

## **Management of Primary Malignant Bone Tumors of the Knee**

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### **Authors' contributions:**

*This work was carried out in collaboration among all authors. Author CEE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MR, AM, MR and AG managed the analyses of the study. Author MB managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Primary malignant bone tumors appear to be preferentially located around the knee, but they remain rare. The prosthetic treatment of these tumors is experiencing a significant rise today, both technically and technologically.

We report retrospective study of nine cases of primary malignant knee tumors, patients with extra-articular bone damage or a tumor dependent on soft tissue were excluded. The average age was 21 years. Radiological and extension assessments were carried out in all patients. The average follow-up was 30 months.

The treatment consisted in all patients of pre and post-operative chemotherapy, associated with a carcinological monoblock resection, and reconstruction by total massive cemented knee prosthesis. There was only one case of local recurrence, treated by a secondary mid-thigh

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amputation. Functional results according to Lysholm's score were excellent in 77,78% of cases and middling in 22,22% of cases. Multidisciplinary management with early diagnosis, appropriate extension assessment, and conservative surgery on two steps with a period of observation, gives better results.

*Keywords: Knee; malignant tumors; treatment.*

## 1. INTRODUCTION

Primary malignant bone tumors are rare, they represent less than 1% of malignant tumors in adults, and 5% of those in children [1], however location around the knee remains the most common [2]. After the age of 50, a secondary tumor should be mentioned first.

History, image examination, and histopathological analysis compose the essential tripod of the diagnosis of bone tumors [3].

The treatment of patients by a multidisciplinary team is the guarantee of optimal management. Thanks to the progress of onco-surgery, conservative treatment now holds an essential place in the management of these tumors.

The aim of our work is to review the diagnostic, therapeutic and evolutionary characteristics of these malignant knee tumors.

## 2. METHODOLOGY

### 2.1 Patients and Methods

We report a retrospective study of nine cases of primary malignant knee tumors collected at the orthopaedic traumatology department of the university hospital Ibn Rochd in Casablanca over a five-year period from January 2016 to December 2020.

We included patients with primary malignant bone tumor of the knee, with an epiphyseal or metaphyseal location, treated by resection and prosthetic reconstruction. We excluded patients who died before surgery, secondary bone tumor, exclusively diaphyseal tumors, and primary malignant tumors from the soft tissue with bone invasion.

Data entry was carried out using Excel software. A descriptive analysis (average and percentage) was then carried out on the same software.

These were five men and four women with an average age of 21 years (extreme: 17-46 years).

The time elapsed between the onset of symptomatology and diagnosis was on average four months and half (extremes 2 and 18 months).

On clinical examination, pain and swelling were reported by all patients, functional impotence was found in six patients, impairment of the general condition was noted in three cases, amyotrophy and joint effusion in two patients, no cases of nerve-vessel compression have been reported.

Each patient received a radiological assessment including: standard X-ray (Fig. 1), a computerized tomography (CT scan) to better study bone damage (Fig. 2), a magnetic resonance imaging (MRI) to assess locoregional invasion (Fig. 3), and an extension assessment. Radiographic signs are reported in Table 1.

The tumor was present at the distal femur in four cases, and at the proximal tibia in five cases.

For the extension assessment we performed: a thoraco-abdomino-pelvic CT scan that revealed in a patient a pulmonary micronodule and it was without particularity in the rest of the serie. Bone scintigraphy of the four osteosarcoma cases did not show any other locations.

For all patients, biopsy was performed that confirmed the histological type of tumors (Table 2).

**Table 1. Radiological signs**

Radiological signs	Cases number
- Osteolytic lesion	5
- Ostéocondensation	3
- Mixed lesions	1
- Cortical rupture	2
- Soft tissue hyperdensities	1

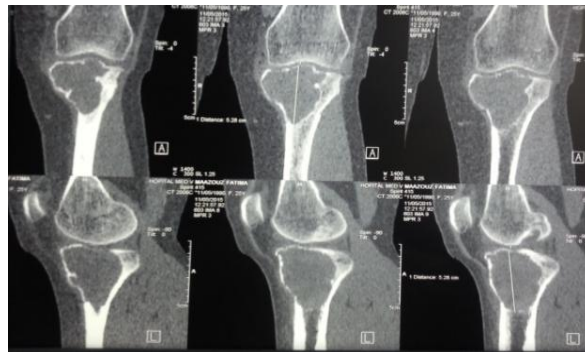
**Table 2. Histological type after surgical biopsy**

<b>Histological type</b>	<b>Cases number</b>	<b>%</b>
- Osteosarcoma	4	44,45
- Chondrosarcoma	3	33,33
- Synovialosarcoma	1	11,11
- Giant cell tumor	1	11,11
Totale	9	100

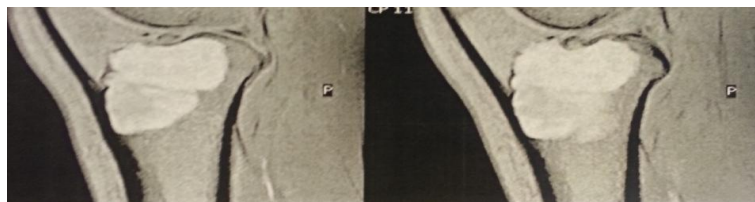
**Iconographies**



**Fig. 1. Osteolytic lesion of proximal tibia**



**Fig. 2. CT scan of the lytic image**



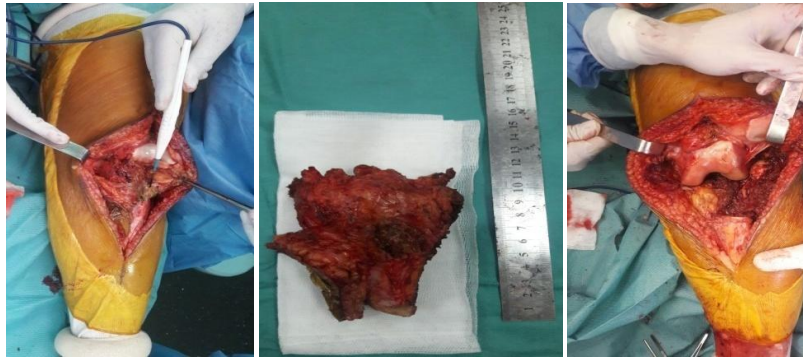
**Fig. 3. MRI control**

**3. RESULTS**

The management of these tumors consisted of pre- and post-operative chemotherapy, associated in all patients with conservative surgery. The internal para-patellar approach was used in all patients.

The treatment took place in two steps, and consisted in first of a monoblock carcinological resection, succeeded after six months of observation by a reconstruction with massive total cemented knee prosthesis (Fig. 4).

Patients were assessed after an average decline of 30 months (extremes: 10–38 months).



**Fig. 4. Monoblock resection**



**Fig. 5. Radiological control of knee reconstruction**

Functional results according to Lysholm's score were excellent in 77.78% of cases and middling in 22.22% of cases. There was only one case of local recurrence in a patient with chondroblastic osteosarcoma treated by a secondary mid-thigh amputation. Two patients developed pulmonary metastasis treated with lobectomy and adjuvant chemotherapy.

In our study no cutaneous or nerve complications, neither any postoperative infection were noted.

#### **4. DISCUSSION**

The most common malignant bone tumors are osteosarcoma, which accounts for 20% of the malignant bone tumors, and is found in 60% of the knee [4], followed by Ewing's sarcoma (16% of the malignant tumors, and 15% of the knee [5]). They reach the child and the young adult. Chondrosarcoma accounts for 11% of malignant bone tumors and 8% of knee tumors [6].

Analysis of the results of literature and those of our study shows that early diagnosis is an

important prognostic factor, in particular the resectability of the tumor, the initial volume and the response to neoadjuvant chemotherapy [7,8].

The MRI provides a better understanding of local lesion extension and defines resection planes and safety margins. Thanks to this evolution of imaging associated with surgical techniques, as well as the introduction of chemotherapy, conservative treatment is currently possible in about 80% of cases [9]. The current challenge is not only to ensure the survival of the patient but also the assurance of a satisfactory function of the limb in the long term. Many authors have shown that when a conservative action was technically possible, there was no difference in survival with amputation. Such treatment is therefore preferred [9].

Tumor removal must be carcinological and broad. Several method of reconstruction have been reported in the literature (Table 3) [5].

The survival of implants varies between 90% and 50% after 10 years, regardless of the model and the histological type [10,11].

**Table 3. Reconstruction methods**

Serie	Cases number	Reconstruction method
- M. Meherzi[13]	26	26 massive prosthesis
- Kc. Saikia etal[16]	32	32 arthrodeses
- M.Mazaleyrat [17]	161	156 cimented hinged protheses and 5 uncemented
- Our serie	9	9 massive cemented prosthesis

**Table 4. Postoperative complications**

Serie	Cases number	Cutaneous complications	Nervous complications
- I. Ilyas[18]	13	2 superficial necrosis	5 fibular nerve paralysis
- BKS.	33	2 superficial necrosis	1 fibular nerve paralysis
Sanjay[19]	9	0	0
- Our serie			

The results of these different methods depend on the importance of bone resection and soft tissues (especially muscular) and its location [5]:

- Resections of the distal femur with massive prosthetic reconstruction perform better than at the tibia due to reconstruction of the extension system.
- Arthrodesis provides satisfactory results except when climbing stairs and sitting. It is reputed for the reliability of its survival but also for the loss of major function that it entails.

Most authors have given a positive evaluation of the use of denosumab in the treatment of Giant Cell Tumor [12].

According to the series published in the literature, the local recidivism rate is 10% on average for knee tumors[13]. The survival of the five-year-old patient is 75% distal femoral and 93% tibia [14].

The complications are intimately linked to the general condition of the patient in peri and postoperative, they are four times more frequent in case of reconstruction than in amputation. The rate of infectious complications varies between 5 and 40% depending on the series [15], and are favored by chemotherapy, the use of a massive material (increased risk of hematoma) or a broad muscle resection (poorly vascularized areas) [5]. Neurological complications are due to either a surgical section in case of invasion of nerve structures by the tumor, or a per-operative lesion (Table 4). They may also be secondary to chemotherapy [15].

## 5. CONCLUSION

The prosthetic treatment of primary malignant bone tumors around the knee is experiencing a significant rise today both technically and technologically. Management of these tumors is multidisciplinary, and must be early and appropriate. Conservative surgery remains the best way to guarantee satisfactory functionality for the patient.

## CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline patients consent and ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Anract P, Golwasser F. Épidémiologie des cancers osseux. In: Cancers osseux. Paris: John Libbey. 2007;2.
2. Balladelli A, Ghinelli C. Rizzoli syllabus – Atlas of musculoskeletal tumors and tumorlike lesions : IOR ; 2012-2013.
3. Andrade Neto, Francisco Teixeira, Manuel Joaquim Diógenes, Araújo Leonardo Heráclio do Carmo, Ponte, Carlos Eduardo Barbosa. Knee bone tumors: Findings on conventional radiology. *Radiologia Brasileira*. 2016;49(3):182-189.
4. Ottaviani G, Jaffe N. The epidemiology of osteosarcoma. In : Jaffe N, et al, eds.

- Pediatric and adolescent osteosarcoma. New York : Springer; 2009.
5. Mattei JC, Curvale G, Rochwerger A. Stratégie chirurgicale dans les tumeurs osseuses « du genou ». Bull Cancer. 2014;10.
  6. Lee FY, Mankin HJ, Fondren G, et al. Chondrosarcoma of bone. An assessment of outcome. J Bone Joint Surg Am. 1999;81-A.
  7. Hegyi M, Semsei AF, Jakab Z, Antal I, Kiss J, Szendroi M, Kovacs G. Good prognosis of localized osteosarcoma in young patients treated with limb-salvage surgery and chemotherapy. Pediatric Blood & Cancer. 2011;57(3):415–422. DOI:10.1002/pbc.23172
  8. Kundu ZS, Tanwar M, Rana P, Sen R. Fibulectomy for primary proximal fibular bone tumors: A functional and clinical outcome in 46 patients. Indian J Orthop. 2018;52(1):3-9.
  9. Rougraff BT, Simon MA, Kneisl JS, Greenberg DB, Mankin HJ. Limb salvage compared with amputation for osteosarcoma of the distal end of the femur. A long-term oncological, functional, and quality-of-life study. J Bone Joint Surg. 1994;7A:649-56.
  10. Abdulkarim A, Keane A, Hu SY, Glen L, Murphy DJ. Rotating-hinge knee prosthesis as a viable option in primary surgery: Literature review & meta-analysis. OrthopTraumatol Surg Res. 2019;105:1351–9.
  11. Grimer RJ, Aydin BK, Wafa H, Carter SR, Jeys L, Abudu A, et al. Very long term outcome after endoprosthetic replacement for malignant tumours of bone. BoneJointJ. 2016;98:857–64.
  12. Couch C, Emory C, Nicholas R, Montgomery C. Giant cell tumor of bone: Review of current literature, evaluation, and treatment options. The Journal of Knee Surgery; 2018.
  13. Malek Meherzi, Moez Ouertatani, Hakim Kherfani, Haroun Bouhali, Ilyes Hsaïri, Sabeur Bouhdiba. Traitement des ostéosarcomes du genou par résection–reconstruction par arthroplastie massive. À propos de 26 cas. Revue de Chirurgie Orthopédique et Traumatologique. 2014;100(7):S253.
  14. Horowitz SM, Glasser DB, Lane JM, Healey JH. Prosthetic and extremity survivorship after limb salvage for sarcoma. How long do the reconstructions last? Clin Orthop. 1993;280-6.
  15. McDonald DJ, Capanna R, Gherlinzoni F, et al. Influence of chemotherapy on perioperative complications in limb salvage surgery for bone tumors. Cancer. 1990;6:1509-16.
  16. Saikia K, Bhuyan S, Saikia S, Rongphar R, Jitesh P. *Resection and* arthrodesis of the knee joint for giant cell tumours of bone. Journal of Orthopaedic Surgery. 2010;18(2):208–214.
  17. Mazaleyrat M, Le Nail LR, Auburger G, Biau D, Rosset P, Waast D, et al. French society of orthopedic surgery, traumatology (SoFCOT). Survival and complications in hinged knee reconstruction prostheses after distal femoral or proximal tibial tumor resection: A retrospective study of 161 cases. Orthop Traumatol Surg Res. 2020;106(3):403-407.
  18. Ilyas I, Pant R, Kurar A, Moreau PG, Younge DA. Modular megaprosthesis for proximal femoral tumors. Int Orthop. 2002;26(3):170-3. DOI: 10.1007/s00264-002-0335-7. Epub 2002 Mar 8.
  19. Sanjay B, Moreau P. Limb salvage surgery in bone tumour with modular endoprosthesis. International Orthopaedics SICOT. 1999;23:41–46.

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