Chronic diaphyseal osteomyelitis of long bones refractory to conventional therapy - Benefits and risks of reaming of the femoral medullary cavity*

Ostéomyélite diaphysaire chronique des os longs résistante aux traitements classiques. Bénéfices et risques de l'alésage centro-médullaire fé moral

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Summary: Osteomyelitis of long bones represents a severe complication during fracture healing. If ongoing infection occurs despite reoperation and if antibiotic treatment is of no benefit, reaming of the medullary canal may be beneficial. We investigated the long term follow up (minimum 2 years) of patients submitted to reaming of the medullary canal to evaluate the efficacy of this method. Criteria for successful procedure: no further operative procedure/antibiotic treatment. 32 patients out of 37 were followed over a 9 year period. Mean incidence of surgical treatment for osteomyelitis prior to reaming: 3.2 operations. Mean duration until reexamination after reaming: 3.7 years. 89% of patients had a full range of motion upon reexamination, in the others further articular injuries were present. 84.3% of patients were working in the same profession as prior to the fracture, 72% were active in sports again, 97% of patients were pain free. One otherwise healthy patient suffering from sclerosing osteitis (Garré) died during reaming of the femur due to bone marrow embolism to the lung. Reaming of the medullary canal has a high rate of curing osteomyelitis even after several previous attempts of surgical revisions and/or antibiotic treatment. The most likely mechanism is based on improvement of local perfusion. During surgery care must be taken not to provoke pulmonary embolization. Intraoperative monitoring by pulmonary artery catheter should be performed; reaming should be immediately discontinued, if a rise in pulmonary artery pressure occurs.

Key words: Osteomyelitis, therapy — Intramedullary femoral reaming — Complications

In general, the site of infection in osteomyelitis is most commonly a long bone such as the femur or the tibia. The patient with an unhealed, infected long bone is therefore prone to two major problems: Osteomyelitis and imminent fracture of a weight bearing extremity.

Once osteomyelitis has developed, the patient is at risk of developing a chronic disease state. In the presence of cutaneous fistulas, a variety of social problems can arise. In addition, frequent hospitalization without the prospect of cure can lead to further problems including loss of employment. From the patient’s view, most of the problems derive from chronic, sometimes incapacitating pain, often requiring the use of crutches. A number of these patients develop chronic use of analgesics, which furthermore do not give sufficient relief. In extreme cases suicidal ideas have even been seen. A variety of treatment options have been advocated. Instillation drainage and application of antibiotic therapy have been advocated, but the success is often limited. Surgical approaches (debridements, autologous cancellous bone grafting and free or pedicular muscle tissue transfer) might cause temporary improvement of infection but not of pain [5, 7, 8, 18].

The pathogenic origin of this pain remains unclear. Pathologically increased intraosseous pressure has been suggested as being responsible since increased pressures have been measured in these patients [2, 4]. Furthermore, a lack of perfusion has been suggested to cause hypoxemia induced pain in the sclerotic areas.

In these cases reaming of the medullary canal has been advocated. The mechanism of action was said to be an acute reduction of intramedullary pressure as well as a subsequent improvement of perfusion. The latter was thought to be due to improved vascula-
rization during repair of the reaming induced damage. However, to date these theories have not been proven in clinical studies.

In a previous report from our department, Zwipp et al. have followed patients submitted to this approach and have repeatedly seen a successful outcome within short periods after surgery [20]. The present study evaluates follow-up in patients submitted to intramedullary reaming following a minimum period of 2-year following surgery.

**Materials and methods**

The method of reaming of the medullary canal has been performed since 1980 in our department. In the present series we report patients treated between 1980 and 1990.

Localization of osteomyelitis was the femur and the tibia. The inclusion criteria for the study were:

- proven chronic diaphyseal osteomyelitis
- s.p. multiple surgical unsuccessful interventions
- no sequestrum on preoperative imaging.

Follow up was at least 2 years after intramedullary reaming. The type and frequency of treatment prior to the intramedullary nailing procedure, the type of complaint prior to reaming and the course during routine postoperative investigations were recorded.

At surgery, a two plane image intensifier was used. In order to open the intramedullary canal special rigid opening devices were applied. Reaming was usually done from proximal to distal, unless a very distal localization of the infection site was present. For the femur reamers up to 19 mm diameter were chosen, for the tibia up to 14 mm. The mean reaming diameter was 15 mm (range 11.5 - 18.5) for the femur and 12 (range 10 - 14 mm) for the tibia. In most cases PMMA chains were placed intraoperatively, and were usually removed around 10 days after surgery.

Laboratory data, such as erythrocyte sedimentation rate and leucocyte activated scintigraphy were recorded. The reports of histomorphology of osteomyelitis at the time of reaming were documented, as were the reports of bacteriologic studies at the time of reaming and during the postoperative course or upon reoperation. The success rate was set in relation to the type of histology obtained upon initial surgery, to the type of fracture and the type of organism isolated.

At the time of follow up all patients were interrogated about subjective outcome after reaming, implying the degree of pain, the ability to perform daily activities and the ability to do sports. All patients were submitted to a thorough clinical examination investigating range of motion and soft tissue status. Routine 2 plane X-rays were taken of the affected extremity. If no evidence of infection was present and the patient was pain free, no further blood withdrawal was done. Criteria for successful outcome were modified and expanded based on those described by Kelly et al. [8] (Table 1).

**Results**

Thirty-seven patients with proven chronic osteomyelitis and submitted to reaming were documented between 1980 and 1991. 32 patients fulfilled the inclusion criteria listed above. Out of these we performed a follow-up clinical examination in 26; the other patients were asked about their current status without clinical examination or were lost to follow-up. Mean age at the time of initial surgery was 37.7 years (range 16-59 years). Nineteen patients (73%) were male and 7 (27%) were female.

Mean incidence of surgical treatment for osteomyelitis prior to intramedullary reaming in patients submitted to more than one surgical procedure was 11.0 (range 4-30 operations). The type of treatment prior to intramedullary reaming included surgical debridement, sequestrectomy, bone grafting, abscess drainage, osteotomy, application of PMMA chains and instillation drainage. 20% of patients had further diseases predisposing to osteomyelitis, such as diabetes mellitus (16.6%) or a further septic focus (3.4%). The site of the osteomyelitis was the femur in 19 cases (73%) and the tibia in 7 cases (27%). Osteomyelitis was a complication of trauma (i.e. fracture) in 78.1% of patients; 29% (n=9) of patients had open fractures and 50% (n=16) had closed fractures.

Preoperatively, 78% of patients had moderate to severe psychological problems as a result of their disease. The majority of patients had severe pain, which in some even lead to thoughts of committing suicide (at least 5 patients). There was a documented need for psychological consultation for this reason in 1 patient; a higher number is likely to have been present, but was not documented. In 7 patients (21.8%) with a cutaneous fistula the main concern was of contaminating the environment.

At surgery, the femur was reamed from 11.5 mm to 18.5 mm diameter (mean 14.5 mm); and the tibia from 10 to 14 mm diameter (mean 12.4 mm). The femur was reamed from distal to proximal in 58%; in the tibia it was done from proximal to distal in 86%.

Thirteen out of 32 patients (40.6%) received PMMA-chains after reaming. In addition, instillation drainage was done in 3 patients. One of these had a successful outcome.

We investigated whether the type of fracture or timing of surgery influenced the success of the operation. As shown in Table 2 almost all fractures were submitted to primary stabilization. Among these, the success rate was 85.7% in closed fractures and 57.1% in open fractures. Obviously, hematogenous osteomyelitis and primary reduction of a closed fracture was associated with the best outcome (Table 2). Table 3 shows the relationship between the morphological type of osteomyelitis and the outcome after reaming. A tendency to better results of reaming in patients with chronic active and persistent osteomyelitis was present (Table 3).

Case no. 1 shows an adequate result from the surgical procedure. A 27 year old male had a femur fracture from a MVA 7 years previously. He then developed chronic sclerosing osteomyelitis and had 5 operations (PMMA-chains, instillation drainage, open wound treatment). He was then referred to our institution and reaming was planned. Figure 1a shows a preoperative x-ray of the femur. Reaming was done up to 16.5 mm diameter. The operative procedure was uneventful as was the postoperative course (Fig. 1b). Clinical follow up 5 years after reaming showed well healed bony structures, the patient was pain free and had returned to sporting activities (Fig. 1c).

**Complications**

Two (6.3%) patients had ongoing infection at the time of follow-up. Reinfection after the first reaming developed in 5 patients (21.8 %). All of these had a history of multiple previous surgical interventions. Three of these had further operations, after which they were cured. In one patient refracture occurred as a result of repeated reaming of the tibia.

The types of organisms isolated from the bone at the time of initial surgery and subse-