A case of massive osteolysis after knee prosthesis polyethylene failure

Jun-Wen Wang[1] and Cheng-Ching Lin[2]

A case of massive osteolysis of the distal femur in response to particulate polyethylene from a broken uncemented tibial component is described. The osteolysis was so extensive that it made the revision arthroplasty extremely difficult. Early detection and early revision is recommended.

Departments of [1]Orthopedics and [2]Pathology, Chang Gung Memorial Hospital, 123, TaPei Road, Niao Sung, Kaohsiung, Taiwan, Republic of China. Tel +886-7 7317123. Fax -7 7318762
Submitted 92-11-24. Accepted 93-01-21

Failure of a total knee replacement due to a thin polyethylene tibial component has been reported (Engh 1988, Christensen et al. 1990, Lindstrand et al. 1990), but rarely massive osteolysis. We report a case of extensive osteolysis of the distal femur caused by polyethylene failure 7 years after an uncemented total knee replacement.

Case report

A 53-year-old man with primary arthrosis of the right knee underwent an uncemented total knee arthroplasty with a porous-coated anatomic prosthesis (Howmedica) at another hospital in 1983. The components used were of medium size, with a total 7 mm thick tibial component. The patient weighed 67 kilograms and he was 160 centimeters tall.

6 months postoperatively, the patient returned to his previous work as a farmer without any restriction. He was doing quite well until about 3 months before visiting our clinic in 1990. After a minor sprain, there was an abrupt onset of pain and increasing symptoms. There was moderate swelling with effusion, and diffuse tenderness, with 15 degrees of varus instability. The knee was aspirated and the synovial fluid was cultured. There was no growth of microorganisms. Weight-bearing radiographs showed loss of medial joint space with varus tilt and destruction of the tibial component. A huge cystic lesion measuring 5 × 10 cm was seen in the metaphysis of the femur extending into the intramedullary canal.

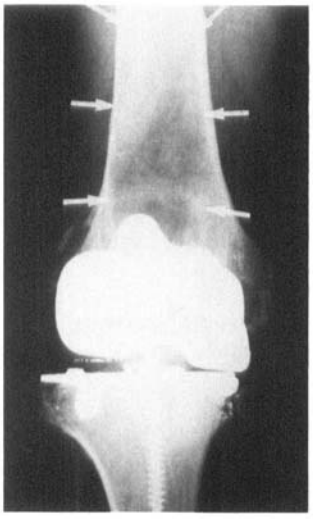
5 weeks later the knee was revised. A marked greyish pigmentation and villous hypertrophy of the synovium covering half of the femoral prosthesis were noted. The polyethylene liner of the tibial component was worn out at its medial part. Fissuring and delamination of the polyethylene of the patellar component were also noted. The medial part of the tibial base plate and the cancellous screw were broken, and there was no evidence of bony ingrowth. The femoral and patellar components were removed, although they were not loose. The entire distal femur was filled with greyish fibrous tissue. After removal of this, a large cavity with walls thin as an eggshell remained. Histological examination of the synovial and fibrous tissues showed many histiocytes with foreign body giant cell reaction around irregular birefringent fragments of polyethylene debris. There was no evidence of foreign body reaction to metal debris. All cultures from synovial tissue and swabs were negative for aerobic and anerobic microorganisms and tuberculosis bacilli.

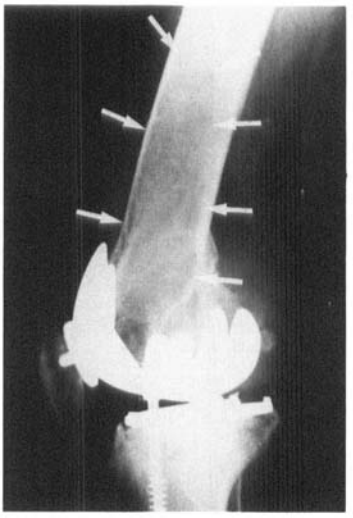
After a complete debridement, the knee was reconstructed with a cemented PCA revision prosthesis (Howmedica) and femoral head allografts.

Discussion

Aggressive granulomatosis or osteolysis of the bone surrounding well-fixed cemented or cementless total hip prothesis has been reported previously (Harris et al. 1976, Jasty et al. 1986, Maloney et al. 1990, Santavirta et al. 1990). The cause of this phenomenon is thought to be a foreign body reaction in response to cement debris or particulate polyethylene. Since the introduction of the uncemented total knee arthroplasty, early polyethylene failures of the tibial component have been reported (Engh 1988, Lindstrand et al. 1990). Investigators have found that the contact stresses on the polyethylene in a total knee replacement are larger than those on an acetabular component

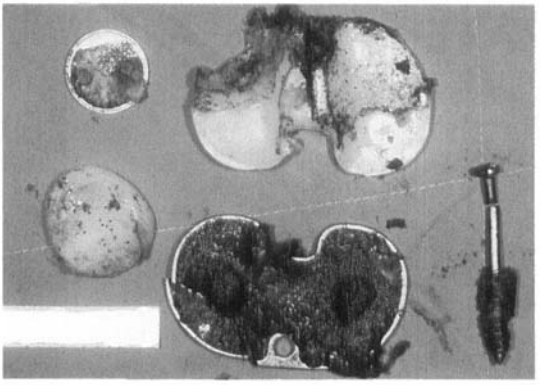
Massive osteolysis after an uncemented total knee replacement in a 53-year-old man.



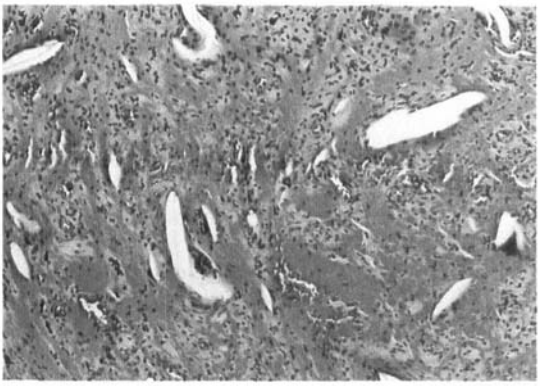


Standing radiographs 7 years postoperatively. There was a loss of medial space, indicating polyethylene failure. A huge cystic lesion in the metaphysis of the femur extending into the diaphysis and multiple loose beads in the joint and tibial metaphysis were seen.

Extensive hypertrophy of the synovium.



Delamination, deformation and extensive wear of the polyethylene insert of the tibial component. The medial tibial plate and cancellous screw were broken.



Histological examination of the synovium showed many various-sized polyethylene particles surrounded by histiocytes or foreign-body giant cells (HE, ×100).

(Bartel et al. 1986). Polyethylene thinner than 6–8 millimeters in a total knee replacement may cause early failure (Bartel et al. 1985, Engh et al. 1992). The thickness of the polyethylene used in this case was only 3.5 millimeters, which we believe was the main cause of failure. Nolan and Bucknill (1992) were the first to report extensive osteolysis of the knee in a stable total knee replacement. Later, Kilgus et al. (1992) reported a case of more extensive osteolysis. Tallroth et al. (1989) have warned against the possibility of rapid growth of the foreign body granuloma, with risk for a spontaneous fracture. Therefore revision arthroplasty must be performed as soon as possible.

References

Bartel D L, Burstein A H, Toda M D, Edwards D L. The effect of conformity and plastic thickness on contact stresses in metal-backed plastic implants. J Biomech Eng 1985 ; 107 (3): 193–9.

Bartel D L, Bicknell V L, Wright T M. The effect of conformity, thickness, and material on stresses in ultra-high molecular weight components for total joint replacement. J Bone Joint Surg (Am) 1986; 68 (7): 1041–51.

Christensen O M, Christiansen T G, Johansen T. Polyethylene failure in a PCA unicompartmental knee prosthesis. Acta Orthop Scand 1990; 61 (6): 578–9.

Engh G A. Failure of the polyethylene bearing surface of a total knee replacement within four years. A case report. J Bone Joint Surg (Am) 1988; 70 (7): 1093–6.

Engh G A, Dwyer K A, Hanes C K. Polyethylene wear of metal-backed tibial components in total and unicompartmental knee prostheses. J Bone Joint Surg (Br) 1992; 74 (1): 9–17.

Harris W H, Schiller A L, Scholler J M, Freiberg R A, Scott R. Extensive localized bone resorption in the femur following total hip replacement. J Bone Joint Surg (Am) 1976; 58 (5): 612–8.

Jasty M J, Floyd W E, Schiller A L, Goldring S R, Harris W H. Localized osteolysis in stable, non-septic total hip replacement. J Bone Joint Surg (Am) 1986; 68 (6): 912–9.

Kilgus D J, Funahashi T T, Campbell P A. Massive femoral osteolysis and early disintegration of a polyethylene bearing surface of a total knee replacement. A case report. J Bone Joint Surg (Am) 1992; 74 (5): 770–4.

Lindstrand A, Ryd L, Stenström A. Polyethylene failure in two total knees. Wear of thin, metal-backed PCA tibial components. Acta Orthop Scand 1990; 61 (6): 575–7.

Maloney W J, Jasty M, Harris W H, Galante J O, Callaghan J J. Endosteal erosion in association with stable uncemented femoral components. J Bone Joint Surg (Am) 1990; 72 (7): 1025–34.

Nolan J F, Bucknill T M. Aggressive granulomatosis from polyethylene failure in an uncemented knee replacement. J Bone Joint Surg (Br) 1992; 74 (1): 23–4.

Santavirta S, Konttinen Y T, Bergroth V, Eskola A, Tallroth K, Lindholm T S. Aggressive granulomatous lesions associated with hip arthroplasty. Immunopathological studies. J Bone Joint Surg (Am) 1990; 72 (2): 252–8.

Tallroth K, Eskola A, Santavirta S, Konttinen Y T, Lindholm T S. Aggressive granulomatous lesions after hip arthroplasty. J Bone Joint Surg (Br) 1989; 71 (4): 571–5.