

Chapter 15

Questions and Answers

Mikel San-Julian

Abstract The technique of physal distraction before tumor excision has been described at several national and international meetings, where it has invariably aroused considerable interest. This chapter deals with some of the questions put forward at these meetings.

- **Does this technique mean any delay in the protocol for treatment of the tumor?**

Answer: No.

You can place the external fixator during the course of pre-operative chemotherapy. You need only 15 min. to place the external fixator, 15 days before the established date for surgery. The external fixator allows the patient to continue with his or her normal life, and it does not impede adherence to chemotherapy protocols, even intra-arterial procedures.

- **Do you employ the technique in all cases of metaphyseal bone tumors?**

From: Antonie Tamineau, University of Leyden, The Netherlands In: SICOT, 1996 Meeting, Amsterdam

Answer: No.

It is a technique for selected cases: those cases of metaphyseal bone tumors in which the tumor has not crossed the growth plate. If the tumor has crossed the growth plate, the joint will require reconstruction surgery (arthrodesis, prosthesis, or osteoarticular allograft).

- **What is the reason for the distraction technique?**

From: Zdenek Matejowsky Sr., Praga

In: EMSOS, 1994 Meeting, Amsterdam

Answer: The anatomy of the growth plate.

The growth plate, which is what seems to represent a temporary barrier to tumor spread, is not a flat surface but is rather convoluted, and so, when performing

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intra-epiphyseal osteotomy, it is difficult to be sure that the section has not passed through the tumor and left tumoral tissue behind.

- **What about the risk of infection?**

From: Mario Campanacci, Bologna

In: ISOLS, 1995 Meeting, Firenze

Answer: The risk is the same as with other reconstructive surgery.

The risk of infection is no higher in tumor pathology than it is in other scenarios of reconstructive surgery. Obviously, patients are immuno-suppressed as a result of the chemotherapy, but the external fixator is only used for 10–15 days. Not even in cases where we used an external fixator as a support for autografting or bone transport (see Chap. 9), have we had any problems related with infection. Seven percent of our series suffered an infection of the reconstruction during the follow-up; this rate is no higher than that in our own overall series of allografts or prostheses, or that reported by other authors.

- **Do you employ antibiotics during the distraction procedure?**

From: Cristina Alves, Portugal

In: Pediatric Orthopaedic Meeting, Aveiro, Portugal, 2015

Answer: No

- **Could you exploit the procedure to achieve some lengthening before resection?**

From: Marco Manfrini, Bologna

In: EMSOS, 1997 Meeting, Münster

Answer: No.

The technique is just an epiphysiolysis in order to achieve a good margin for resection of the tumor. It is not a lengthening procedure. The tumor should be resected as soon as possible. Other techniques exist for avoiding or correcting limb-length discrepancies after tumor resection.

- **Could this technique stimulate tumor growth?**

From: Wilfred Winkelman, Münster

In: EMSOS, 1997 Meeting, Münster

Answer: No.

The disruption of the growth plate occurs suddenly after several days of distraction. We do not believe that this stimulates tumor growth.

- **Does chemotherapy influence callus formation?**

From: Wilfred Winkelman, University of Münster

In: EMSOS, 1997 Meeting, Münster

Answer: What callus?

Chemotherapy has an important effect on the consolidation of allografts and callus formation in bone transport procedures (see Chap. 9), but epiphysiolysis before resection of the tumor is not a procedure concerned with callus formation: it is simply a way to get a good resection margin, and so there is no need to wait for callus formation.



Fig. 15.1 (a–c) The oldest patient in our series was 15 y-o

- **Are there any age limits for the procedure?**

From: Name unknown

In: EMSOS, 1997 Meeting, Münster

Answer: Appropriacy has to be determined on a patient by patient basis.

The youngest patient in which the technique has been used was 3 years old (see Fig. 12.8), but malignant bone tumors are not frequently seen in children so young. The oldest patient in the series was 15 years old (Fig. 15.1). Before applying the technique, one has to ascertain that the growth plate is still active and that the patient has not finished growing.

- **Has the technique been employed in lytic lesions?**

From: Becker, Münster

In: EMSOS, 1997 Meeting, Münster

Answer: Yes.

Osteogenic sarcoma and Ewing's sarcoma, the two bone tumors most frequently seen in childhood, are not usually lytic lesions. However, we have successfully used the technique with lytic lesions such as telangiectatic osteosarcoma (see Fig. 11.11). In such cases, it is important to be sure that there is no pathological fracture.

- **Has the technique been employed in metaphyseal tumors which were seen to be in contact with the growth plate in the MRI scans?**

From: Name unknown

In: SICOT, 1996 Meeting, Amsterdam

Answer: Yes.

The most important thing is to be sure that the tumor has not crossed the growth plate.

- **Has the technique been employed in benign lesions?**

From Gabriel Mato, Portugal

In: Pediatric Orthopaedic Meeting, Aveiro, Portugal, 2015

Answer: We have not used the technique in such cases, but other colleagues (for instance, Julio de Pablos and colleagues at the Rizzoli Institute) have done so.

- **Does the retained growth plate remain active after the distraction procedure?**

From: Marco Manfrini, Bologna

In: EMSOS, 1997 Meeting, Münster

Answer: In some cases.

As reported by De Pablos et al. from our department, if physal distraction is used as a lengthening procedure, the growth plate may continue growing when lengthening is performed at a rate of 1–1.5 mm/day. In cases of epiphysiolysis for preserving the epiphysis, it is also possible that the growth plate will continue growing; Chap. 9 presents some cases that demonstrate subsequent growth. However, arrest of growth could be caused by other factors, such as, radiotherapy, delayed weight bearing, and the osteosynthesis device used for stabilization of the retained epiphysis (see Chap. 9).

- **Osteosynthesis of the allograft with a locked nail will not allow subsequent growth!**

From: Rodolfo Capanna, Firenze

In: ISOLS, 1996 Meeting, Firenze

Answer: True.

We used this kind of osteosynthesis device in patients who were nearing the end of growth. Allografts which were 1.5–2 cm longer than the resected piece were employed in an attempt to minimize the final limb-length discrepancy. We preferred this approach to osteosynthesis for the older patients in our series because it eliminates the risk of allograft fracture. However, in young children, we prefer minimal osteosynthesis devices of the epiphysis, such as Kirschner wires or the distal end of two Enders, to permit later growth (see Chap. 9).

- **How could you be sure about tumor extension before the MRI era?**

From: William Enneking, University of Gainesville (Florida)

In: ISOLS, 1995 Meeting, Firenze

Answer: Sometimes we could not be sure, and so we used a modified surgical procedure.

Before the advent of MRI, we used other imaging methods, such as, CT, scintigraphy, X-ray, and angiography when needed. In cases where we still found ourselves left with any doubt about whether the tumor was compromising the physis, we approached surgery with a variant of the usual technique. This variant has three surgical steps that enable us to inspect histologically the distracted margin (see Chap. 8). We believe that nowadays, owing to the accuracy of MRI, the three step variant is rarely necessary.

- **I believe that there is usually a high risk of local recurrence; how many of your patients had a follow-up longer than 2 years?**

From: William Enneking, University of Gainesville (Florida)

In: ISOLS, 1995 Meeting, Firenze

Answer: Most of them.

When Dr. Enneking put this question to us, he suggested that we had been lucky to have had no cases of local recurrence. We have been employing the technique since 1984, and so the first patient in our series now has 31 years of follow-up.

- **What happens if the distraction does not take place correctly?**

From: Ulrich Exner, Zurich (Switzerland)

Answer: Intra-epiphyseal osteotomy can still be performed.

Although distraction is possible even in lytic tumors, in a couple of our patients, pathological fracture occurred during distraction. In these cases, we carried out an intra-epiphyseal osteotomy to remove the tumor. There were no complications, neither case suffered local recurrence, and function was good.

- **What happens to the femoralis trochlea or to the anterior tibial tuberosity in cases when epiphysiolysis cannot be done, and intraepiphyseal osteotomy is performed?**

From: Seban Hopyan, Toronto, Canada

Answer: In the distal femoral case, part of the epiphysis will be lost and the stability of the joint will be affected, the femoropatellar joint will also be affected. In the proximal tibia, it is necessary to reattach the patellar tendon to the graft. This is avoided with epiphysiolysis, because the whole anterior tibial tuberosity is retained.

- **Given the proven safety and the excellent results, why is this technique not more widely adopted?**

From: Name unknown.

In: ISOLS, 2007 Meeting, Hamburg

Answer: Confidence in the technique requires very different types of specialist knowledge and experience. I think there are two main reasons why the technique has not been more widely adopted. First, orthopedic oncologists are not

necessarily accustomed to dealing with techniques such as external fixation, growth plate surgery, and lengthening procedures, because such surgeons concentrate primarily on tumor surgery. Without a clear understanding of how the growth plate breaks when distraction is slowly applied, a surgeon focused on resection may find it difficult to muster sufficient trust that epiphysiolysis can provide a safe margin of resection in bone sarcomas. Cañadell had a wide experience in pediatric orthopedics, external fixation, and many other fields of orthopedics, and it was perhaps this broad familiarity which enabled him to conceive of and develop his technique. Second, in many centers, the indications for amputation have only diminished very slowly during the last two decades; to stop amputating bone tumors requires considerable confidence in the efficiency of chemotherapy. Professor Cañadell was exceptional in his decision to stop amputating bone tumors once he knew of this efficiency. When he started this technique for preserving the joint, most people simply did not believe it was possible without diminishing the chances of survival. Nowadays, the technique is being used in many distinguished cancer centers around the world including centers in Seville, Barcelona, Madrid and Valencia (Spain), Zurich (Switzerland), Leiden (the Netherlands), Pernambuco (Brazil), Istanbul (Turkey), Budapest (Hungary), Bologna (Italy), and Ji'Nan, He'Nan, TianJin, Xi'an (China).