

Living Cryopreserved Bone Allograft as an Adjunct for Hindfoot Arthrodesis



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KEYWORDS

- Bone graft • Cellular bone allograft • Mesenchymal stem cell • Nonunion
- Revision surgery

KEY POINTS

- Nonunions are a prevalent and disabling complication of foot and ankle arthrodesis procedures.
- Cellular bone allografts incorporate all 3 essential elements of bone healing while eliminating the commonly associated drawbacks of autografts and traditional allografts.
- Current cellular bone allograft products differ in their source of osteogenic cells, type of scaffolding, and graft composition.
- The available literature demonstrates that cellular bone allografts seem to be safe and effective in hindfoot and ankle arthrodesis procedures.

INTRODUCTION

Hindfoot arthrodesis procedures are commonly performed within a foot and ankle surgeon's practice. Unfortunately, the development of a nonunion remains a prevalent and disabling complication of these surgeries. To improve fusion rates, bone grafts and various biologic supplements are commonly used. This article focuses on the use of bone grafts in hindfoot arthrodesis procedures and the development of orthobiologics, specifically, cellular bone allografts (CBAs). Furthermore, this review aims to provide important considerations with the use of bone grafts as well as practical applications.

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HINDFOOT ARTHRODESIS

Arthrodesis is an invaluable procedure for correcting a wide variety of hindfoot pathologies, allowing the surgeon to create a stable, plantigrade foot. National trends in recent years reveal a dramatic increase in the number of foot and ankle arthrodesis procedures performed.¹ This phenomenon is likely secondary to the aging population and associated comorbidities.¹ Considered the gold standard for end-stage arthritis, hindfoot arthrodesis may correct deformities secondary to the following²:

- Osteoarthritis,
- Rheumatoid arthritis,
- Traumatic arthritis,
- Charcot arthropathy,
- Long-term instability, and
- Malalignment.

Although the goals of arthrodesis are to reduce pain, enhance function, and provide a better quality of life for the patient, there are several factors that may impede a successful outcome. Such risk factors are either attributed to the patient or the provider³ (Table 1). The patient-specific risk factors compromise vascularity and thereby diminish the delivery of reparative cells and nutrients to the operative site.⁴ Previous studies indicate a nonunion rate as high as 40% when performed on these high-risk patients with these aforementioned comorbidities.^{5,6}

Patients with symptomatic nonunions often face severe pain and debilitation. In addition, patients may also experience residual psychological and socioeconomic effects, which could lead to potential narcotic dependence or depression.⁷ Owing to these complications, foot and ankle surgeons are constantly striving to improve the success rate of arthrodesis procedures with the use of bone grafts and biological augmentation (Fig. 1).

BONE GRAFT

Historically, bone grafts were used to fill osseous defects and correct malalignment. More recently, the use of adjunctive bone graft and bone graft substitutes has played a paramount role in hindfoot arthrodesis procedures. Bone grafting aims to increase

Table 1 Risk factors for arthrodesis nonunion	
Patient specific	Alcohol abuse Avascular necrosis Diabetes Infection Noncompliance Nonsteroidal antiinflammatories Obesity Old age Osteoporosis Tobacco abuse
Provider specific	Inadequate fixation Insufficient joint preparation Joint surface gapping Poor postoperative protocol

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