A. Navicular fractures
   a. Problem(s)
      i. Nonunion
      ii. Fragmentation
      iii. Arthritis
      iv. Loss of foot architecture
   b. Solutions
      i. Conventional wisdom
         1. Nonunion management depends on what has been done prior
         2. Nonunion is surgically managed by open bone grafting and fixation
            a. Bone graft sources
               i. Iliac crest
               ii. Proximal tibia
               iii. Distal tibia
               iv. Calcaneus
            b. Fixation can include
               i. Screws – solid vs cannulated
               ii. Specially designed plates
               iii. Combinations
            c. Augmentation
               i. Due to notoriously slow healing response, adjuvants are considered routine
               ii. BMP
               iii. MSC
               iv. DBM
   3. Fragmentation
      a. May be result of old injury, avascularity or bipartite naviculum
      b. Can be managed by repair of fragments and bone graft
         i. Typically unsatisfying for surgeon
         ii. Of unproven benefit for patient
         iii. Of increasing interest due to lack of quality options
   4. Arthritis is typically addressed by fusion
      a. Differing ideas on exactly what to fuse and how to best achieve fusion
         i. In situ talo-navicular
ii. extended “paranavicular” fusion
   1. can be done with or without graft depending on navicular qualities like shape, bone stock, vascularity

iii. medial column and subtalar

ii. My preference/considerations
   1. Foot morphology may need overhaul
      a. Extreme cavus can lead to stress overloads in navicular leading to failure of initial procedure(s)
      b. May need to relieve stress by reducing arch height and redistributing forces
      c. Osteotomies adjust height and position of heel and plantarflexion of 1st ray
      d. Typically need lateralizing calcaneal and dorsiflexion 1st ray osteotomies
   2. Frank arthritis is managed by a rigid full length orthosis
      a. If this fails then surgery may be performed in the form of an arthrodesis of the talo-navicular and possibly naviculo-cuneiform (medial column)
         i. Slot graft technique (Johnson, Klein, et al.) is an advantage by providing rigidity with both bone and fixation as well as generating increased vascularity due to wide cancellous bed
         ii. Trough is created through talar head, navicular body, and cuneiforms (usually the 1st interspace)
      b. Older patients or those thought to be healing problem may benefit from including the calcaneo-cuboid and/or the subtalar for a triple

Bibliography

Navicular
Torg JS, Pavlov H, Cooley LH et al.: Stress fractures of the tarsal navicular. JBJS 64:700-12, 1982

NOTES