Limb Preservation: Staged Management of Charcot

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Agenda

• To introduce or re-introduce fixation topics in Charcot management

• Illustrate the use of staged protocol for difficult salvage
• Important to understand
  – Biology
  – Pathophysiology
  – Natural history
  – Biomechanics
  – Principles of fixation
  – Properties of fixation
  – Application of fixation
  – Limits of fixation
Why is fixation in Charcot so challenging

- High risk patient
  - Osteoporosis
  - Neuropathy
  - Weight

- Race between healing and failure
  - Looking for good bone to fixate
  - Extend area for fixation
  - Extend area for load
  - Limit in soft tissues
All these lead to

- Weakness of bone

- Combined with
  - Glycosylated tissue
  - Poor vascularity
  - Impaired nutrition
  - Obesity
  - Lack of pain sensation

- Standard fixation is inadequate
Principles of “Superconstructs”

- V. James Sammarco, MD
  - F&A Clinics 2009

- Fusion extended beyond zone of injury
- Bone resection to shorten, allow reduction of deformity, prevent tension on soft tissue
- Use strongest device that can be tolerated
- Position fixation to maximize mechanical function

Superconstructs in the Treatment of Charcot Foot Deformity:
What about internal fixation?

- Permanent
- Mostly static
- More direct fixation, stability
- Can achieve multiple styles of fixation, compression
- Increasing technology
What about external fixation?

- Allows fixation outside zone of “injury”
- Can be dynamic
- Adds stability
- Can aid in reduction
- Reduces tension
- Offloads
Both have limitations

- Limited by soft tissue coverage
- Limited surface area
- Limited size and quality bone
- Pin infections
- Inadequate strength
- Short life span
Can be combined

- Try to get best of both worlds
- Added risk of infecting internal hardware
- Limited real estate, competing
- Cost
- Time
So how to choose fixation

- Wounds
- Infection history
- Location deformity
- Prior incisions
- Prior hardware

- Stage of Charcot?
What does the literature tell us?

- **Eichenholtz 1966**
  - Did mention surgery in early, acute phase may be of benefit
    - Limited inflammatory cells
    - Best bone
    - More stable soft tissue

- **Harris and Brand**
  - JBJS Br 1966

- **Newman**
  - JBJS Br 1981
• 198 pts, 201 feet
• 147 acute midfoot
  – Decision conservative vs surgical based on deformity/plantigrade
  – 1 year follow
  – 60% treated successfully without surgical intervention
  – Remainder required surgical intervention with 8 amputations
The results of arthrodesis of the ankle for leprotic neuroarthropathy

T Shibata, K Tada and C Hashizume

- 26 pts, followed 9yrs
- 17 ankle fusions, 9 tibiocalcaneal
- 4 fusions in Stage 0, 1 in Stage 1
- All failures (27%) in Stage 3
- Noticed halt in midfoot changes after ankle fusion!!!
• 14 acute midfoot
• ORIF, prolonged NWB, PWB
• Remained stable at avg 41 months
• Retrospective
• 22 pt, 26 feet
• 8 with current ulcers
• Only 4 active stage
• 9 complications
  – 5 hematoma
  – 4 non union
• Improved quality of life, timely recovery
• 85 Charcot
• 8 in active phase
• Single stage internal fixation


• Gradual correction
• Minimally invasive fixation
• 11 feet
• 22 month follow no wounds
• Only 1 in active stage

UPMC experience

• 15 reconstructions
• All active stage
• All staged protocol
• Mean 25 month follow

• Open wounds (33%)
• 26% Midfoot
• 33% Chopart
• 39% Ankle
• Mobile so no need for gradual
• Exfix for maintenance of alignment, protection of soft tissue
• Converted to fusion

• All salvaged
• 2 (13%) had an ulcer at follow
• Avg 5.6 surgeries
Case: Inactive Charcot, wounds, osteo

- Referred for chronic wound, deformity, Charcot ankle, osteomyelitis
- From a Wound Center
- TCC, VAC etc…
• Prior minor amputations left
• Unstable ankle
• Large lateral ankle and plantar heel wound
- How do you deal with
  - Instability
  - Chronic wound
  - Chronic osteomyelitis
  - Bone loss

- Need staged
- Need consults
- Need infection management
- Need stability
- Need to think about later surgeries
Remove bone, take cx, set yourself up for future
Antibiotic spacer
Fixator applied
Fixator gives…

- **Reduction deformity**
  - Removes tension
  - Set-up for future surgery
- **Stability**
  - Aids wound healing
  - Reduces inflammation
- **Protection**
  - From themselves
  - From other providers/SNF
- **Allows time for**
  - Infection control
  - Skin healing
  - Planning
2 weeks, 4 weeks
Once healed

• Need to make stability and correction permanent

• Have done “holiday”

• Follow labs outpt

• Take bone biopsy, frozen section intra-op
• Fixation depends on
  – Location
  – Bone quality, amount
  – Prior wounds, ulcers, incisions

• Anterior incision
• Have OK calcaneal tuber
9 months. In CROW
Case: Active, ulcerating

- Seen in local ER, sent by local DPM
- Diagnosed
  - Fracture
  - Placed in splint
- DM
- Neuropathy
- Increased edema, skin temp
- Beginnings of wound medial column
Active, “mobile”
Closed reduction, temporary fixation
Manage edema, deformity
Make it permanent, extend zone, control motion
Progression
Case: Inactive Charcot, midfoot ulcer, osteo
Plantar incision, osteotomy
Stepwise reduction
Reduce MF to RF
Hold reduction, remove tension
Once clean, convert to arthrodesis, extend
Case: Inactive Charcot ankle, unstable, osteo, multiple I&Ds
Ankle Charcot, instability, ulcer both sides
Staged, debridement, abx spacer, ex fix
Debride, reduce, stabilize, deal with infection
• Consults
• Medically optimize
• Deal with osteo, PICC

• What is the role of the fixator?

• Will need to make final, stable LE
Conversion to arthrodesis, IM nail
Case: Inactive midfoot Charcot, large wound

- Chronic wound 2+ years
- Multiple abx, debridements, grafts, boots, CROW

- NO DM, but has neuropathy

- BMI 60

- Probes to bone

- What is plan?
• See some of the prior debridements

• Multiple CORA
• Chronic wound

• Will need staged

• How?
• Consults?
• Fixation?
Reduce, maintain

- Wedge through deformity
- Cultures
- Biopsy
- Correct deformities
- Ex fix
  - Helps soft tissue
  - Helps manage NWB
  - Keeps tension from wound
  - Allow access to wound
- Wound vac
- Consults
- SNF
Over 4 weeks
• Remove ex fix
• Allow pin sites to heal
• Finish Abx
• Follows with ID

• Compressive dressing/Jones

• Cast over next month

• Plan definitive
Need to make corrections permanent
• Pantalar
• Midfoot

• What fixation?
• Concerns?
Case: Chronic Charcot, ulcer, osteomyelitis

- Referred with non-healing wound, deformity
- From outside Wound Center
- BMI 50
- Cannot use boot, failed wound care, VAC, attempts at offloading
• Difficult to get proper radiographs due to size, immobility

• Came with serial MRIs
How do you go about managing?

- Requires
  - Reduction deformity
  - Wound management
  - Infection management
  - Offloading
  - Maintenance of reduction
  - Etc…
- External fixator
- Helps manage
  - Deformity
  - Inflammation
  - Infection
  - Wound
  - Pressure
In just 2 weeks
Charcot salvage requires knowledge of both internal and external fixation.

- Exfix provides stability, offloading, reduction of deformity.
- Stability is important part of infection and soft tissue management.
- Staged procedures can achieve stable plantigrade foot in difficult patients.