

## Surgical Technique

# The Surgery of Femoral Sarcomas: The Tripod Technique

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## Abstract

In children, bone sarcomas predominate in the lower femur. The availability of a bone bank neither is nor frequent and the complications of using a growing prostheses are not to be memorized. Here it is described an alternative technique that uses 3 bone grafts obtained from the same leg (2 from the peroneus and 1 from the tibia) and placed in a tripod position, maintained by an external fixator, the resection of the tumor being just below the lower femoral growing plate (which needs to be free from disease and seems to act as a barrier to the tumor spread). It has the advantage of simplicity and particularly of early post-operative mobilization.

**Keywords:** Femoral sarcomas; Lengthening devices; Bone grafts; Chemotherapy

## Introduction

It is nowadays usually accepted that the surgical treatment of distal femoral tumors in children, one must be as conservative as possible, but without jeopardizing safety as much as possible [1,2]. The substitution of the removed bone by a graft obtained from a bone bank is unfortunately not frequently accessible and a "growing prostheses" is sometimes an alternative (unfortunately the ideal growing prostheses has probably not yet been discovered and the complications if its use are not to be discarded). That is why we have looked for alternatives and here is presented the "Tripod Technique" [3]. The aim is to show how to perform the technique when one needs to remove a lower femur malignant tumor.

## Materials and Methods

We present 2 patients, one with an osteosarcoma and the other with a fibrosarcoma of the lower end of the femur, but not involving the epiphysis. Obviously it is essential a general examination and staging of the tumor, taking particular care through CT or MRI and Scintigraphy, to exclude satellite lesions in the shaft and also assuring that the epiphysis and the lower growing plate are intact (this later one as if functioning as a barrier to the tumor progression) [4].

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The proximal section of the diaphysis is done with a safety margin of a few centimeters above the upper macroscopic limits of the tumor and the lower transverse section is performed parallel and just below

the growing plate (referenced with appropriate needles that easily penetrate the cartilage) (Figure 1 and 2).

Then an external fixator is placed linking the upper and lower femoral ends. Before putting in place the grafts the external fixator is elongated as much as the thigh muscles allow (thus obtaining a moderate lengthening of the thigh 2 cm or 3 cm to be partially shortened with the shortening of the external fixator) [5].

From the same leg, one then obtains 3 bone grafts, 2 by partition of the peroneus and one from the antero-internal area of the tibia, which will then be interposed as a tripod between the 2 bone segments, 2 posteriorly and one anteriorly. Their length (carefully equal for the 3 grafts), has been estimated according to the maximum possible distraction obtained from stretching the muscles with the distractor [6]. Having obtained that lengthening, the grafts are then put into place and stabilized by shortening the external fixator, thus pressing the bone grafts against the femoral shaft proximally and distally at the remaining femoral lower epiphyses (Figure 3-9).

For post-operative immobilization we rely on the external fixator, as a plaster cast would have to be applied for 8 to 12 months in order to obtain a safe and stable bone healing [7,8].

## Discussion

With the use of the external fixator walking becomes possible in a few weeks post-operatively. Having maintained the femoral condyles one can allow a certain amount of knee flexing. Although

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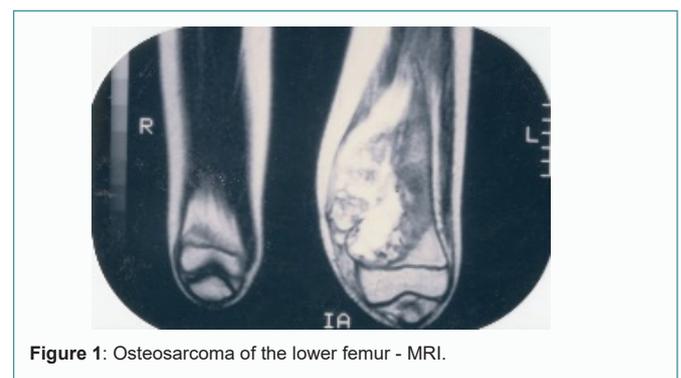
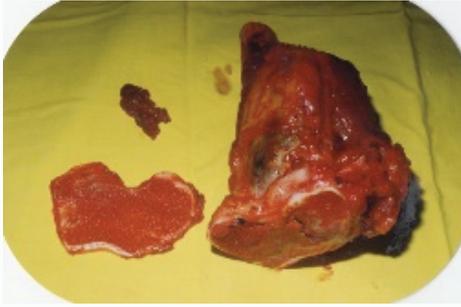


Figure 1: Osteosarcoma of the lower femur - MRI.



**Figure 2:** Complementary distal resection (in the epiphyses), as initial cut was not considered safe.



**Figure 3:** Peroneal and tibial grafts.



**Figure 4:** Tripod grafts in position.



**Figure 5:** External fixator in place at the end of the operation.



**Figure 6:** Grafts in place and external fixator.



**Figure 7:** Fibrosarcoma - specimen.



**Figure 8:** The femur some years later.



**Figure 9:** Lower limbs.

markedly limited. Surgery, associated with chemotherapy, continues to be essential in children's bone malignant tumors which in children tend to predominate in the lower femur. If the tumor invades the epiphyses this technique is obviously impracticable and then the substitution for growing prostheses seems to be the best approach, preferably to the classical amputation or even a rotationplasty [9].

It is also essential to evaluate the expected remaining leg growth till adulthood taking into account the existing "charts", the overall familial tendency, the expected possible need for further surgery to compensate for eventual leg discrepancy, etc.

One of the advantages of this technique is that it is in principle definitive, more economic and also with fewer complications than using the growing prostheses in a growing child. Nevertheless the patients have to be advised to be careful not to over strain the operated leg, has one of our patients had a fracture when enjoying modern dancing.....!

By using the homo-lateral leg, if anything goes wrong, the normal leg will have been spared. When last seen, the patient with the Osteosarcoma was alive, 8 years later and the one with the Fibrosarcoma was alive 25 years later, proving the safety of the procedure for specific situations [10].

Euramos 1, advocates surgery after 11 weeks chemotherapy and the need for a good safety margin. As far as chemotherapy we treated the osteosarcomas according to Rosen T10. In cases of lower femur tumors but sparing the epiphyses, the tendency is to use an endoprosthesis, that normally assures a satisfactory result. If the tumor involves the knee joint an extra articular resection should be performed [11,12].

Before a decision is taken, the Parents (and whenever possible the Patient, usually an adolescent or young adult), must be well informed, be aware of risks and benefits of limb salvage and agree with the option.

## Conclusion

The technique is a good alternative to the growing prostheses, particularly in adolescents that have almost ceased to grow taller. It is rather simple and more economic. In the absence of metastases or local recurrence and having avoided the user of irradiation, one could, around 2 years later, proceed to bone lengthening for correction of an eventual dysmetria due to growth ( if a simple shoe correction is not considered adequate).

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