondary to total hip arthroplasty wear debris. *J Arthroplasty*. 1999;14:771–774.
- Hananouchi T, Saito M, Nakamura N, Yamamoto T, Yonenobu K. Huge pelvic mass secondary to wear debris causing ureteral obstruction. *J Arthroplasty*. 2005;20:946–949.
- Harvie P, Giele H, Fang C, Ansorge O, Ostlere S, Gibbons M, Whitwell D. The treatment of femoral neuropathy due to pseudotumour caused by metal-on-metal resurfacing arthroplasty. *Hip Int*. 2008;18:313–320.
- Haynes DR, Rogers SD, Hay S, Pearcy MJ, Howie DW. The differences in toxicity and release of bone-resorbing mediators induced by titanium and cobalt-chromium-alloy wear particles. *J Bone Joint Surg Am*. 1993;75:825–834.
- Johanson NA, Pellicci PM, Tsairis P, Salvati EA. Nerve injury in total hip arthroplasty. *Clin Orthop Relat Res*. 1983;179:214–222.
- Korkala O, Syrjanen KJ. Intrapelvic cyst formation after hip arthroplasty with a carbon fibre-reinforced polyethylene socket. *Arch Orthop Trauma Surg*. 1998;118:113–115.
- Leinung S, Schönfelder M, Würl P. [Inflammatory pseudotumor of the iliopsoas muscle with a femoral paralysis caused by massive metal abrasion of a hip endoprosthesis][in German]. *Chirurg*. 2002;73:725–728.
- Letourneau L, Dessureault M, Carette S. Rheumatoid iliopsoas bursitis presenting as unilateral femoral nerve palsy. *J Rheumatol*. 1991;18:462–463.
- Matsumoto K, Hukuda S, Nishioka J, Fujita T. Iliopsoas bursal distention caused by acetabular loosening after total hip arthroplasty. *Clin Orthop Relat Res*. 1992;279:144–148.
- 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.
- Rosner BI, Postak PD, Greenwald AS. Cup/liner incongruity of two piece acetabular designs: implications in the generation of polyethylene debris. *Orthop Trans*. 1995;18:1143.
- Schmalzried TP, Amstutz HC, Dorey FJ. Nerve palsy associated with total hip replacement. *J Bone Joint Surg Am*. 1991;73:1074–1080.
- Schuh A, Werber S, Zeiler G, Craiovan B. Femoral nerve palsy due to excessive granuloma in aseptic cup loosening in cementless total hip arthroplasty. *Zentralbl Chir*. 2004;129:421–423.
- Stiehl JB, Stewart WA. Late sciatic nerve entrapment following pelvic plate reconstruction in total hip arthroplasty. *J Arthroplasty*. 1998;13:586–588.
- Wooten SL, McLaughlin RE. Iliacus hematoma and subsequent femoral nerve palsy after penetration of the medial acetabular wall during total hip arthroplasty: report of a case. *Clin Orthop Relat Res*. 1984;191:221–223.