Key Lessons Learned: Ask Me How I Know

NONUNIONS

What Really Matters

Most errors in nonunion treatment occur because of a failure to recognize WHAT you are dealing with…..and then failing to correct all the issues at hand.

#1. Lesson……..MAKE A PROBLEM LIST……..

Correct pre op determination of “what you have”… ANALYSIS OF NON-UNION

1. *Appropriate x-ray evaluation*….
   - Long alignment film
   - Determine mechanical axis malalignment
   - Hypertrophic vs Atrophic vs bone loss vs infected nonunion

2. *Relative value of adjunctive studies*
   - MRI
   - Nuclear med studies.
   - CT

3. *Infection work-up*
   - WBC, WSR, CRP, intraop frozen section
   - Combination of risk factors used to calculate overt infection risk

4. *Host status:*
   - *Metabolic bone disease work-up*

**Cierny – Mader clinical staging of ostetomyelitis**

- **Type 1** *Medullary* osteomyelitis and is primarily an endosteal lesion
- **Type 2** *Superficial* infection, which involves only the outer portion of the cortex
- **Type 3** *Localized* osteomyelitis involving cortical sequestration with cavitation extending into the medullary cavity a
- **Type 4** *Diffuse* osteomyelitis is a permeating, circumferential, and through-and-through lesion with extensive involvement of the medullary cavity

Operative intervention

1. **Staged reconstruction**
   - Debridement of all infected material and hardware
In cases where you do not suspect infected hardware……still consider staging the reconstruction

2. **Dead space management**
   - AB spacers
   - AB beads
   - Negative pressure dressings
   - Soft tissue coverage

3. **IM nails..best for hypertrophic, well aligned non-union**
   - Tibial nonunion after 1º nailing, other clinical scenarios include:
     - Nonunion after casting
     - Nonunion complicated by infection

   **Dynamization**
   - Allows compression across distraction / fracture site
   - Must be axial stable fracture
   - ? Destabilize fracture
   - Autodynamization common…
     - …ride it out
   - Perform early…6 -12 weeks…. May not work after 4-6 months

   **Indications for tibial nail Rx of nonunion**
   - Canals in relative continuity
   - Minimal deformity < 15º
   - Relative contraindications
   - Prior infection
   - Excessive shortening
   - Caution with prolonged external fix

   **Exchange nailing**
   - Over-ream canal and place larger diameter nail…(2mm If Possible)
   - Locking screws?
   - Dynamic locking slot
   - Must be rotationally stable
   - Fibular ostetomy
   - Assess rotational stabiity.. Pre…cut
   - Perform if distraction at tibia
   - Match resection to tibial distraction
   - Not at same level as tibial nonunion

   **Tibial exchange nails success rate…..92% + (Johnson , Watson et.al…1989)**
   - Limited with bone defects  (?size)
   - More than 30-50% of cortex over 2cm
   - Increase diameter of prior nail ave. 2 mm
   - Results diminished after 2 prior nailings
   - Heavy smokers may require graft augmentation
   - Must minimize any distraction at fx / nonunion site (nail dynamization)
4. Tension band plating
   Good deformity correction
   Upper / lower meta-diaphyseal peri-articular nonunions +, - bone graft
   Failed exchange nailing (multiple attempts) with large canal

   Plating can Correct mechanical axis
   Proximal femur / tibia
   Distal femur / tibia
   Mid diaphyseal (rarely)

When to consider Plate vs ex fix
   Degree of deformity to be corrected
   Acute vs gradual correction (infection)
   Associated problems
   Bone loss

1. External fixation
   Best deformity correction
   Correct all axis of deformity
   Re-establish limb length
   Segmental defects
   Bone transport
   Sepsis

Adjuvants to healing for non union treatment

1. Orthobiologics
   Autogenous bone graft
   RIA
   Masquelet’ techniques
   Vascularized bone grafts
   Composite bone grafts
   BMAC + DBM + allograft + porous ceramic
   BMP’s ( only 1 currently FDA approved for nonunion)
   Ultrasound / E-Stim

REFERENCE

4. Cattaneo R, Catagni M, Johnson EE: The treatment of infected nonunions and segmental defects


