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## CASE STUDIES

# Rehabilitation treatment of a patient with a hybrid hip endoprosthesis after osteosarcoma of the proximal femur - a case report

*Tratamentul de recuperare al unui pacient cu endoproteză hibrid de șold post osteosarcom al femurului proximal - prezentare de caz*

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**Abstract**

*Background.* Osteosarcoma is the most frequent primary bone tumor found in adolescents, the proximal femur being the fourth most frequent location of osteosarcoma. The rehabilitation of patients with osteosarcoma starts during the preoperative stage with a view to reducing the associated costs and pain, facilitating the early restoration of the function of the affected limb and the increase in the quality of life of these patients. The postoperative rehabilitation program is intense and can last up to one year according to some authors, its main objectives being: amelioration of pain, improvement of the range of motion and muscle tone, treatment of scars, prescription of medical devices, and improvement of the quality of life.

*Aim.* The aim of this study was to present the case of a 38-year-old patient with a hybrid endoprosthesis of the left coxofemoral joint for an osteosarcoma located in the lesser trochanter of the femur, in order to establish an adequate rehabilitation treatment.

*Methods.* The patient was diagnosed 16 years before with an osteosarcoma located in the lesser trochanter of the femur, for which he received neoadjuvant chemotherapy and surgical treatment with the resection of the proximal 1/3 of the femur, followed by arthroplasty.

Due to the ascent of the endoprosthesis, about 8 years later, revision surgery with a hybrid total endoprosthesis was performed.

The patient presented to the Clinical Rehabilitation Hospital Cluj-Napoca in March 2017, complaining of muscle weakness and decreased range of motion in the left hip, the tests applied being suggestive in this respect.

*Results.* The initiation of adequate rehabilitation treatment significantly improved the tested joint angles and muscle forces after two weeks of treatment.

*Conclusions.* Joint mobility and muscle strength were significantly improved, without reaching normal values.

**Key words:** osteosarcoma, rehabilitation treatment

**Rezumat**

*Premize.* Osteosarcomul reprezintă cea mai frecventă tumoră osoasă primară întâlnită la adolescenţi, femurul proximal fiind cea de-a patra localizare ca frecvență pentru osteosarcom. Recuperarea pacientului cu osteosarcom începe încă din faza preoperatorie în vederea reducerii costurilor şi durerii asociate, facilitând reluarea precoce a funcţiei membrului afectat și creșterea calității vieții acestor pacienți. Programul postoperator de recuperare este intens şi poate dura, după unii autori, până la un an, principalele obiective ale acestuia fiind: ameliorarea durerii, îmbunătăţirea amplitudinii de mişcare, a tonusului muscular, tratamentul cicatricilor, prescrierea dispozitivelor medicale şi îmbunătăţirea calităţii vieţii.

*Obiectiv.* Obiectivul acestui studiu este de a aduce în atenție cazul unui pacient în vârstă de 38 de ani cu o endoproteză hibrid la nivelul articulației coxo-femurale stângi pentru un osteosarcom localizat la nivelul trohanterului mic al femurului, în vederea stabilirii unui tratament adecvat de recuperare.

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*Metode.* Pacientul a fost diagnosticat în urmă cu 16 ani cu osteosarcom localizat la nivelul trohanterului mic al femurului, pentru care a urmat chimioterapie neo-adjuvantă și tratament chirurgical cu rezecția 1/3 proximale a femurului, urmată de artroplastie.

Datorită ascensionării endoprotezei, are loc după aproximativ 8 ani o intervenție chirurgicală de revizie, cu o endoproteză totală hibrid.

Pacientul se prezintă la Spitalul Clinic de Recuperare Cluj-Napoca în martie 2017, acuzând scăderea forţei musculare și amplitudinii de mișcare a șoldului stâng, testele aplicate fiind sugestive în acest sens.

*Rezultate.* Instituirea unui tratament adecvat de recuperare a îmbunătățit semnificativ unghiurile articulare și forțele musculare testate, după aproximativ două săptămâni de tratament.

*Concluzii.* Mobilitatea articulară și forța musculară au fost ameliorate semnificativ, fără a atinge valorile normale.

**Cuvinte cheie:** osteosarcom, tratament de recuperare.

## Introduction

Osteosarcoma (OS) is the most frequent primary bone tumor found in adolescents (Campanacci, 2013). With an annual incidence of 3.1 cases per 1 million population in USA, OS accounts for less than 1% of newly diagnosed cases in adults and 3-5% of these in children (Damron et al., 2012). A greater predominance is seen in the male sex, with the highest incidence between the age of 10 and 14 years (Dos Santos & Swerdlow, 1993). In 75% of cases, OS is located in the long bone metaphyses of the limbs (Miller, 1981). Currently, patients diagnosed with OS benefit from surgical treatment and postoperative neoadjuvant and adjuvant chemotherapy (Ferrari & Serra, 2015).

Many uncontrolled studies have demonstrated that an adjuvant and neoadjuvant chemotherapy program significantly improved the prognosis of patients with non-metastatic OS, increasing the survival rate from 60% to 70%, concomitantly with an increase in the rate of limb salvage surgery from 80% to 90% (Mittermayer et al., 2001). The combination of methotrexate, adriamycin and cisplatin has become the gold standard in North America and Europe. Some centers add ifosfamide, but recent randomized clinical studies have not evidenced an increased rate of survival (Ferrari et al., 2012).

Before starting chemotherapy, OS should be subjected to biopsy for the identification of the histological type and grade. Percutaneous biopsy techniques for the diagnosis of bone and soft tissue lesions have been used since the late 1970s. Even if percutaneous biopsy is more specific for the obtaining of tissue in order to establish histological diagnosis, surgical biopsies are more frequent, being performed en bloc to reduce the risk of local recurrence (Ayala et al., 1989).

The proximal femur is the fourth most frequent location of osteosarcoma. Most of the tumors located at this level can be approached by surgery, because femoral vessels, the crural and sciatic nerves are rarely involved (Ecurad et al., 2013).

For a long time, amputation was considered to be necessary for local tumor control, but this has changed over the past two decades due to progress made in oncology, imaging, as well as to reconstruction techniques, which have made limb salvage surgery more feasible (Li et al., 2016). Currently, 85% of all OS cases can be resected and reconstructed, with the preservation of the affected limb and its function (Marulanda et al., 2008). Many studies show a 67-90% survival rate of patients with endoprostheses after osteosarcoma at 5 years from surgery (Grimer et al., 2016). Current limb salvage techniques include reconstruction using a bone graft (Enneking & Mindell, 1991), an endoprosthesis (Cheng & Gebhardt, 1991) or a hybrid prosthesis (Eckardt et al., 1991).

A frequent complication of hip endoprostheses is dislocation, with a rate varying from 1.7% to 20%. This is due to extensive resection of soft tissues around the joint and capsule (Gosheger et al., 2006).

Osteosarcoma located in the proximal femur requires resection and reconstruction of the hip joint and proximal femur. The use of both megaprostheses and alloprosthetic composites has favorable results (Zehr et al, 1996). Sometimes, for certain reconstructions, a bone graft in conjunction with an endoprosthesis is used. An adequate graft is selected and implanted to replace the resected bone segment. The articular surfaces of the graft are excised and replaced using conventional total arthroplasty techniques. The bone graft is a source for tendon insertions, while the prosthesis ensures a reliable and stable joint and a support for the bone graft. A graft-prosthesis construction has a lower fracture rate and is not susceptible to osteoarthritis (Muscolo et al., 2006).

The rehabilitation of patients with OS starts during the preoperative stage in order to reduce the associated costs and pain, facilitating the early restoration of the function of the affected limb and the increase in the quality of life of these patients (Karasek et al., 1992).

The postoperative rehabilitation program is intense and can last up to one year, according to some authors (Fulton, 1994). Its main objectives are: amelioration of pain, improvement of the range of motion and muscle tone, treatment of scars, prescription of medical devices if necessary, and not least, improvement of the quality of life by minimizing the limitations in activities of daily living caused by the disease and associated treatments (Lambert & Sugarbabker, 1992).

The principles of the rehabilitation program are:

1. During the first 6-8 weeks, the patient should avoid adduction, flexion more than 90° and internal rotation of the hip.
2. The limb has a tendency to external rotation because the external adductors and rotators are attached in a shorter position during surgery, which is why the limb must be maintained in a neutral position with a splint.
3. Exercises for the improvement of the range of motion of the hip and knee joints.
4. Maintenance of muscle tone: progressive, within the

limit of tolerance during the first 4-6 weeks, consisting of isotonic contractions. After the early postoperative period, both open and closed kinetic chain exercises are indicated.

5. Ambulation: the patient will use a walker or crutches for 6-12 weeks, then a cane (Lewis, 1992).

## Hypothesis

We present the case of a 38-year-old male patient with total hip endoprosthesis after resection of an osteosarcoma located in the left proximal femur as a model for postoperative management of rehabilitation treatment.

## Material and method

The study was carried out according to current deontological laws, with the approval of the Ethics Committee of the "Iuliu Haţieganu" University of Medicine and Pharmacy, after the patient gave his written informed consent.

*Research protocol*

*a) Period and place of the study*

In March 2017 the pacient presented to Clinical Rehabilitatiom Hospital Cluj-Napoca for the rehabilitation of muscle weakness and decreased range of motion in the left hip.

*b) Subject*

We present the case of a 38-year-old male patient who attended the our hospital for the rehabilitation treatment.

The current disease started insidiously in April 2001 with mixed pain in the left coxofemoral joint (CF), irradiating to the inguinal area, increased by effort, refractory to ordinary analgesics.

In November 2001, the patient observed an aggravation of symptoms, with a progressive limitation of hip joint mobility, for which reason he presented to the service of Orthopedics of the Cluj County Emergency Hospital in Cluj-Napoca. A pelvic X-ray for CF was performed and a tumor mass was described in the left lesser trochanter. Subsequently, bone scintigraphy was indicated, which described a single area with increased pathological uptake in the left lesser trochanter. Following the investigations performed (X-ray and bone scintigraphy), surgical biopsy under spinal anesthesia was decided, with en bloc resection of the tumor for histopathological examination.

Anatomo-pathological examination described a malignant tumor process, in which the proliferated cells (osteoblastic in nature, presenting atypias) directly produced bone spicules, among which many vessels of various calibers, as well as osteoplasts and fibroblasts were present, an appearance suggestive of telangiectatic osteosarcoma.

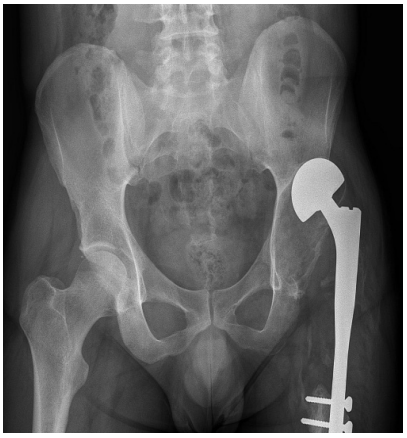
Given the established diagnosis, the patient presented to the "Ion Chiricuţă" Oncology Institute Cluj-Napoca, where neoadjuvant chemotherapy was initiated according to the protocol of the Rizzoli Institute: high dose methotrexate with folic acid protection - week 0, 4, doxorubicin + cisplatin - week 1, ifosfamide + cisplatin - week 5, 8.

In February 2002, the patient was scheduled at the Clinic of Orthopedics Timişoara, where he underwent resection of the proximal 1/3 of the left femur and total joint arthroplasty with bipolar Kent prosthesis (Fig. 1).

**Fig. 1 –** X-ray of the left hip (AP), February 2002. Bipolar Kent endoprosthesis

Postoperatively, the patient received adjuvant chemotherapy, 6 cycles, with complete remission.

In March 2010, the patient presented to the service of Orthopedics Cluj-Napoca for pain and functional impotence of the left lower limb. Radiographic and scintigraphic examination supported the ascent of the prosthesis, without other images suggesting a primary bone tumor (Fig. 2a, 2b).



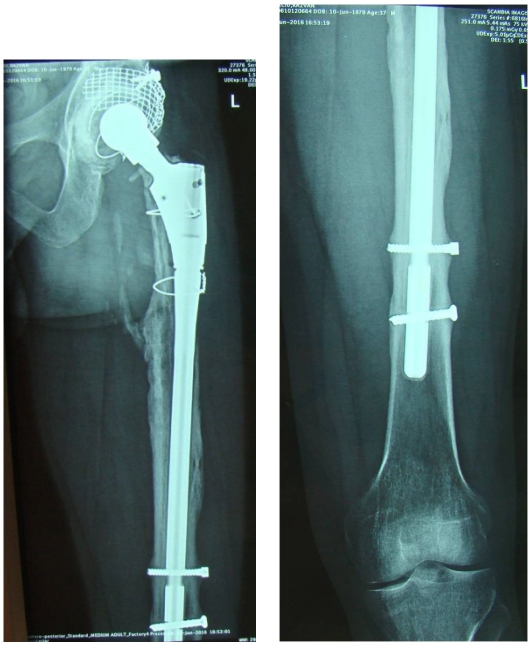
**2a** **2b**

**Fig. 2a –** Pelvic X-ray for CF (AP), March 2010
**Fig. 2b –** X-ray of the left distal femur (AP), March 2010

Surgery was recommended, which was performed in May 2010 at the Elias Emergency University Hospital Bucharest. Revision surgery was carried out with reverse hybrid total hip arthroplasty, with a modular femoral component and augmentation of the cotyle with external bone graft and mesh, augmentation of the femur with massive bone graft fixed by cerclage (Fig. 3a, 3b).

In March 2017, on general and local objective examination, the following were found: BMI=22.5, good general state, L-S spine: mild dextroconvex scoliosis, effaced lordosis, left CF: postoperative scar in the proximal

1/3 of the left hip, left thigh circumference at 10 cm from the patella = 40 cm, at 20 cm from the patella = 49 cm, right thigh circumference at 10 cm from the patella = 42 cm, at 20 cm from the patella = 52 cm (Table I), the difference in length between the lower limbs was about 1 cm, measured from the umbilicus to the internal malleolus (92 cm the left lower limb, 93 cm the right lower limb).



**3a** **3b**

**Fig. 3a –** X-ray of the left hip (AP), May 2010
**Fig. 3b –** X-ray of the left distal femur (AP), May 2010

**Table I**
Thigh circumference of the lower limbs

| Length | Left thigh circumference | Right thigh circumference |
|---|---|---|
| At 10 cm from the patella | 40 cm | 42 cm |
| At 20 cm from the patella | 49 cm | 52 cm |

*c) Tests applied*

Hip joint and muscle assessment at the time of presentation in our clinic were evaluated using goniometry which showed a limitation of active mobility in the left hip.

Considering these aspects, the patient was proposed and underwent a complex and individualized rehabilitation treatment; its objectives were the improvement of muscle strength and range of motion, the correction of walking, and the increase in the quality of life.

The patient received kinesiotherapy complemented by hydrokinesiotherapy, toning massage of the lower limb, occupational therapy, for two weeks, with a favorable evolution of the tested joint angles and muscle forces.

The kinesiotherapy program included exercises for the increase in the range of motion of the hip joint, endurance exercises, muscle stretching exercises for the gluteal and quadriceps muscles, closed kinetic chain exercises for stabilization and coordination, recovery of standing and walking with progressive loading. A kinesiotherapy session lasted for 30 minutes, and was performed twice a day.

Hydrokinesiotherapy brought the benefits of mobilization in water (30 minutes daily), while massage, in addition to its local and general effects, improved the patient's psychological state. Occupational therapy was mainly aimed to recover walking, being performed daily for 30 minutes.

The patient continued the kinesiotherapy program at home, daily, being followed up every 3 months.

## Results

Initial evaluation of the left hip revealed: flexion 110$^o$, abduction 25$^o$, internal rotation 20$^o$, external rotation 30$^o$. The passive range of motion was 5-10$^o$ greater, without reaching normal values for the coxofemoral joint.

Testing of the iliopsoas, as the main thigh flexor muscle in the pelvis, evidenced a 4 out of 5 strength, testing of the middle gluteal muscle showed a 3 out of 5 strength, and the pelvitrochanteric muscles (as external rotators) and the internal rotators of the hip also had a reduced strength, with values of 4 out of 5 strength degrees.

After three months from the initial evaluation active flexion of the hip was 120$^o$, abduction 30$^o$, internal rotation 30$^o$, external rotation 35$^o$.

Also improve muscle strength, testing of the middle gluteal muscle became 4 of 5 strength, other muscle groups reached the addition of 4 addition of 5 strength degrees.

So we can say after 3 months of intens rehabilitation the patient was able to stand and walk without using assistive walking divaces, to maintain balance, there were observed an improvement of muscle strength and range of motion and also an improvement in the quality of life**.**

## Discussions

The rehabilitation of patients with OS depends on its anatomical location and the type of surgery, either limb salvage with reconstruction or amputation (Lane et al., 2001).

Reconstructions with allografts remain fragile for a long time period. In addition, because of surgery and chemotherapy, these patients are at risk for complications such as: decrease in the range of motion, reduction of muscle strength, poor motor control, difference in the length of the limbs, pain, complications that may affect the activities of daily living as well as quality of life (Yadav, 2007).

Studies have demonstrated that adherence to a strict, well documented program in accordance with the anatomical location of OS can significantly improve the functional status of these patients (Shehadeh et al., 2013).

Regarding the use of electrotherapy for the purpose of analgesia or neuromuscular stimulation in these patients, there is no consensus as to its usefulness, the type of electric current or the timing of this therapy.

The particularity of the case resides in the anatomical location of the tumor in the lesser trochanter of the femur, which makes it more difficult to approach and requires complex and laborious surgery, which caused the ascent of the first endoprosthesis, with the subsequent reconstruction of the acetabulum and proximal femur.

## Conclusions

1. The rehabilitation program should be adapted to the location of the osteosarcoma and the type of surgery, and should be continued until the therapeutic objectives are reached.

2. Successful limb salvage and reconstruction surgery requires an intense and complex rehabilitation program.

3. The impact of physiotherapy is predicated on an ability to preserve those structures necessay for function, to match patient expectations with oncologically appropriete treatment and to designe a rehabilitation programe that can be followed in the long term to sustain function.

### Conflicts of interests

There are no conflicts of interest.

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