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CASE REPORT

Polymethylmethacrylate arteriography – A complication of total hip arthroplasty

Konstantinos PANOUSIS, Kenneth A. YOUNG, Peter GRIGORIS

From Western Infirmary, Glasgow, Scotland, United Kingdom

We report a complication of contemporary cementing technique in total hip arthroplasty, that is, extensive retrograde filling with polymethylmethacrylate cement of the nutrient artery of the femur.

Keywords : total hip arthroplasty ; complications ; polymethylmethacrylate cement ; cementing technique.

INTRODUCTION

Current concepts in cemented hip arthroplasty advocate optimization of the mechanical interlock of polymethylmethacrylate (PMMA) cement with trabecular bone. Contemporary cementing techniques have been developed to achieve this, one component of which is the pressurisation of the cement within the proximal femur. Previous case reports have highlighted extra-osseous extrusion of cement (*1, 3, 5, 7, 8*), all of which are interpreted either as intravenous extrusions due to the appearance of valvular constrictions or as extravascular extrusions of PMMA through a femoral vascular channel.

We report a case demonstrating extrusion of PMMA into the nutrient artery of the femur. To the best of our knowledge this radiographic feature implicating the arterial supply of the femur has not been previously reported. The case has been followed up for over one year, with no adverse consequences.

CASE REPORT

A hybrid total hip arthroplasty was performed upon a 60-year-old female for osteoarthritis. An uncemented acetabular component (Allofit S, Sulzer AG, Baar, Switzerland) was utilized along with a cemented femoral component (Müller Straight Stem Modular, Sulzer AG, Baar, Switzerland).

Intraoperatively excessive endosteal arterial bleeding was encountered in reaming the proximal femur, despite hypotensive anaesthesia, maintaining the blood pressure at 100/50 mm Hg during cementing.

A Hardinge (DePuy International, Leeds, UK) cement restrictor was inserted, followed by the retrograde introduction of a double mix of Palacos R (Schering-Plough Ltd., Welwyn Garden City, UK) standard viscosity cement via the cement gun at two minutes post mixing. Thumb pressurisation only was employed, with the introduction of the

■ Konstantinos Panousis, Clinical Fellow (Orthopaedics).
■ Kenneth A. Young, Specialist Registrar (Orthopaedics and Trauma).
■ Peter Grigoris, Consultant Orthopaedic Surgeon.
University Department of Orthopaedic Surgery, Western Infirmary, Glasgow, Scotland, UK.
Correspondence : Konstantinos Panousis, Ag. Lavras 79, 15773 Zografou, Greece. E-mail : panousis@hotmail.com.

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Fig. 1a, b. — Postoperative radiograph of hip arthroplasty showing a thin, linear radio-opacity that communicates with the posterior aspect of the femoral shaft, extends proximally and medially for approximately 8 cm and has no valvular constrictions. **(a)** Anteroposterior and **(b)** lateral view.

femoral component relatively late in the cement curing process to maintain pressurisation. The patient made a good recovery from surgery. The postoperative radiographs (fig 1 a, b) showed a thin, linear radio-opacity communicating with the posterior aspect of the femoral shaft. This extended proximally and medially for approximately 8 cm and was of uniform calibre suggesting PMMA within a blood vessel. There were no valvular constrictions evident, indicating that the pressurised cement had produced a retrograde arteriogram of the nutrient artery of the femur.

DISCUSSION

An anatomical study (*2*) has established that a reliable, clinically applicable topographic relationship exists between the femur, the perforating arteries and the nutrient artery of the femur. The authors divided the femur into sixths and found that the second and third perforating arteries consistently crossed the femur in its third sixth. Within this segment they also consistently identified the nutrient artery, commonly a branch of the second perforating artery, and its nutrient foramen. A further anatomical study (*3*) of 49 cadaveric femora found one to three vascular channels in all specimens. The location of the most proximal channel was found to be at approximately 10.1 cm from the midpoint of the lesser trochanter. Dissection and histology of two femora showed that the channel contained 1 artery and 2 veins. A third anatomic study (*5*) found two nutrient foramina in 80% of ten cadaveric femora, however in all cases these were again consistently located in the third sixth of the femur along the linea aspera (fig 2).

Other authors (*1, 5, 7, 8*) have identified intravasated standard viscosity cement characteristic of venous filling in a total of four patients. The common feature of these cases is the appearance of valves characterized by localized constrictions in the calibre of the cement radio-opacity. It is well established that the nutrient artery has an accompanying vein or veins, which have been implicated in these cases. In the report by Knight *et al*, posterior distal cement extrusion was noted in 8 patients (*3*). The authors noted that the size of the extrusions was greater than the diameter of normal vessels of the area and suggested that the extrusion was either extravascular or that the initially intravascular PMMA ruptures the vessel and escapes in the surrounding tissues.

Our case demonstrates PMMA within a small diameter vessel with no valvular constrictions, which communicates with the femur at a point consistent with the nutrient foramen. This appearance, coupled with the extent of intraoperative endosteal bleeding leads us to the conclusion that the PMMA has formed a retrograde arteriogram of the nutrient artery of the femur.

Pressurisation of cement is maximal during insertion of the femoral prosthesis (*4*), regardless of the method of cement introduction (finger packing or cement gun). It is likely in our case that the introduction of the femoral prosthesis rather than thumb pre-pressurisation has led to the radiographic appearance.

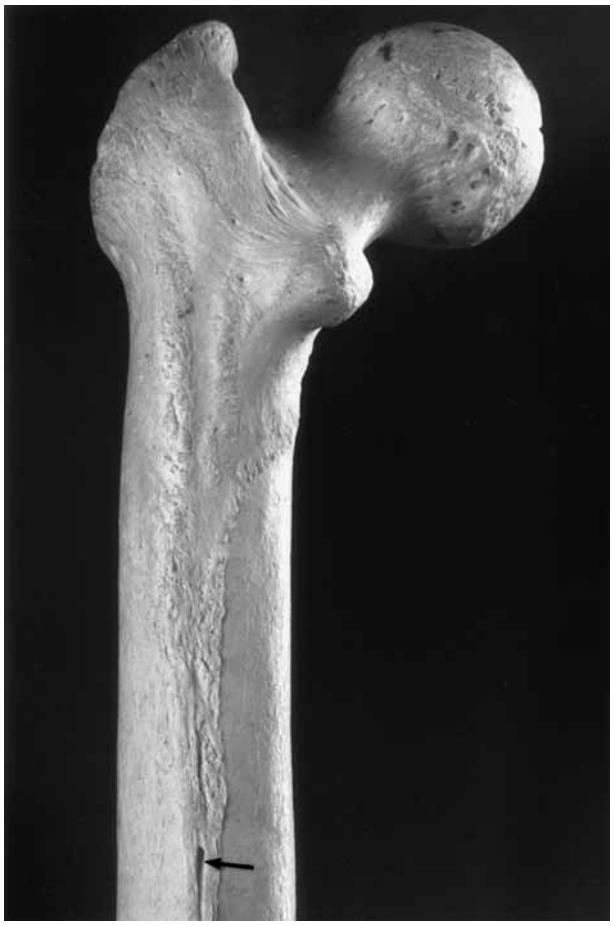

Fig. 2. — Posterior aspect of anatomic femoral specimen demonstrating nutrient foramen (arrow).

We would suggest that this extrusion is unlikely to affect the long term survival of the prosthesis as we can infer from the radiographic appearances that the cement has been well pressurised, thereby optimising mechanical interlock with endosteal bone. Furthermore, due to extensive anastomoses of the perforating branches of the deep femoral artery, which supply overlying muscle and periosteum segmentally, obliteration of the nutrient artery alone is unlikely to lead to problems of avascularity.

Our patient is entirely asymptomatic at one year post-operatively, and the radiographic appearances to date are unchanged. The importance of identifying the pattern of an intravascular extrusion of cement is to differentiate from an extra-osseous extrusion due to iatrogenic breach of the femoral cortex, which may well have implications regarding either periprosthetic fracture or the long-term survival of the prosthesis.

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