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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Surgical treatment of peri-implant femoral fractures – case report and literature review

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SUMMARY

Introduction Peri-implant femoral fractures (PIFF) are defined as fractures of the femur with the presence of previously implanted non-prosthetic osteosynthetic material.
A review of available literature revealed that there are several proposed classifications and sets of guidelines for surgical treatment of PIFF.

Case outline A 49-year-old patient was injured from a fall on the same level, the day before admission to the hospital. The anamnesis at admission showed that six months earlier, he had sustained a pertrochanteric fracture of the left femur, which had been treated surgically with a short cephalomedullary nail. Two years prior to hospital admission, the patient had sustained a tibial plateau fracture of the same leg, which was treated non-surgically with above the knee cast immobilization. After the fracture had healed, paresis of the peroneal nerve was diagnosed, while subsequent follow-up revealed secondary post-traumatic arthrosis of the knee joint. Reduction and fixation of the fracture was performed on a surgical extension table, with the use of fluoroscopy. Previously implanted osteosynthetic material was removed, a short cephalomedullary nail, and fixation of the fracture was carried out with a long cephalomedullary nail. Six months after the operation, the patient can ambulate independently, without assistance. He reports no pain in the left groin and upper leg but reports pain and limitation of movement in the left knee joint.

Conclusion By reviewing the available literature, we found that the patient was cared for in our hospital in keeping with all current recommendations for surgical treatment of this type of fracture.

Keywords: pertrochanteric fracture; cephalomedullary nail; peri-implant fracture

INTRODUCTION

In the overall number of fractures, the incidence of proximal femur fractures is 14%, of which 42% are transtrochanteric fractures. However, the treatment of proximal femur fractures accounts for 72% of the total cost of treating all fractures [1]. The total annual direct medical costs associated with all hip fractures was $50,508 per patient, resulting in a yearly estimate of $5.96 billion to the U.S. healthcare system. Intertrochanteric hip fractures accounted for an annual estimate of $52,512 per patient, corresponding to an overall annual economic burden of $2.63 billion to the U.S. health-care system and representing 44% of all hip fracture costs [2]. Bearing in mind the increase in life expectancy and the incidence of fractures of the trochanteric region, an increase in the number of peri-implant femoral fractures (PIFF) is to be expected. PIFF are defined as fractures of the femur with the presence of previously implanted non-prosthetic osteosynthetic material [3,4]. These fractures most commonly occur in the elderly. In their study, Vilar-Sastre et al. [5] reported a predominance of elderly women with comorbidities and plate fixation. The incidence of PIFF is 1.7% [6], while according to Halonen et al. [7], it is 1.4%. The decision on the method of surgical management of peri-implant fractures is influenced by several factors – primarily the condition of the initial fracture, i.e., whether it has healed, but also by the type of primary osteosynthesis used (plate or nail fixation), as well as by the location of the new fracture. A review of available literature found several proposed classifications and sets of guidelines for surgical treatment of PIFF [4, 8–11]. The aim of this paper is to present the surgical method of treating PIFF in a younger patient, with reference to the classifications and protocols recommended in literature for the surgical management of these types of fractures.

CASE REPORT

A 49-year-old patient was admitted to hospital due to pain in the left thigh, painful and limited movement of the left hip and knee and shortening of the left leg. He was injured from a fall on the same level, which occurred the day before he was admitted to the hospital. Physical examination and radiography of the pelvis and the left upper leg with the knee joint, in two directions, revealed the presence of a short cephalomedullary nail (Figure 1), a PIFF in the projection of

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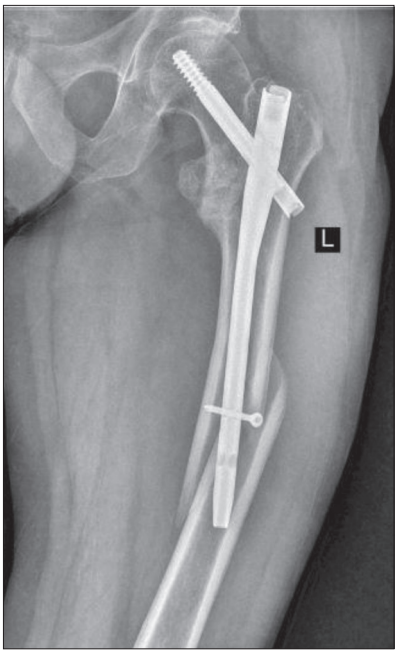

Figure 1. Radiography of the left hip joint and femur on admission; peri-implant femoral fracture at the level of the tip of the nail [source: PACS Bežanijska Kosa UHMC]

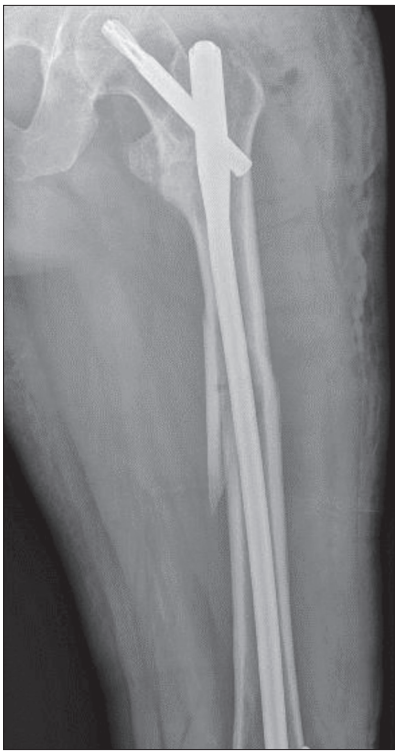

Figure 2. Radiography of the left hip and thigh on the first postoperative day [source: PACS Bežanijska Kosa UHMC]

Figure 3. Radiography of the distal end of the femur and the knee joint on the first postoperative day [source: PACS Bežanijska Kosa UHMC]

Figure 4. Radiography of the left hip and thigh two months after surgery [source: PACS Bežanijska Kosa UHMC]

Figure 5. Radiography of the left thigh and knee six months after surgery [source: PACS archive Bežanijska Kosa UHMC]

the tip of the nail, and marked knee joint degenerative changes which we classified as N1A type of fracture according to Chan classification. On admission to the hospital, the patient was fitted with an above-the-knee plaster splint, and analgesic, anticoagulation, and symptomatic therapy was administered. From the anamnestic data taken at admission, we learned that six months before the actual injury, the patient had sustained a pertrochanteric fracture of the left femur, which was treated with a short cephalomedullary nail, at a different hospital. Two years before, during the COVID-19 pandemic, he had sustained a fracture of the tibial plateau of the same leg. He was treated non-operatively at a different hospital, with above-the-knee cast immobilization, after which he developed peroneal nerve paresis. On admission to our hospital, on the X-ray we diagnosed post-traumatic arthrosis of the knee joint. Immediately after admission to the hospital we started with preoperative preparation and planning. An hour before the surgical procedure, two grams of cefazolin were administered. The operation was performed on the orthopedic extension table, with the use of fluoroscopy. We approached the tip of the greater trochanter along the old surgical scar. There we encountered the problem of identifying the proximal end of the nail, due to the fact that during the primary osteosynthesis an end cap was not inserted. After debridement and "release" of the tip of the greater trochanter, we attached the insertion handle, with fluoroscopic guidance. After this, we approached the lag screw through the old surgical scar, removed it, and did the same with the distal static screw. After that, we extracted the nail itself. The removed nail was 240 mm long, 11 mm wide, with a lag screw that was 105 mm long and with a 130° angle. After removing the nail components, swabs of the femoral neck and canal were

taken. With fluoroscopic guidance, we inserted, without femoral canal reaming, a proximal femoral antirotation nail (Proximal Femoral Nail Antirotation – PFNA ® – DePuy Synthes GmbH, Oberdorf, Switzerland), 420 mm long, 12 mm wide, with a 105 mm blade, and an angle of 130°; a distal static screw, 44 mm in length; and an end cap with extension 0 (Figures 2 and 3). Operative wounds were sutured in the standard manner. Physical therapy and rehabilitation of the patient began on the first postoperative day. Walking with crutches was permitted with non-weight bearing on the surgically treated leg. Postoperative recovery was uneventful, the dressings on the wounds were changed regularly, and they healed *per primam*. Swab samples taken intraoperatively were sterile. On the seventh postoperative day the patient was discharged in good general condition. The sutures were removed in the outpatient clinic of our hospital, on the 13th postoperative day. Upon the completion of stationary physical therapy, two months after surgery, the patient was ambulatory with the help of an axillary crutch, used with the opposite, i.e., right arm. Radiographic evidence of healing was visible (Figures 4 and 5) and the patient was, therefore, allowed to walk with full weight bearing on the surgically treated leg, with the support of a cane. At the six-month follow-up, the patient was able to walk independently, without walking aids, but complained of severe pain in the left knee.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written consent to publish all shown material was obtained from the patient.

DISCUSSION

A PIFF in the projection of the tip of the cephalomedullary nail indicates that there was a "stress riser" in that location [4]. Bearing in mind the anamnestic data confirming that directly before the fall the patient had been ambulatory without walking aids, but with pain and limited movement of the knee joint, as well as the X-ray of the injured upper leg and hip at admission, we concluded that the pertrochanteric fracture had healed. According to the proposed classification by Chan et al. [4], we classified this fracture in the N1A group, i.e., in group 32BNP according to Videla et al. [8, 9]. Therefore, as an option for surgical treatment, the possibility of replacing the short cephalomedullary nail with a long intramedullary nail was considered. However, removal of the lag screw would have left a "cavity" in the neck and would potentially represent a weak point at the primary fracture site, so although classified as N1A, we treated the fracture as an N1B type, which is in keeping with the recommendations [12]. Therefore, we decided to replace the existing short nail with a long cephalomedullary nail, with the same angle of 130°, but with a larger diameter (12 mm), without prior femoral canal reaming, because we took care not to damage the endosteal vascularization of the femur. Also, we locked the nail distally, as unlocked nails do not guarantee sufficient stability [13]. One of the potential methods of surgical treatment was the use of a distal femoral plate with locking screws and the use of cables, but due to the extensiveness of the approach and the presence of secondary, post-traumatic arthrosis of the knee joint, we abandoned that option. Considering the clinical and radiographic signs of post-traumatic knee arthrosis, the plan is to replace the degenerative joint with an artificial one. The inserted end cap will allow easier access to the tip of the greater trochanter and the nail itself. This will facilitate the removal of the cephalomedullary nail, which is necessary, in order to perform the implantation of a total endoprosthesis of the knee. PIFFs most often occur in the elderly population. In the case presented here, the most likely cause of PIFF due to low-energy trauma in a person of a younger age is a stress riser on the distal end of the nail combined with post-traumatic arthrosis of the knee joint, accompanied by severe pain and instability. By reviewing the available literature, we found that the patient was cared for in our hospital in keeping with all current recommendations for surgical treatment of these types of fractures. However, the replacement of a short nail with a long one, after PIFF at the tip of a short nail, may be associated with increased patient morbidity [14]. Surgical treatment of PIFF is a challenge because the fracture occurs in the presence of pre-existing non-prosthetic implanted material, often accompanied by osteoporosis, and there is also a high risk of iatrogenic fracture. All this becomes even more significant when we take into account the fact that orthopedic trauma associations still have no uniform position regarding the method of classification and the treatment protocol for these fractures.

Conflict of interest: None declared.

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Хируршко лечење периимплантних прелома бутне кости – приказ болесника и преглед литературе

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САЖЕТАК

Увод Периимплантни преломи фемура дефинисани су као преломи бутне кости уз присуство претходно уграђеног непротетског остеосинтетског материјала. Прегледом литературе установљено је да постоји неколико предлога класификација и водича за оперативно лечење периимплантних прелома фемура.

Приказ болесника Болесник стар 49 година повређен је падом на истом нивоу дан пре пријема у болницу. Анамнестички, на пријему, наводи да је шест месеци пре наведене повреде задобио пертрохантерни прелом леве бутне кости који је лечен хируршки, кратким цефаломедуларним клином. Две године пре пријема болесник је имао прелом горњег окрајка голењаче исте ноге, који је лечен неоперативно, натколеном гипсаном имобилизацијом. По санацији прелома дијагностикована је пареза перонеалног живца, док су накнадни прегледи открили секундарну, посттрауматску артрозу зглоба колена. Репозиција прелома и његова фиксација изведена је на екстензионом столу под контролом флуороскопа. Том приликом је одстрањен претходно имплантирани остеосинтетски материјал – кратки цефаломедуларни клин, а прелом је фиксиран дугим цефаломедуларним клином.

Шест месеци после операције болесник је могао да се креће самостално, без помоћи. Негирао је бол у левој препони и натколеници, али је наводио бол и ограничење покрета у зглобу левог колена.

Закључак Прегледом доступне литературе установили смо да је болесник у нашој установи збринут по свим тренутно актуелним препорукама за хируршко лечење овог типа прелома.

Кључне речи: пертрохантерни прелом; цефаломедуларни клин; периимплантни прелом