

# Particular Characteristics of Medical Rehabilitation in Patients Operated for Osteoarticular Tumors according to the Campanacci Method

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## ABSTRACT

*The modern treatment of the osteoarticular tumors requires a multidisciplinary approach. Due to their proximity to major neural and vascular pathways, to the fact that they affect young people, as well as because they can permanently impair the functionality of the limb, the preoperative assessment of the patients must be performed in detail (physical, imaging, biochemical and histological examination) in order to prepare for the surgical procedure with a minimum impact on the quality of the life of the patients. In the last 5 years, in the Clinic of Orthopedics of the Universitary Emergency Hospital of Bucharest 7 patients, aged between 25 and 40 years, with giant cell tumor were operated, the sex ratio being F/M : 5/2. The surgical procedures were radical, followed by adjuvant treatment and supportive therapy. The decision to follow a certain treatment must be taken with the full consent of the patient, taking into account the requirements of his/her daily life. The surgical intervention must have the full support of the teams of kinesi therapists, psychologists/psychiatrists and social worker. In these situations, the social integration was faster and the arthrodesis, as a therapeutic stage, was more easily accepted.*

**Keywords:** osteoarticular tumors, rehabilitation, arthrodesis, modular prosthesis

## INTRODUCTION

**T**he treatment of musculoskeletal tumors always requires a multidisciplinary approach, the involvement of a team made up of an orthopedic surgeon, a radiologist, a pathologist, a kinesi therapist and, according to the case, a

radiotherapist, an oncologist and a psychologist/psychiatrist. It is very important for the surgeon to observe the principles of oncological surgery, for the radiologist and the pathologist to be experienced in the diagnosis of tumors of the bones and soft tissues alongside with the oncologist, who will coordinate the adjuvant treatment. The chances of a successful treat-

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ment increase considerably when the therapeutic team includes physical therapy and psychological support programs (1).

The medical history and the physical examination as initial examinations have particular importance for the assessment of the patient with musculoskeletal tumors, the main complaint at onset being either progressive pain, at rest or at night, in the case of malignancies as well, or pain related to physical activities, when the benign tumors are large enough to weaken the resistance of the bone. Besides the description of the characteristics of the tumor (size, adherence to the planes, density, local temperature, consistency, localization), it is also necessary to assess the peritumoral muscular atrophy, the neurological deficits, as well as those of the local blood circulation.

The investigation of patients with musculoskeletal tumors must include simple X-rays of the affected region. Frequently, such X-rays, corroborated with the age of the patient and the localization of the tumor, are enough to make an accurate diagnosis. However, in order to obtain a good preoperative planning for the purpose of determining the degree of resectability, the tumoral invasion into the adjacent tissues must be assessed, as well as the relation with the large vessels and local neural pathways, and its vascularisation. In such a case the X-rays examination must be completed with a CT scan, an MRI, Doppler ultrasound, ultrasound, other examinations required by the suspicion of distance metastases (bone scintigraphy, chest X-rays). A possible biopsy must be preceded by a detailed clinical and paraclinical investigation.

Enneking proposes the following classification of musculoskeletal tumors (1).

Among benign tumors, some can be only occasionally aggressive, their aggressivity being placed in between that of purely benign tumors (such as osteoid osteoma) and that of malignant tumors such as osteosarcoma.

Giant cell tumors can occasionally have an aggressive behaviour. This type of tumor represents approximately 5% of the total number of bone neoplasms and is found in patients aged between 20 and 40 years, with a slight predominance for the female sex. It is a lithic tumor, more frequently localized at the level of the long bones, especially the distal femur and the proximal tibia (Figure 1). The third localization in point of frequency is the distal radius, in this case presenting with increased aggressive-

ness (Figure 2). Except for the sacrum, other localizations are rare (2).

Although giant cell tumors are individual lesions, in 1-2% cases they can be synchronous or metachronous multicentric. It is not clear if multicentricity represents multiple primary lesions or bone metastases of the primary lesion. In 3% of the patients, lung metastases may occur, and the mortality rate in these cases is of 15% (2).

In the rare cases (5%) in which giant cell tumors are malignant, these can be classified as primary or secondary. Primary tumors are defined as sarcoma occurring in the typical lesions of the giant cell tumor, whereas the second category is secondary to primary tumors (3).

The histopathological diagnosis is confirmed by the presence of the giant cells with 40 – 60 nuclei surrounded by mononuclear stromal cells with identical nuclei with those in the tumoral cells, besides the macrophages, bone-forming areas or secondary aneurysm osteal cysts. The attempts of histological classification (grading) have proved to be without prognostic significance (4). □

**MATERIALS AND METHOD**

During the period 2007 – 2011, 7 patients, aged between 25 and 40 years, diagnosed with giant cell tumor were treated in the Clinic of Orthopedics I of the University Emergency Hospital of Bucharest. One of the 7 cases was a relapse after a surgical treatment performed in another department.

BENIGN			
1. Latent			
2. Active			
3. Aggressive			
MALIGNANT			
Stage	Grading	Localization	Metastases
IA	Low	Intracompartmental	No
IB	Low	Extracompartmental	No
IIA	High	Intracompartmental	No
IIB	High	Extracompartmental	No
III	Indifferent	Indifferent	Regional / at a distance

TABLE 1. Classification of musculoskeletal tumors according to Enneking



**FIGURE 1.** A, B: AP X-rays, respectively ML of the knee showing a lithic image at the level of the medial condyle. C: T2 axial MRI D: T1 MRI in frontal plane showing the extension of the lesion at the level of the joint, a typical case for the giant cell tumor (2).

The female – male ratio was 5/2, in 5 cases the localization of the tumor was at the distal level of the femur, and in the 2 cases the localization was at the proximal level of the tibia.

At the physical examination, all the patients initially complained of progressive pain, during physical activity, which subsequently extended also during rest, as well as a significant regional deformation (Figure 3).

Although the physical and radiological examinations (Figure 4) were suggestive, in all 7 cases the diagnosis was made with certainty by

the histopathological examination of the tumor fragments from the biopsy.

The treatment of choice in the case of giant cell tumors is the surgical intervention performed to completely remove the lesion. Many patients with such tumors successfully benefited from the treatment with intralesional procedures (removal of the tumor by curettage, instillations with phenol, application of liquid nitrogen etc), while in other cases the same type of tumors progressed to metastases and had a fatal evolution (2).

In the case of the patients treated in the clinic of the University Emergency Hospital of Bucharest the surgical intervention was intended to be radical, both from the desire to avoid secondary lesions and relapses, and because of the size and extension of the tumor.

For the preparation of the surgical intervention, the following were evaluated:

- The extension at the level of the joint (Figure 5),
- The invasion of the adjacent tissues (Figure 6),
- The existence of bone and distance metastases (Figure 7),
- The vascularization of the tumor (Figure 8)

In 6 of the 7 cases the total removal of the tumor was performed and the remaining bone fragments were stabilized with orthopedic cement (playing a double role, cytotoxic and for resistance) and osteosynthesis material (Figure 9) with internal fixation. A modular prosthesis was used in one case (Figure 10).

Four issues which must be dealt with by the surgery of osteoarticular tumor have been identified (1):

1. Will the survival of the patient be affected by the treatment selected/applied?



**FIGURE 2.** X-ray in AP plane of distal radius of a 36-year old woman, suggesting a giant cell tumor (1)



**FIGURE 3.** Strong regional deformation in patients with giant cell tumor at the level of the distal femur / proximal tibia

2. What is the short term and long term morbidity ratio?
  3. What will be the functionality of the limb treated in a conservative manner (pre-served) as against a limb with prosthesis?
  4. What are the psychosocial consequences?
- All these aspects must be discussed with the patient before surgery, so that the decision



**FIGURE 4.** X-rays examination AP and ML of the knee; giant cell tumor at the level of the proximal tibia



FIGURE 5. CT scan and 3D reconstruction to show the extent of the tumor at the level of the joint



FIGURE 6. The tumor infiltrates the femoral-patellar space and the Hoffa fat. Cortical breach also in the popliteal space

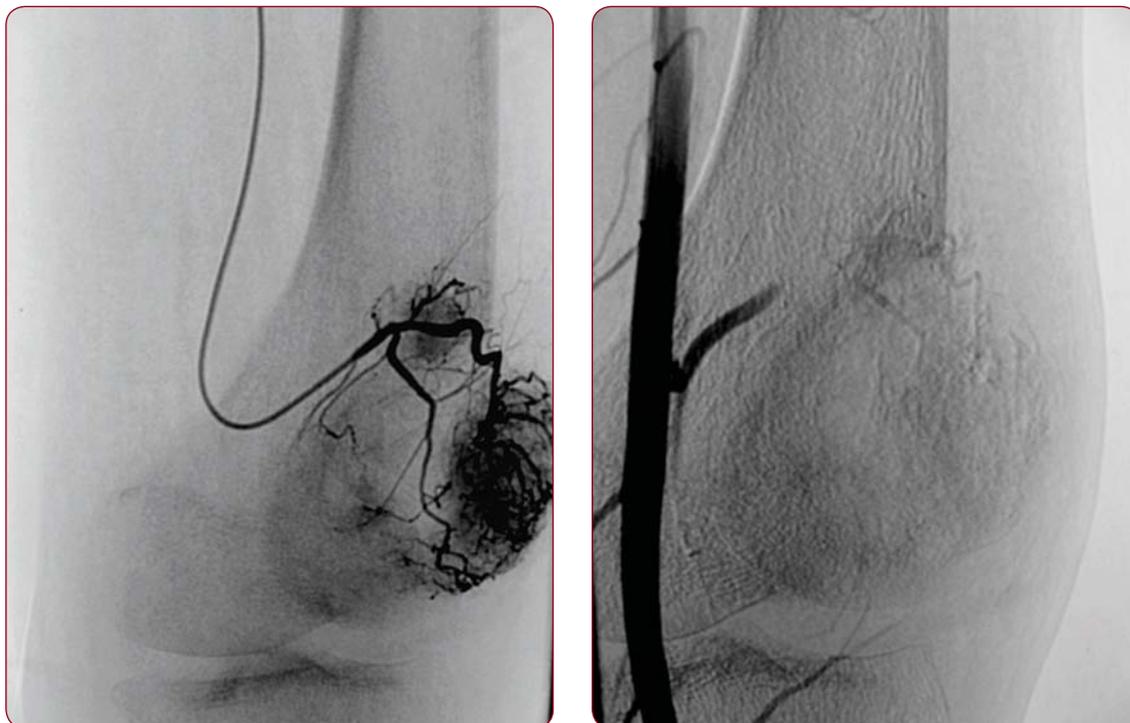
might represent the best solution for the patient. This solution can be different for every patient, according to his/her medical and social education, sex, religion, age etc.

Although from the surgical point of view the wound did not raise any particular problems, the extent of the surgical intervention led to a significant functional deficit which required a special medical rehabilitation program.

This program was managed by the kineto-therapy team of the clinic and consisted in the re-education of walking through the gradual



FIGURE 7. Existence of bone and distance metastases using bone scintigraphy. Capture at the level of the femoral condyle. No other capture areas can be seen



**FIGURE 8.** Substraction angiography of the limb: loading at the level of the tumor through the superior lateral genicular artery; embolisation with a fragment of gelasan; absence of loading post-embolisation

loading of the pelvic limb, the retoning of the muscles, mainly by performing isometric movements, and, secondarily by physiotherapy. The assessment of articular, muscular and coordination deficiencies of the lower limbs is performed by the gait analysis. Although separate evaluations of the muscular groups or joints are within normal range, a complete recovery shouldn't be considered unless a normal gait is achieved.

Kinetherapist's major goal is to try everything to get the patient back to the normal mobility, the issue that counts the most in the patient's quality of life.

**THE REHABILITATION ALGORITHM AFTER RADICAL SURGERY FOR OSTEOARTICULAR TUMORS ACCORDING TO THE CAMPANACCI METHOD**

**48 hours postoperatively**

- The proclive position of the lower limb reduces the postoperative edema
- Active movements of the ankle and toes prevents the tromboembolic complications
- Pain management with medication and pain relief position of the limb (20° of knee flexion when a modular prosthesis is used)

- Isometric muscular contractions
- 3<sup>rd</sup> day postoperatively**
- Increasing the joint mobility and active bed side mobilization
- Progressive loading of the limb using the crutches
- Increasing the muscular strength and the walking perimeter
- The patient should try to gradually introduce all the movements performed in a regular life style (sitting, getting up, standing, getting on/off the bed...).

**21 days postoperatively**

- Exercises to continuously increase the muscular strength through isometric contractions with progressive resistance against
- Gait control, complete loading. ◻

**RESULTS AND CONCLUSIONS**

In all the cases the healing was obtained and there were no relapses or secondary post-ablation determinations.

The level of the pain was assessed both preoperatively and postoperatively using the Visual – Analogue Scale (Figure 11), and a decrease was noted from a preoperative average of 8 to

an average of 3 in the first week postoperatively.

A particular aspect of the rehabilitation of the patients after this surgical intervention is the psychosocial one, as the immobilization of the joint of the knee by arthrodesis can lead, in some patients, to conflict states or depression. The support of the specialists in liaison psychiatry can avoid these situations which delay the physical rehabilitation and social integration of the patient. When a modular prosthesis is implanted, the following factors should be considered: the joint mobility, the joint stability (and the muscular strength of the adjacent muscles) and the gait characteristics. The exercises performed aimed exactly the recovery of the natural gait's patterns erased by the lack of use due to the patient's condition (flexion – extension, heel to toe rolling, complete loading etc).

In general, a good psychological preoperative preparation and the complete involvement of the patient in the subsequent therapeutic decision lead to better therapeutic results. In the case of the patient for whom the modular prosthesis was used for the reconstruction, his state of mind was better than that of the patients for which arthrodesis was used. On the other hand, in the cases where the patients decided to accept arthrodesis based on good information from the therapeutic team, the results of the daily physical activity and the social integration were considered successful (5).

An important aspect of bone reconstruction "in expectation" for the treatment of osteoarticular tumors is the shortening of the operated limb by approximately 2 – 4 cm. During the "in expectation" period this inequality must be compensated, using orthopedic methods, both



FIGURE 9. Osteosynthesis material with internal fixation



FIGURE 10. Modular prosthesis

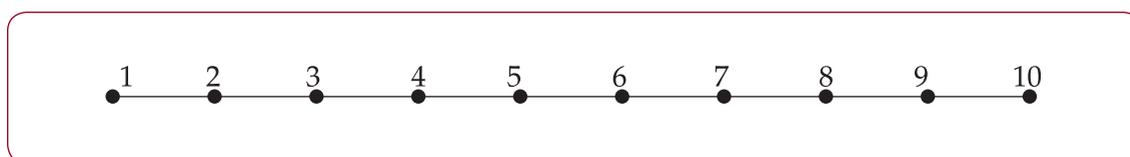


FIGURE 11. Visual analogue scale

to improve the patient's quality of life and to avoid the secondary imbalance of the pelvis.

When comparing the medium term results of amputation, arthrodesis and arthroplasty for tumors of the knee it was noticed that the patients with amputation had difficulty in walking on steep, rough or wet surfaces, but were active and the least afraid of injuring the amputated limb. The patients with arthrodesis performed even physical activities requiring exertion (work or leisure), but encountered difficulties when sitting down especially in narrow spaces (cars, theatre etc). The patients with arthroplasty generally led a more sedentary life and were more protective of their limb. However, they encountered the least difficul-

ties in performing their daily activities. Moreover, these patients were the least conscious of their disability (2).

To conclude, the improvement of the results of the rehabilitation of the patients after a surgical intervention of reconstruction in expectation for osteoarticular tumors using the Campanacci method is contingent upon the multidisciplinary approach of the treatment, the involvement of the patient in the surgical decision-making process through good information on the course of the treatment and the importance of kinesitherapy, on a doctor – patient relation based on trust and especially on a rapid social integration.

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