

## Modular megaprosthesis as definite treatment of femur osteomyelitis

C. KOUTSERIMPAS<sup>1</sup>, K. RAPTIS<sup>1</sup>, A. MARI<sup>2</sup>, A. KOTSIRAKIS<sup>1</sup>

**SUMMARY: Modular megaprosthesis as definite treatment of femur osteomyelitis.**

C. KOUTSERIMPAS, K. RAPTIS, A. MARI, A. KOTSIRAKIS

*Chronic osteomyelitis represents a challenging to treat clinical entity. A case of a whole femur chronic osteomyelitis, definitely treated with total femur resection and a positioning of a modular megaprosthesis in 2 stages is presented. An 81-year-old female, with hip hemiarthroplasty and internal fixation plate of the distal femur presented with signs and symptoms of femur osteomyelitis. Based on the clinical, radiologic and laboratory findings, the diagnosis of chronic femur osteomye-*

*litis was established. Multiple bone cultures from different femur sites revealed the same methicillin resistant S. aureus. The patient was subjected to a two stage femur reconstruction operation. At the first stage, radical debridement, total femur resection and the application of a custom made vancomycin loaded spacer was performed. After a total of 6 weeks i.v. and 3 months oral proper causative antimicrobial treatment a modular megaprosthesis was applied. The patient was definitely treated from total femur chronic osteomyelitis and has returned to her daily activities. Chronic osteomyelitis demands a multidisciplinary approach, including the right causative long-term antimicrobial treatment, as well as the proper surgical treatment, aiming for eradication of infection and best possible postoperative limb function.*

KEY WORDS: Chronic osteomyelitis - Femur osteomyelitis - Megaprosthesis - Skeletal defect - Femur resection.

### Introduction

Osteomyelitis represents an inflammation of the bone and bone marrow most commonly caused by pyogenic bacteria. Osteomyelitis may involve any bone and is classified into three types: acute, subacute and chronic (1). The most common pathogens responsible are gram-positive organisms such as: *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumoniae* and coagulase-negative *Staphylococci species*. The poorly treated or delayed stage of the disease may lead to chronic infection, resulting in necrotic devascularized bone (2, 3).

The management of such an infection consists of the proper antimicrobial treatment, according to the culture results, as well as adequate surgical debridement of the infected bone (2, 3).

We present a rare case of an 81-year-old female, with hip hemiarthroplasty and internal fixation plate of the distal femur, affected by total femur osteomyelitis. The patient was treated with total femur resection and application of a modular megaprosthesis.

### Case report

An 81-year old female presented to the emergency department due to severe pain of the left thigh and inability to bear weight. She complained of similar symptoms during the last 6 months. Her medical history was remarkable for hematogenous osteomyelitis at the age of 10, treated with antimicrobial agents, as well as a left hip hemiarthroplasty 10 years ago and an internal fixation of left femur with a blade plate due to a supracondylar femur fracture 9 years ago.

At presentation she was hemodynamically stable (blood pressure= 140/90 mmHg, heart rate= 73 beats per min, SpO<sub>2</sub>= 99%) and febrile (38°C). Up-

<sup>1</sup> Department of Orthopaedics and Traumatology, "251" Hellenic Air Force General Hospital of Athens, Athens, Greece

<sup>2</sup> Department of Internal Medicine, Infectious Diseases Unit, "251" Hellenic Air Force General Hospital of Athens, Athens, Greece

Corresponding author: Christos Koutsierimpas, e-mail: chrisku91@hotmail.com

on physical examination, inability of full weight bearing due to severe pain, as well as reduced active and passive range of motion of the hip and knee joint were evident (hip joint: flexion: 80°, abduction 15°, adduction 10° and extension 0°; knee joint: flexion 20°, internal rotation 0° and external rotation 5°). Additionally, clinical examination revealed a thigh fistula, draining pus. Pus cultures were obtained.

Plain radiologic evaluation of femur revealed cortical thickening, irregularity of the cortices and sequestrum, whereas severe knee osteoarthritis was evident. Additional laboratory studies were ordered to evaluate the radiographic findings. These revealed white blood cell count (WBC) = 10000 g/L, c-reactive protein (CRP) = 180 mg/dL and erythrocyte sedimentation rate (ESR) = 102 mm/1<sup>st</sup> hour, while the rest investigation was within normal limits. Furthermore, under general anesthesia multiple bone cultures were obtained from different regions of the femur.

The bone as well as the pus cultures revealed the same methicillin resistant *Staphylococcus aureus*. Based on the clinical, radiologic and laboratory findings, the diagnosis of chronic femur osteomyelitis was established. The patient was commenced on antimicrobial treatment with intravenous (i.v.) vancomycin and a two stage surgery was planned. Initially, under general anesthesia and in a lateral position, radical surgical debridement of soft tissues and total femur resection was performed, while a custom made spacer of 2 Steinmann pins and vancomycin-loaded cement was placed (Figure 1). The patient was under i.v. antimicrobial treatment with vancomycin for the next 6 weeks of hospitalization, where she was stable and defervesced. Upon discharge, the antimicrobial agent was switched to oral linezolid for another 3 months. At the end of this period the laboratory follow-up showed WBC= 5100 g/L, CRP = 2.7 mg/dL and ESR = 18 mm/1<sup>st</sup> hour.

Three months later, her laboratory exams were within normal limits, while no femur fistula was present, so the patient was submitted under general anesthesia to the second stage of the femur reconstruction. With the patient in a supine position and through a long lateral incision extending from 3 to 4 cm proximal to the greater trochanter to the anterolateral aspect of the patellar tendon and tibial tuberosity, the custom made cemented spacer was removed and a femur modular megaprosthesis



**Figure 1 - Plain X-ray, following the first stage of the femur reconstruction procedure. Radical surgical debridement and femur resection have been performed. The custom made spacer of 2 Steinmann pins and vancomycin-loaded cement has been placed.**

joined to a press-fit acetabular implant (total hip arthroplasty) and a tibial component via a rotating hinge mechanism (knee arthroplasty) was positioned. Combined attachment of the abductors and psoas to the lateral and medial aspects of the prosthesis, preserving balanced prosthetic range of motion was also performed (Figure 2).

Two days later, the patient suffered from a posterior hip dislocation. This was attributed to a short megaprosthesis. Therefore, under general anesthesia the dislocation was reduced and the megaprosthesis was adjusted to the proper length.

The patient is followed up at the outpatient clinic. Eight years later, she has no signs or symptoms of infection, while she is able to take care of herself and



**Figure 2 - Plain X-ray views following the second stage of the femur reconstruction. The modular megaprosthesis has been applied.**

mobilize with a walking-gait. Regarding hip range of motion, she exhibits active flexion=110°, abduction=25°, adduction=20° and extension=10°. She has active knee joint flexion=50°, internal rotation=5° and external rotation=15°.

## **Discussion**

Chronic osteomyelitis represents a challenging to treat disease. A structured approach with a multidisciplinary team is of utmost importance for the eradication of such infections. Chronic osteomyelitis may result from inadequately treated hematogenous acute osteomyelitis or more commonly from a contiguous source of infection in cases of open contaminated fractures, surgical treatment of fractures, or prosthetic replacements (4, 5). The reported patient was submitted to 2 operations (hip hemiarthroplasty and internal fixation of the distal femur). However,

her history was remarkable for hematogenous femur osteomyelitis at the age of 10. Additionally, for a long time following these 2 surgical procedures the patient was without symptoms (9 and 10 years respectively). Therefore, we suspect that the spread was hematogenous.

Chronic osteomyelitis is characterized by the formation of a sequestrum (necrotic bone), which was present in whole femur at the reported patient. Damage to the bone is also caused by cytokines like IL-1 and TNF, present at the site of infection (6). The surface of the sequestrum or implants provide a base for formation of the biofilm, made up of polysaccharide polymers that form a fibrous matrix around the host cells and bacteria, making the infection more difficult to treat. Antimicrobial treatment is not sufficient as stand-alone management at the presence of necrotic bone. Radical surgical debridement of necrotic bone and surrounding soft tissues in those cases should also be performed (5-7).

In the present case, the patient was suffering from severe thigh pain which was affecting her daily activities and independence. Multiple cultures from different sites of the femur revealed the same pathogen, indicating chronic osteomyelitis which had affected the whole femur. Careful planning from a multidisciplinary team, including an infectious diseases specialist, microbiologist, as well as an orthopaedic surgeon, was then carried out and a two-stage operation in combination with the proper causative antimicrobial treatment was decided. Total femur resection is a major laboring procedure, necessitating a detailed preoperative evaluation, including physical and imaging examination which determine the extent of soft tissue resection and the reconstruction options (8). It is of paramount importance to spend adequate time during this preoperative planning, since most complications may be avoided by predicting their like-hood. Surgical technique should also be modified accordingly (8-10).

Chronic osteomyelitis or a periprosthetic infection with massive bone defect is probably one of the worst case scenarios as an orthopaedic surgeon could face nowadays. Management is challenging, often requires multiple and complex surgical operations, while it is associated with high morbidity and health-care costs (11, 12).

Megaprotheses of the femur with endoprosthetic reconstruction are most commonly used in oncological patients, since the proximal femur and mid-femur region represent common sites for primary

bone sarcomas and metastatic tumors (11, 12). We presented a rare case of chronic osteomyelitis of the whole femur, definitely treated with whole femur resection and the application of a modular megaprosthesis.

The management of severe femoral bone loss associated with hip or femur infection is still controversial as it is a major problem in joint replacement surgery. Femoral megaprotheses have been rarely reported in reconstructive procedures for this complex condition. The use of such massive implants has become an attractive option in end-stage prosthetic joint operations or in the surgical treatment of infections with large bone defects. This option prohibits amputation or hip disarticulation. However, there are only a few small clinical series studying the use of these implants in such infections (11, 13, 14).

The main concerns following such a laboring operation are hip dislocation and recurrent infection (14). The reported patient suffered from a posterior hip dislocation 2 months post operatively, so the use of a hip brace, in order to reduce such a risk could prove beneficial (14, 15). Additionally, to minimize the risk of re-infection the use of antimicrobial surface coatings of megaprotheses has been proposed (14, 16).

There are many different techniques for covering skeletal defects. Bone loss less than 6 cm may be

bridged with autologous bone grafts, while for larger defects distraction osteogenesis, such as the Ilizarov ring technique, may be performed. The Ilizarov ring fixation with distraction has been proved effective in many difficult cases. However, this technique is time-consuming, necessitating meticulous care during the course of treatment (17, 18). In the reported case, such measures could not be performed, since the infection included the whole femur. The megaprosthesis in combination with the proper causative antimicrobial treatment offered to the present patient relief of the symptoms and independency in daily activities.

The present case illustrates the difficulty in handling cases of chronic osteomyelitis. This clinical entity demands a multidisciplinary approach, including the right long term antimicrobial treatment based on cultures as well as the proper surgical treatment, aiming for eradication of infection and best possible postoperative limb function.

#### *Conflict of interest*

The Authors declare that there is no conflict of interest.

#### *Consent for publication*

Received.

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