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CORR Insights

CORR Insights®: What Are the Risk Factors and Management Options for Infection After Reconstruction With Massive Bone Allografts?

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Where Are We Now?

Massive allografts remain an important reconstructive alternative in the armamentarium of musculoskeletal oncologists, adult reconstruction, and other orthopaedic surgeons. Allografts replace osseous defects with like-tissue, restore bone stock for eventual revision reconstructions in younger patients, and offer anatomic tendon attachments and resulting muscle function (for example, in knee extensor, hip abductor, and shoulder rotator cuff grafts) not yet achievable by tendon-to-metal interfaces. When a flawless allograft or allograft-prosthesis composite reconstruction is performed, and the all-too-frequent complications (namely, infection, fracture, and nonunion) are avoided, the functional outcomes achievable frequently surpass those possible by other means, with these other means generally being limited to megaprosthesis reconstruction, resection arthroplasty variants, or some form of amputation.

Unfortunately, infection following massive allograft reconstruction is common. The crude infection rate of 9% at 10 years of followup found in the study by Aponte-Tinao and colleagues [1] remains consistent with previously published estimates in patients treated with bulk allograft infection, which range from 8.5% to 13% [5, 6]. Infections frequently coexist with, or predispose to, the other dreaded allograft complications of

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fracture and nonunion. Collectively, these complications devastate what would otherwise be excellent oncologic and functional outcomes for many patients. Unfortunately, management of allograft infections often fails; for example, only 18% of allografts were successfully managed with débridement, antibiotics, and allograft retention in this study. More distressing still, failure of secondary reconstructions following graft removal, antibiotic cement spacer placement, and staged revision reconstruction was frequent (34%), and more frequent still when a second allograft was placed in lieu of conversion to a megaprosthesis. This proportion is more than twice as high as that seen for two-stage total joint arthroplasty reimplantations [2]. The results of this study on the management of allograft infections are thus important, and the authors reasonably conclude that secondary endoprosthetic reconstruction should be preferred in such instances.

Where Do We Need To Go?

The obvious goals are to both decrease initial oncologic allograft infection rates and more effectively manage infections that do develop. Given the high risk of failure from infection in primary and staged revision reconstructions, at 9% and 34% respectively, there is plenty of room for improvement. We, therefore, require the evaluation of one or more techniques, be they innovative and novel or simple, to prevent (ideally) or mitigate established infections following bulk allograft reconstructions. Laminar airflow, exhaust hoods, and ultraviolet radiation are obvious and potentially beneficial interventions towards this end. However, the lowest hanging fruit is not always sweetest—most surgeons already approach massive allograft reconstructions with meticulous care with regard to infection prevention modalities.

How Do We Get There?

Aponte-Tinao and colleagues [1] interestingly noted that prolonged postoperative antibiotic administration did not protect patients from infection, and may have actually resulted in a higher risk of infections in treated patients. However, there is a growing body of evidence, particularly within the spine literature, that topical antibiotic powder placed at the conclusion of procedures may markedly reduce postoperative infections [3]. This simple and inexpensive technique has not yet been evaluated in a bulk allograft setting, to my knowledge. Likewise, some authors advocate intramedullary cementation for allograft strengthening following osteoarticular or other plate-fixed allograft reconstructions [4]. As the purpose of such cement does not include durable bone-implant fixation, the compromise of which remains a concern during prosthesis implantation, adding antibiotics to the cement there seems to pose little risk.

These two simple ideas are just that, and I do not pretend to have the answers with regard to massive allograft infection prevention and treatment. If I did, I would be treating all of my own patients with these improved techniques, and I likely would be writing a scholarly manuscript on the topic and not simply a commentary. However, the road forward seems clear—the "how," if not the "what," are obvious—in that we need prospective studies analyzing new modalities which can prevent septic allograft complications. These need not be randomized (although that would, naturally, be great), but should be large, and therefore likely should include patients from multiple centers. This aspect is important because, in spite of the much smaller number likely necessary to demonstrate important results given the high baseline infection rate, other aspects such as tibial allograft site and patient gender [1] may also impact the risk of infection. Simple univariate analysis, therefore, remains unlikely to

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be convincing and definitive unless the compared groups are both large and similar. The article by Dr. Aponte-Tinao and colleagues has identified the problem, which too frequently develops, and the disastrous results, which too frequently follow. Let us now set about finding the solutions.

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