Expert's comment concerning Grand Rounds case entitled “Surgical management of recurrent thoracolumbar spinal sarcoma with 4-level total en bloc spondylectomy: description of technique and report of two cases” (by Claudia Druschel; Alexander C. Disch; Ingo Melcher; Tilmann Engelhardt; Alessandro Luzzati; Norbert P. Haas; Klaus-Dieter Schaser)

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Dear Editor,

I have read this article with great interest.

The general approach of the problem and the description of the magnitude of the clinical importance of this topic have high relevance. The authors describe excellent surgical techniques in a well-structured fashion. The illustrations are on high level not only from professional but also from aesthetic standpoints as well.

This paper well illustrates the great advancement what spine tumor surgery underwent in the recent years. By the

surgical (technical) development, the limits of interventions widened dramatically. Well-organized groups working in large spine centers made pioneering job pointing out the most important requirements: well-established multidisciplinary cooperation in decision making (so-called “onco-teams” or “sarcoma groups”, etc.) as well as in the surgical procedures (cooperation between spine surgeons and thoracic, vascular, plastic, etc. surgeons in the surgical planning and at the operating table) [1–4]. No doubt, that the development of anesthesiology and intensive care made a large impact, and gave us enormous potency in the aggressive surgical treatment of the oncological patients.

I think, in these extended spine tumor surgeries the main point today is the question of the indication. However, in the process of decision making there are several essential questions to be answered. The first circle of these is the interdisciplinary consensus (based on the proper oncological staging) about the need (and place) of surgical therapy, while the next one is the detailed planning of the surgical procedure. The presurgical planning is more, than a simple summary and description of the technical steps of the surgery. It is a kind of creation with deep intellectual content based on the personal experience and general professional education and literacy of the spine tumor surgeon. Finally, if the procedure is oncologically indicated, intervention is well planned, than the realization of the plans highly depends on the general condition of the patient in relations of the perioperative morbidity.

As a surgeon, I am very frequently asked to operate patients with multilevel spine tumors, based on the decision of our OncoTeam (organized by the National Center for Spinal Disorders and the National Institute of Oncology). In our institution the clearest indication for multilevel total “en bloc” spondylectomy (TES) is a low-grade primary malignancy, like chordoma or chondrosarcoma as well as

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aggressive benign tumors like osteblastoma. In my personal experience, this indication is also acceptable in any sarcomas as a part of the complex oncological treatment, if the local recurrences do not respond to the conventional oncological therapies. But the largest patient group among our multilevel (more than two segments) TES was the local recurrence after a previous spine surgery (11 of the 15 patients). At the moment, metastatic involvement is not an indication for this kind of surgery in our hands, and any metastatic manifestation of the target primary malignant spine disease (e.g., pulmonary metastasis of a spinal chondrosarcoma) contraindicates multilevel “en bloc” resection. In certain cases, when oncological indication is accepted, the tumor-extension could influence the decision. I think, the cranio-caudal extension is not a technical limitation; however, we have not operated five levels cases yet.

The lateral and ventral extension could hardly influence the indication. My limitations of indication in the thoracic spine are the extended bilateral involvement of the thoracic wall or involvement of the large vessels with no possibilities of vascular reconstruction. (This kind of vascular involvement is also a clear contraindication in the lumbar spine too.) Our only early postoperative death (on the 12th postoperative day) was a 67-year old male patient (ThIX-XII recurrent chordoma) with extended thoracic wall resection (more than 10 cm bilaterally), four level TES and replacement of the aorta in 3 cm length on the ThX level. The patient died in the ICU due to mainly respiratory complications.

The aggressive extension of the tumor in the surrounding muscles or skin did not play any role for contraindication in our institution until now. The surgical indication is not really influenced by the methods of soft tissue reconstructions what are routinely discussed with plastic surgeons at the early phase of the surgical decision making. (Rotatory or free musculocutan and musculofascial flaps are widely used in our experience.)

In the analysis of the different possibilities of the surgical intervention, my first step is always to answer the most important question: am I able to perform “en bloc” resection, and obtain tumor-free margins? To give the optimum answer, different factors should be investigated carefully, like the involvement of the dural sac, nerve roots or anterior structures (large vessels, lung, etc.): all of them could represent technical limitations. If I do not see the possibility for TES, I decide on the piecemeal fashion, but discuss all of the factors leading to this decision with the patient.

There are some questions, that I am not able to answer safely even having the latest diagnostic techniques besides me. The blood supply of the spinal cord (the role of Adamkiewicz artery) is a good example for the changing

“myths”. Our angiologists always try to investigate it before surgery, giving some forecast, what kind of functional loss should be considered due to the ligation of three–four pairs of radicular arteries. In majority of extradural spine tumor cases (particularly in tumors with epidural compression), to estimate it is very difficult, sometimes practically impossible. The authors in a previous paper [5] already discussed the role of the Adamkiewicz artery in details, and they do not give special importance to preserve it during multilevel TES. My experience is the same, and I also share the opinion of Murakami et al. [6] who reported 15 multilevel TES cases without spinal cord functional loss: interruption of the Adamkiewicz artery in multilevel TES did not adversely affect the spinal cord function.

When I see good chances to perform multilevel TES, I spend long time with the planning of the steps of the surgery in details. I agree with the authors regarding the importance of the preoperative examinations and investigations supporting the preoperative planning what they listed in this paper. I also try to obtain as much details as possible regarding the relationship between the tumor and the surrounding organs. To measure the dimensions of the tumor, to recognize the best planes for blunt dissection and to find the optimal anatomical sites of the sharp dissection; these are essential questions.

After the tumor resection, there are several technical possibilities for soft tissue and bony reconstruction. Artificial substitution of the dural sac, vessels, chest wall, or abdominal wall is widely used in our experience. For the reconstruction of the spinal stability, modular posterior transpedicular implants and anterior devices are available on the market. Regarding the bone grafting, my technique has been changed in the recent years. Today I use almost exclusively artificial bone substitutes, and did not see lower rate of incorporation at the host/graft surface comparing the previous techniques, when I preferred morselized autologous bone graft. No question, that anterior devices made of carbon or PEEK gives better visibility of the bony incorporation than titanium ones on the postoperative radiology.

There are some discussions among the experts about the surgical approaches. This article shows very proper examples on how to select and apply anterior and posterior approaches. No question, that in the cases of recurrent tumors, anterior approach gives much safer and effective possibilities for the tumor resection and anterior reconstruction.

However, for primary intervention between Th9-L3 segments, I personally prefer single posterior approach, if there is no anterior extraosseal soft tissue component of the tumor (Tomita Type 6 [7]). In these cases the only technical difficulty is the safe resection of the crura of diaphragm. (At their origins the crura are strong and tendinous

in structure, well palpable from posterolateral direction on the ventral surface of the vertebral bodies during the posterior approach). After careful blunt dissection it could be safely cut from the origin (to prevent local recurrence, I cut at about 10 mm far from the vertebral body, because of the rich lymphatic chain of the crura).

The intraoperative complications could be prevented by careful planning and proper and constant surgical technique. The learning curve is long, but in my opinion, well-motivated spine tumor experts, who perform routinely monosegmental “en bloc” resections, after a certain experience, are able to perform multilevel surgeries as well. Also, the postoperative complications could be managed in a well working ICU in almost every case.

The functional results of this procedure are really good. All of our cases (seven of them after temporary bilateral motor weakness in the lower extremity, mainly with radicular origin) healed with good neurological function, four of them can work in full time jobs, two are also active, but in part-time. Two patients died, one mentioned above while the other had a lethal heart attack 7 years after the surgery at the age of 71. The youngest patient was 23-year old at the time of the surgery (recurrent chondrosarcoma, grade II), the oldest one was 69.

The oncological outcome of this procedure is acceptable. Our mean follow-up is 78 months (11–126 months). Five of our fifteen patients had local recurrence. Two chondrosarcomas in the thoracic spine were discovered at 22- and 29-month follow-up; the others were chordomas (34, 31 and 54 month FU). From this point of view, the follow-up time of the two patients reported in this article of the authors probably is a little bit short (an osteosarcoma, grade III with 17 months and a chondrosarcoma, grade II with 8 months FU).

In my opinion, a well-experienced spine tumor expert with proper institutional environment is able to resect almost any size of spine tumors at any part of the human spine.

Based on the meticulous presurgical planning, well-selected approaches (anterior-posterior, combinations, etc.) and strong collaboration with other specialists like vascular or plastic surgeon, etc., highly developed anesthesiology and intensive care background give us the possibility to perform so extended surgeries that were previously unimaginable.

A comprehensive spine tumor center with the background of the onco-team has to deal with the most extended tumors, and offer surgical solution, if it is needed.

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