

REVIEW / PRACA POGLĄDOWA

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**FUNCTION OF ONCOLOGICAL ENDOPROSTHESIS  
IN RECURRENT OSTEOSARCOMA OF DISTAL FEMUR**

**FUNKCJA ENDOPROTEZY ONKOLOGICZNEJ W NAWROTOWYM MIĘSAKU  
KOSTNOPOCHODNYM DALSZEGO KOŃCA KOŚCI UDOWEJ.**

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**S u m m a r y**

Endoprosthesis is the commonly used method of segmental reconstruction after bone tumor resection around knee. To achieve stability after extensive removal of knee structures, hinged endoprostheses are usually being preferred as a limb salvage procedure. Despite advances in diagnostics and preoperative tumor chemotherapy and radiotherapy, as well as meticulous intraoperative preparation, local tumor recurrence is still possible. We analyzed 22 patients with osteosarcoma in distal femur who underwent the knee arthroplasty with modular replacement system between 2002 and 2007. Three of them (two females aged 33 and 44 and one male aged 29) developed local recurrence 7, 9 and 12 months after operation. All of them were offered the amputation or metastatectomy,

as well as further chemotherapy, and all refused. Reasons for refusal included disseminated disease, uncertain prognosis of amputation treatment and still good functional outcome despite existing tumor around the prosthesis. Two of the above mentioned patients deceased from disseminated disease 7 and 11 months later, one patient is still being followed 10 months long. Clinical examinations have shown the effective and satisfactory prosthesis functions in reported patients during the whole observation period. We have concluded that limb salvage surgery with implantation of hinged knee endoprosthesis in tumors in distal femur provide satisfactory functional outcome even when local tumor recurrence is found.

**S t r e s z c z e n i e**

Endoproteza jest powszechnie używaną metodą segmentalnej rekonstrukcji po resekcji guzów kości w okolicy stawu kolanowego. Dla uzyskania stabilności po rozległym usunięciu struktur stawu kolanowego, protezy zawiasowe są zazwyczaj preferowane jako procedury oszczędzające kończynę. Pomimo zaawansowanej diagnostyki i przedoperacyjnej chemioterapii i radioterapii guza, jak również drobiazgowego śródoperacyjnego preparowania, miejscowa wznowa guza nadal jest możliwa.

Przeanalizowaliśmy 22 pacjentów z mięsakiem kostno pochodnym dalszego końca kości udowej, którzy zostali

poddani endoprotezoplastyce poresekcyjnej stawu kolanowego z użyciem modularnego systemu pomiędzy 2002r. a 2007r. U trzech z nich (dwie kobiety w wieku 33 i 44 lata i jeden mężczyzna w wieku 29 lat) rozwinęła się miejscowa wznowa 7, 9 i 12 miesięcy po operacji. Zaproponowano im amputację lub resekcję wznowy, jak również dalszą chemioterapię. Wszyscy odmówili. Przyczynami odmowy były: rozsiana choroba nowotworowa, niepewne rokowanie po amputacji i wciąż dobry czynnościowy wynik pomimo istniejącego guza wokół endoprotezy. Dwóch z tych pacjentów zmarło z powodu rozsiajanego procesu nowotworowego 7 i 11 miesięcy później,

a trzeci chory był jeszcze obserwowany przez kolejnych 10 miesięcy.

Kliniczna ocena pokazała wydolną i zadawalającą funkcję endoprotezy u opisywanych chorych podczas całego okresu obserwacji. Stwierdziliśmy, że operacje oszczędzające

kończynę z wszczepieniem endoprotezy poresekcyjnej, zawiasowej stawu kolanowego w guzach dalszego końca kości udowej przynosi zadawalający wynik czynnościowy nawet kiedy występuje miejscowa wznowa guza.

**Key words:** Hinged prosthesis function, Limb salvage surgery, Osteosarcoma

**Słowa kluczowe:** funkcja endoprotezy zawiasowej, operacje oszczędzające kończynę, mięsak kostnopochodny.

## INTRODUCTION

Surgical treatment of both primary and metastatic malignant bone tumors has radically changed in recent years since modern imaging; reconstructive surgery techniques and above all pre- and postoperative chemotherapy protocols were put into use. However the problems connected with frequently seen late diagnosis are still the main reason for both local recurrence and metastatic disease as well, what clinically, usually brings bad final result. Contrary to soft tissue sarcomas, the primary process of tumor growth in bone develops in untypical, scheming pattern. The symptoms, especially pain may appear late, usually only when the periostium is locally damaged or pathological fracture appears. Other groups of patients can even present with advanced or neglected forms of benign and pseudoneoplastic bone tumors which in rare cases characterise with metastatic disease despite their slow growing process. Many clinical cases are regarded as those which may be potentially malignant or already metaplastic requiring other kind of therapy.

Endoprosthesis is the commonly used method of segmental reconstruction after bone tumor resection around knee. To achieve stability after extensive removal of knee structures, hinged endoprostheses are usually preferred as a limb-salvage procedure. Despite advances in diagnostics pre- and postoperative tumor chemo-therapy, radiotherapy and meticulous intraoperative preparation local tumor recurrence is still possible.

## MATERIAL AND METHODS

We analyzed 22 patients with osteosarcoma in distal femur who underwent en bloc resection of the tumor followed by the knee arthroplasty with modular replacement system between 2002 and 2007. The group of patients was composed of 12 men and 10 women and all of them underwent neoadjuvant chemotherapy protocol apart from planned surgical procedure. All surgical procedures had been planned individually before chemotherapy began. The margins of resection in femur varied between 8 and 10 centimeters and in cases with pathological fractures 10 and 15 centimeters. Safe margins were established by intraoperative pathology test. Following en bloc resection procedure we performed reconstruction of the distal femur and knee joint by means of The Global Modular Replacement System of Stryker in seventeen cases and Mutars Silver Coated Tumor System of Implantcast in five of them. Among

all operated patients, initially 6 presented with pathological fractures of distal femur which were caused by previous misdiagnosis or self negligence of the patient. However, in our center the presence of pathological fracture was neither the exclusion criteria for reconstructive surgery nor complete chemotherapy protocol.

We selected three patients with initial pathological fractures who developed later progression of the disease and lived with the recurrent tumor around the knee prosthesis.

In two individuals presenting with pathological fractures on admission (two females aged 33 and 44) we observed local recurrence respectively 7, 9 months after operation. In one male patient, aged 29, both local recurrence and metastatic disease was revealed 12 months after surgery. All of them had initial reconstruction with Silver Coated Mutars Tumor System (IC). They were finally offered the amputation or metastatectomy, as well as further chemotherapy, and all refused. The reasons for refusal included disseminated disease, uncertain prognosis of amputation treatment and still good functional outcome despite the tumor growth around the prosthesis. Two of the above mentioned patients, i.e. female 44 years, and male 29 years deceased from disseminated disease respectively 7 and 11 months afterwards, one female patient (33 years of age) is still being followed 10 months long (Fig. 1,2,3). In all, the study period in the first two cases was 16 and 23 months after surgery and in the last case it amounted 17 months. The evaluation of the limb function after performed wide femur resection and subsequent total knee replacement with described systems was based on the criteria of Musculoskeletal Tumor Society (MSTS) and Mankin's criteria. We also took the level of algia into consideration by usage of Visual Analogue Score (VAS) in patients with the recurrence at site of operation and tumor localised around the stem of prosthesis.

## RESULTS

In relation to the group of three described patients having had complications during the administered complex therapy we have noticed that clinical tests based on the MSTS and Mankin's criteria have shown the effective and satisfactory prosthesis functions. All three patients preserved the range of knee joint motion from 0 to 90 degrees and had been able to walk with full weight bearing on the operated limb nearly for the whole period. None of them complained of severe pain discomfort, dysbasia or needed any orthotic support. VAS was 4 in two cases and 5 in one. Two of the mentioned patients deceased from the disseminated disease (female 44 years, and

male 29 years) at 7 and 11 months respectively after the local recurrence or distant metastases had been diagnosed. They presented with significant gait impairment 14 days before death in the first case and 10 days before death in the other. The 44 year old lady died because of a secondary tumor (leukaemia) during complementary chemotherapy. The 29 year old man died of respiratory insufficiency due to multiple lung metastases. The third described female patient did not accept second look surgery aiming at broader resection or amputation. She also refused complementary chemotherapy but only accepted high dose radiotherapy which was administered immediately. The pain sensation was described as moderate especially on palpation in two patients who died. VAS results were 4 (female 44 yrs.) and 5 (male 29 yrs.). One female patient aged 33 who is still being observed has not had any tenderness around the implant, so far (VAS = 0).

## DISCUSSION

The essential question in treatment of osteosarcoma is a complete excision of the whole tumor. Undoubtedly, surgery should be carried out together with chemotherapy, which significantly lowers the risk of local recurrence and metastasis. Good long term prognosis of osteosarcoma treatment is nearly always achieved in cases in which complete tumor resection is possible. Especially in large, neglected tumors causing pathological fractures around knee it is frequently difficult to plan the extent of surgical resection fairly enough to remove the pathology with the safe margins and leave the sufficient bone stock for implantation of endoprosthesis. Another important issue is the surface of the implant and its contact reaction to surrounding tissues. In our Department we have approved of minimal 7 cm margin for intramedullary space and 5 cm for soft tissues considering intra or extra compartmental involvement. It means that distal metaphysis localization of osteo-sarcoma always requires the resection of the adjacent joint. In cases of limited possibility of resection with margins, some authors advise amputation or disarticulation of the affected extremity. We however, on the basis of other authors experience and studies (1,2,3,4,5,6) emphasize that at present a good response to preoperative chemotherapy can allow the conversion of previously unresectable tumor to resectable one (7,8,9).

Present methods of treatment using limb salvage techniques predominate over amputation. This approach was applied in the 80-ies when it occurred that the prevalence of local recurrence was not lower than in the case of amputees (1,10). Radical surgery is nowadays performed in cases of ascending infection, bone and soft tissue sarcomas of enormous size and distal localization in which removal cannot prognose healing and limb function recovery. In rare cases it may be regarded as palliative solution. The clinical examples of the above described three individuals, living with recurrent tumors around hinged knee endoprostheses are convincing argument

that such solutions can offer patients a chance to continue walking in spite of the advanced progression of the disease. We can say that all the operated knees with the modular replacement systems occurred to be fully functional for the whole period of the disease. Two of the patients who died had suffered from other organs or systems dysfunctions but the locomotor system, especially at the site of surgery was actually functional before the general weakness on terminal stage of the patient.

## CONCLUSIONS

We conclude that limb salvage surgery with implantation of hinged knee endoprosthesis in tumors and large defects of bone tissue in distal femur provide satisfactory functional outcome even when local tumor recurrence is found.

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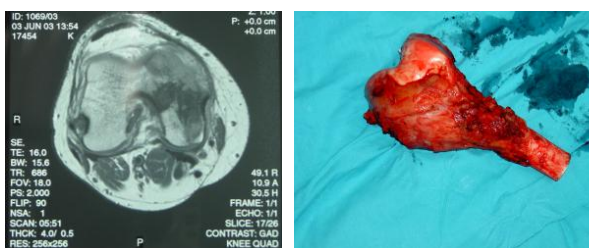


Fig. 1. Osteosarcoma G3 causing pathological fracture of distal femur in 29 year old patient. Initial and postoperative views.



Fig. 2. Recurrence around the stem of the MUTARS prosthesis in 33 female patient due to osteosarcoma G2.



Fig. 3. Osteosarcoma G3 in 44 year old lady deriving from the distal femur, infiltrating proximal tibia and the knee joint. Pre – and postoperative views (GMRS system).

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