Does Bone Graft Work in Foot and Ankle Surgery?
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1) Background

a. ABG considered to be the gold standard in foot and ankle arthrodesis procedures
   i. Brief history of bone grafting (from ICBG to orthobiologics)
   ii. Differentiating the types of ABG
      1. Distant: ICBG, proximal tibial, calcaneal, etc
      2. Local: bone taken from fusion site and used as graft
      3. Structural (e.g. subtalar bone block distraction arthrodesis [SBBDA])
      4. Cancellous
b. Alternatives to ABG
   i. Allograft
   ii. No graft
   iii. Orthobiologics (growth factors used to improve union rates): BMPs, PDGF, PRP
c. What does the literature show regarding success (fusion) rates for autograft, allograft, etc?
   i. How does the literature actually define “success” after fusion surgery?
   ii. Is one better than the other?
   iii. Are there instances when one is preferred over the other?
   iv. Most orthopaedic surgeons seem to agree that ABG has been preferable during cases in
      that have had factors that impede healing (ex, diabetes, smoking, revision)
d. Hypothesis: Autograft is superior to using nothing or allograft with respect to the overall fusion
   rate and time to fusion in foot and ankle surgery. This difference is magnified in certain high
   risk populations, including smokers, diabetics and those undergoing revision surgery.

2) Methods

a. An extensive literature search from 1959 to 2012 was performed using PubMed, Cochrane,
Medline, and EMBASE. Study references were then also searched to identify additional data.
b. Inclusion Criteria:
   i. Arthrodesis study which used autograft, allograft, no graft, or some combination.
   ii. Reported outcomes, including union and nonunion rate
c. Exclusion Criteria:
   i. Technique articles that failed to report outcomes data
d. Search Parameters/Keywords Used: “(foot OR ankle OR calcaneus OR calcaneal OR talus OR
   talar OR subtalar OR tarsal OR ankle OR tibiotalar OR tibiotalocalcaneal OR calcaneocuboid OR
   triple OR talonavicular OR Chopart OR naviculocuneiform OR midtarsal OR mid-tarsal OR
   tarsometatarsal OR Lisfranc OR metatarsophalangeal OR interphalangeal) AND (fusion OR
   arthrodesis OR non-union OR nonunion OR salvage OR revision) AND (autograft OR graft OR
   allograft OR autogenous OR autologous)”
   i. This search generated 953 studies
      1. Of these, 728 studies were excluded based on the above criteria
      2. 225 studies met inclusion criteria
         a. Of these, 49 studies failed to distinguish union rates based on graft type
            used. In other words, these studies used multiple types of graft and
            pooled outcome data.
         b. The remaining 176 studies were used for statistical analysis
e. Levels of Evidence: the majority of available studies were case series (Level 4):
f. Published data involved many different fusion sites:
   i. Tibiotalar: 58 studies
   ii. Subtalar (ST): 31 studies
   iii. Tibiotalocalcaneal (TTC): 15 studies
   iv. Triple: 12 studies
   v. Tarsometatarsal (TMT): 10 studies
   vi. Metatarsophalangeal (MTP): 6 studies
   vii. Tibiocalcaneal (TC): 4 studies
   viii. Calcaneal osteotomy: 3 studies
   ix. Talonavicular (TN): 2 studies
   x. Naviculocuneiform (NC): 1 study
   xi. Calcaneocuboid (CC): 1 study
   xii. Fifth metatarsal fracture/non-union: 1 study
   xiii. Interphalangeal (IP): 1 study
   xiv. Mixed: 31 studies

   g. Type of graft involved:
   i. Autograft: 93 studies
      1. Cancellous autograft: 58
      2. Structural autograft: 31
      3. Cancellous and structural autograft: 4
   ii. Allograft: 10 studies
      1. Cancellous allograft: 4
      2. Structural allograft: 6
   iii. No graft: 27 studies
   iv. Multiple types: 38 studies
   v. Not specified: 8 studies

3) Results:
   a. Predictors of successful union
      i. Graft type
      ii. Fusion site
      iii. Pre-operative diagnosis
      iv. Age
      v. Sex
      vi. Assessment of union (physical exam vs. x-ray vs. CT)
      vii. Unable to analyze obesity, smoking and diabetes due to lack of data
   b. Outcome Measures
      i. Union rate
      ii. Mean time to union
      iii. Rate of clinical success
      iv. Post-op AOFAS score
      v. AOFAS delta (post-op AOFAS – pre-op AOFAS)
      vi. Complications

4) Discussion/Conclusion