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CORR Insights®: Proximal Tibia Reconstruction After Bone Tumor Resection: Are Survivorship and Outcomes of Endoprosthetic Replacement and Osteoarticular Allograft Similar?

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Where Are We Now?

The risks associated with secondary arthritis [2] have resulted in osteoarticular allografts becoming a second (or even third) choice behind alloprosthetic composites [4] and megaprosthesis

This CORR Insights® is a commentary on the article “Proximal Tibia Reconstruction After Bone Tumor Resection: Are Survivorship and Outcomes of Endoprosthetic Replacement and Osteoarticular Allograft Similar?” by Albergo and colleagues available at: DOI: 10.1007/s11999-016-4843-y.

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reconstructions. However, osteoarticular allografts do remain in use, most commonly employed in pediatric reconstructions. It is in this setting that we read the excellent work of Albergo and colleagues, which does cut somewhat against the grain, in that it describes successful long-term results using proximal tibia osteoarticular allografts.

Massive bone allograft internal repair is a slow and incomplete process, and most of a large allograft remains unrepaired even after several years following implantation [5]. For this reason, long-term durability of osteoarticular allograft of the proximal tibia has been a major concern.

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Impressive results have been reported by Muscolo and colleagues [7], stressing the crucial role of anatomical matching and accurate surgical technique. In that study, the authors recommended rigid fixation with compression of the osteotomy and careful soft-tissue reconstruction using balanced suturing of capsule and ligaments, and isometric restoring of the patellar tendon in order to provide adequate joint stability without causing stiffness. The chance to retain the native meniscus of the host might play an additional role in protecting the joint surface of the allograft from early degeneration [7]. Three-dimensional (3-D) CT scan-based planning and a virtual bone bank system have been proposed to achieve precise allograft matching [8].

Proximal tibia reconstructions carry a higher risk of failure than distal femur reconstructions because of limited soft-tissue availability for coverage, high risk of infection, and the need of extensor mechanism restoration. This applies both to

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osteoarticular allografts and endoprosthetic replacement procedures.

Where Do We Need To Go?

Even after the study by Albergo and colleagues, questions remain. For example, how should we reconstruct tumor resections around the proximal tibia? Several factors must be taken into consideration: age, type of tumor, adjuvant treatment, and functional expectations. For older patients, endoprosthetic replacement is the preferred approach, as it allows immediate weight bearing, and help with functional recovery. Endoprosthetic replacement is also recommended for patients with poor prognosis, patients who have not responded well to chemotherapy, patients who require high-dose local radiation, and patients with metastatic disease. Osteoarticular allografts or alloprosthetic composites should only be used for young and active patients with higher functional expectations, patients with good prognosis and good response to chemotherapy, or patients with benign lesions. In growing children, proximal tibia osteoarticular allografts preserve the distal femoral growth plate (rather than violating it with a prosthetic stem) and so these grafts may therefore serve as “temporary biologic spacers,” which might be eventually converted

to endoprostheses at skeletal maturity [2].

When considering the proximal tibia bone tumors, should we take a conservative approach in selected cases, extending the indications of joint-sparing resections? In young patients, if the epiphysis of the proximal tibia is not involved by the tumor, I believe all attempts should be made to preserve it, performing a joint-sparing intercalary tibial resection. In this situation, the defect can be repaired with either biologic or prosthetic reconstruction but the advantage of preserving the native epiphysis must be considered, as it has implications both for functional results and for the risk of failure.

How Do We Get There?

Proximal tibia alloprosthetic composites with semiconstrained prostheses may be successfully used when soft-tissue reconstruction provides an adequate joint stability [6]. When this is not possible, I would lean towards rotating-hinge prostheses. Short-stem allograft-prosthesis composites have a higher risk of allograft fracture, and I believe their use should be limited to pediatric reconstructions. In adults, long-stem alloprosthetic composites bypassing the osteotomy line have been recommended to decrease the

risk of mechanical complications [4]. Additional investigations comparing results of proximal tibia alloprosthetic composites with endoprostheses and osteoarticular allografts are needed.

A major issue with conventional alloprosthetic composites of the proximal tibia in growing children is preserving the unaffected growth plate. We can preserve the growth plate by using a novel technique of resurfacing alloprosthetic composites [3] involving a precision-matched rotating platform of an unconstrained tibial component of a total knee prosthesis system. This approach resurfaces a proximal tibial allograft that can be fixed to the residual tibia by a plate. Resurfacing alloprosthetic composites spare the distal femoral physis and articular cartilage, maintain the bone stock of the tibia, and allow the allograft to be adapted to the small tibial dimension in young patients. However, we still need to validate the long-term results of this exciting new technique.

In light of the advances in diagnostic imaging, it may be possible to obtain a precise 3-D definition of tumoral extension. If we combine surgical navigation with these advances in diagnostic imaging, we should be able to perform accurate and safe multiplanar osteotomies [9]. This may expand the indications for intercalary resections preserving the tibial epiphysis, resulting in the possibility that we

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may be able to perform more joint-sparing resections in the future. However, if we start to move in this direction, we need to be certain that these more-conservative resections indeed do not compromise our ability to achieve a wide resection of the tumor when that is indicated [1]. Future studies comparing long-term results of biologic and endoprosthesis reconstructions after joint-sparing resections of the proximal tibia are needed.

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