Osteonecrosis of the femoral head caused by bone marrow blockage: a case report

A Nishimura, M Hasegawa, A Sudo, A Uchida
Department of Orthopaedic Surgery, Mie University Graduate School of Medicine, Tsu City, Mie, Japan

ABSTRACT

Interruption of the blood flow may occur in intra-osseous arteries within the femoral head. We report a 72-year-old woman who developed osteonecrosis of the femoral head 11 months after surgery involving massive cementing of a segmental distal femoral rotating hinge prosthesis to treat nonunion of the distal femur. The bone cement filled the cavity up to the femoral neck and the superolateral portion of the femoral head, blocking the bone marrow.

Key words: bone cements; bone marrow; femur head; hip; osteonecrosis

INTRODUCTION

Nutrient vessels in the femoral head are divided into extramedullary vessels that arise from the medial femoral circumflex artery and intramedullary vessels. It has been shown that damage to extramedullary nutrient vessels can lead to osteonecrosis of the femoral head.1–4 Another study has suggested that interruption of the blood flow occurs in intra-osseous arteries within the femoral head.5

We report a rare case of osteonecrosis of the femoral head that appears to have been caused by damage to intramedullary nutrient vessels following massive cementing of the segmental distal femoral rotating hinge prosthesis during treatment of nonunion in the distal femur.

CASE REPORT

In July 1998, a 72-year-old woman with bilateral osteoarthritis of the knees fell from stairs and sustained a supracondylar fracture of the right femur. She underwent open reduction and internal fixation with a plate at another institution. In November 2000, she experienced pain in her right knee, and radiography showed nonunion and breakage of the plate. Although a knee brace was used as conservative treatment, bone union was not achieved. In February 2001, the patient underwent total knee arthroplasty.
at the Mie University Graduate School of Medicine in Japan using a cemented segmental distal femoral rotating hinge prosthesis (Physio Hinge Total Knee System, Kyocera, Kyoto, Japan). Cement was injected under pressure into the femur, causing a decrease in blood pressure and respiratory arrest. A radiograph taken after the operation showed that bone cement had filled the femoral cavity up to the femoral neck and the superolateral portion of the femoral head (Fig. 1). The patient stayed in the intensive care unit for 2 months, gradually recovered and was able to walk with the aid of a T-cane. In December 2001, the patient had pain in her right hip and gradually became unable to walk because of increasing pain. The patient was observed for one month; radiographs taken in December 2001 and January 2002 revealed segmental collapse of the femoral head starting from the weight-bearing part and progressing to complete collapse (Fig. 2). Magnetic resonance imaging of the femoral head showed a combination of low- and iso-intensity on the T1-weighted image and an irregular combination of low- and iso-intensity on the T2-weighted image. A diagnosis of osteonecrosis of the femoral head was made (Fig. 3). In February 2002, hip and knee arthroplasty using a metallic total femur prosthesis (KLS System, Kyocera, Kyoto, Japan) was performed. The prosthesis was composed of a modular proximal femoral replacement component joined to a bipolar hemiarthroplasty head and a resurfacing-type modular distal femoral rotating hinge knee component. At operation it was found the right femoral head had been completely depressed;
detached articular cartilage and a softened cortex were identified.

Histological examination confirmed the diagnosis of necrosis of the femoral head with the presence of both fibrosis and a cellular infiltration indicating chronic inflammation. On higher magnification, the femoral head showed only empty lacunae and fat cell changes. Bone cement was found in the marrow of the femoral neck. These findings suggested that osteonecrosis of the femoral head had continued for some time.

Two weeks after the operation, the patient started to walk, weight-bearing, with knee bracing. At a 3.5-year follow-up, she was able to walk using a cane without pain.

DISCUSSION

Several theories have been developed to explain the causes of osteonecrosis of the femoral head—artery disorder theory, 1,5 venous return disorder theory, 2–4 fat embolus theory, 6,7 injury to the wall of a vessel caused by vasculitis, 8 and altered fibrinolysis 9—but none have been proven yet.

The main nutrient arteries crossing into the femoral head from outside the marrow arise from the medial femoral circumflex artery and cross behind the femoral neck as the posterior column branch. Some superior retinacular arteries branch off from this point and enter the femoral bone marrow to provide the caput with nutrition through the lateral epiphyseal artery. Other nutrient arteries cross the inferior medial portion and enter the bone to give nutrition through the inferior metaphyseal artery. The ligamentum teres artery arises from the obturator artery and through anastomosis with the lateral epiphyseal and inferior diaphyseal arteries serves as a nutrient artery. 1

It has been reported that the presence of cement in the cortex does not directly lead to necrosis by itself. 10 Necrosis in this case was not caused by cement mixing in the cortex of the femoral diaphysis. We consider that osteonecrosis of the femoral head was caused by a blockage of the bone marrow of the femoral neck and the superolateral portion of the femoral head by bone cement, leading to poor blood flow and subsequent ischaemia.

The hypothesis that osteonecrosis was caused by a blockage in the bone marrow was not confirmed by the histological findings. As the cement reached the subcapital portion of the femur where the lateral epiphyseal artery separates from the superior retinacular artery, it is possible that the cement compressed the intraosseous epiphyseal artery and/or there was thermal necrosis of the artery. Other possible causes include prolonged hypotension, prolonged recumbence, and the drugs used during intensive care (steroids).

CONCLUSION

Filling cement up to the femoral neck and the superolateral portion of the femoral head may cause blockage of the bone marrow and lead to osteonecrosis of the femoral head when performing total knee arthroplasty using a segmental distal femoral prosthesis.

REFERENCES