Distal Tibia Fractures: Nail vs. Plate

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Disclosure Information
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Conflicts of Commitment/ Effort
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Disclosure of Off-label and/or investigative Uses
I will not discuss off-label use and/or investigational use in my presentation.
Why Nails?

- Protect entire bone in professional athlete prone to accidents
- No subcutaneous hardware (except screw heads)
- Earlier weight bearing, return to work
- Limited articular injury can be managed with screws alone.
- Nail is perfect for diaphyseal component, semi-extended techniques make it easy!

Why consider a Plate?

- Knee pain with IMN?
- Plating is easy
- Plating may be faster
- Plating can be minimally invasive

Why Not Plates?

- 1. Soft Tissues!!
- 2. More difficult/ more “fiddle”
- 3. Prominent hardware; Implant directly beneath incision on subQ tibial border
- 4. Stress transfer at proximal aspect of plate
“Intramedullary Nailing of Distal Metaphyseal Tibial Fractures”

• Retrospective review of 16 month period
• 36 distal tibia fractures
  – Inclusion criteria
  • < 5cm from the joint line (avg 3.5cm)
  • No blocking screws
  • Skeletally mature
  – Simple intra-articular patterns were included
  – Axial loading patterns were excluded
  – 7 different surgeons

Patient data
– 24 male & 12 female
– 18-82yo (mean 30yo)

MOI
– 13 falls
– 7 sports related
– 6 MVA
– 3 MVA v pedals
– 1 explosion
– 1 crush

4 compartment syndromes

14/36 open (39%)
– 1 Grade 1
– 2 Grade 2
– 10 Grade 3A
– 1 Grade 3B

14/36 w/other fractures
– 6 isolated LE injuries
– 2 TMJ fractures/dislocations
– 1 tibial plateau fracture
– 1 femoral fracture
– 5 contralateral LE injuries
– 3 UE injuries

6/36 required initial ex-fix

Fracture Pattern
– 8 43-A1
– 5 43-A2
– 13 43-A3
– 6 43-C1
– 2 43-C2
– 2 43-C3

All 43Cs underwent CT scan & supplemental percutaneous fixation prior to IMN
“Intramedullary Nailing of Distal Metaphyseal Tibial Fractures”

• Fracture Pattern
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  - 5 43-A2
  - 13 43-A3
  - 6 43-C1
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  - 2 43-C3

• All 43Cs underwent CT scan & supplemental percutaneous fixation prior to IMN

Level IV – Case Series

“Intramedullary Nailing of Distal Metaphyseal Tibial Fractures”

• Post-op course
  – Splint 48-72hrs
  – CAM boot thereafter unless pt deemed “unreliable”
  – Extra-articular 6wks NWB
  – Intra-articular 12wks NWB

Level IV – Case Series

“Intramedullary Nailing of Distal Metaphyseal Tibial Fractures”

• Results
  – 5 lost to follow-up, 1 death
    • 2 43A & 4 43C
  – 33/36 w/acceptable alignment (<5°)
    • Avg sagittal deformity 0.9°
      – 2 pts w/5° recurvatum
    • Avg coronal deformity 0.3°
      – 1 pt w/5° valgus
    • No loss of reduction over time

Level IV – Case Series
“Intramedullary Nailing of Distal Metaphyseal Tibial Fractures”

• Results
  – 7/36 (19%) required additional procedures
    • 1 ICBG @ 6.7wks
      – All open
    • 4 nails dynamized @ 3mo
  – 100% union @23.5wks (13-57wks)
    • 44.3wks when requiring ICBG
    • 23.2wks without
  – Complications
    • 1 deep infection
    • 1 iatrogenic proximal tibia fracture

Levels IV – Case Series

“Treatment of Distal Tibia Fractures Without Articular Involvement: A Systematic Review of 1125 Fractures”

• Literature Review
  – 16 studies from 1/1975-9/2005
    • 1 retrospective comparison
    • 15 retrospective case series
  – Treatment
    • Non-op
      – 521 pts (450 from Sarmiento study in 2004)
    • IMN
      – 489 pts
    • ORIF
      – 115 pts

Zelle BA, Bhattachar M, Espinosa M, Israel SJ, & Zlowodzki M.
JOT 2006 60 (1) :76-9.
“Treatment of Distal Tibia Fractures Without Articular Involvement: A Systematic Review of 1125 Fractures”

- Fracture demographics
  - 12.4% open
    - 1% Non-op
    - 28.1% IMN
    - 4.9% ORIF

- ORIF
  - 5.2% non-union
  - 2.6% infection
  - 13.1% malunion
  - 8.7% secondary procedures

- IMN
  - 5.5% non-union
  - 4.3% infection
  - 16.2% malunion
  - 16.4% secondary procedures

“Bottom Line”
- No Prospective RCTs exist
- Overall nonunion 2.4%
- Overall Malunion 14.3%
- Need more research

“Distal Metaphyseal Fractures of the Tibia: a prospective randomized trial of closed reduction & intramedullary nail versus open reduction & plate & screw fixation”

- 78 fractures (7/98-6/01)
  - 2 died
  - 12 lost to f/u
  - 64 fractures available at 2yr f/u
- One surgeon
- Treatment chosen by drawing from a box
  - IMN vs. delayed ORIF
- Grade II or III open fractures excluded

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<table>
<thead>
<tr>
<th>Group I (IMN)</th>
<th>Group II (“anatomic plate”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42pts (19-65)</td>
<td>40pts (17-60)</td>
</tr>
<tr>
<td>22 M, 12 F</td>
<td>24 M, 6 F</td>
</tr>
<tr>
<td>12 smokers</td>
<td>15 smokers</td>
</tr>
<tr>
<td>34 fractures</td>
<td>30 fractures</td>
</tr>
<tr>
<td>15 A1</td>
<td>11 A1</td>
</tr>
<tr>
<td>9 A2</td>
<td>10 A2</td>
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<tr>
<td>5 A3</td>
<td>4 A3</td>
</tr>
<tr>
<td>5 C1</td>
<td>5 C1</td>
</tr>
<tr>
<td>8 open fractures</td>
<td>5 open fractures</td>
</tr>
<tr>
<td>37 fibular fractures</td>
<td>15 fibular fractures</td>
</tr>
<tr>
<td>8 fixed after ER stress test</td>
<td>5 fixed after ER stress test</td>
</tr>
</tbody>
</table>

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- Group I (IMN)
  - 34 pts
  - Shorter OR time
    - 72min
  - Union
    - 18/pts
  - Complications
    - 1 superficial infection
    - 6 deep infections
    - Avg 2.8° angulation
    - 4 malunions
    - >5° V/V
    - >10° A/P
    - 14 deg ankle DF

- Group II (ORIF)
  - 30 pts
  - Longer OR time
    - 89 min
  - Union
    - 20/pts
  - Complications
    - 9 superficial infections
    - 1 deep infection
    - Avg 0.9° angulation
    - 0 malunions
    - <7deg ankle DF

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Level II Im GI & Tae SK, J Trauma 2005 Nov;59(5):1219-23.
“Distal Metaphyseal Fractures of the Tibia: a prospective randomized trial of closed reduction & intramedullary nail versus open reduction & plate & screw fixation”

• Conclusions
  – IMN
    • Improved ankle ROM
    • Decreased soft tissue complications
  – ORIF
    • Improved alignment

Level II: Im GI & Tac SK, J Trauma 2005 Nov;59(5):1219-23.

Summary of current thinking:

Both are appropriate; choose the best approach for the injury

• Soft tissue injury over the distal tibia = nail
  • No soft tissue injury and a patient that needs to kneel or in whom knee pain would be a big issue = plate

Technical Pearls
Challenges of nailing

- Extreme proximal and distal fractures
  - Short segments need to be controlled by nail
  - “Patulous” cortices
  - Soft tissue attachments deform fracture
  - Articular involvement

Most common mistake (?)

“The nail will reduce the fracture”

Nailing Technique Critical

- To successfully nail a distal tibia fracture (below the isthmus)
  - Reduce the fracture
  - Maintain reduction
  - Ream with reduction maintained
  - Place nail across reduced fracture
  - Interlock with reduction maintained
- Not always easy!
Nailing aids distally

- Distractor
- Percutaneous clamps
- Unicortical plate
- Blocking screws
- Fix the fibula!

Address the articular surface first, if necessary.

“Simple” extra-articular
Case courtesy of Dave Bani, Seattle

Step 1: Plate the fibula

Step 2: Percutaneous screw fixation of the tibial plafond
Step 3: Percutaneous clamp reduction of the tibia

Step 4: Suprapatellar portal for nailing
Distal Tibial Plating
• Typically medial sided plate

How to Plate
• Can go antero-lateral as well
• Preliminary ex fix
• Small distal and proximal incisions
How To Plate

- Stab wounds for the rest of the screws
- Minimal screw placement:
  - 2-3 on either side of the fracture is enough

Plate Stiffness

- Plate length: longer is stiffer
- Closely apposed to the bone is stiffer
- Screw placement:
  - Far/ far and near/ near
  - And one right in the middle
Case 2: Post Op
Conclusions

• Either IMN or ORIF can be used to treat extra-articular distal tibia fractures

• Consider the soft tissue envelope

• Need at least 2 distal interlocking screws

• More prospective randomized trials needed
What you can’t see on the x-ray

- Soft tissue complications common in these injuries!
- Do not do plate if the soft tissue is tenuous
- New techniques of nailing are safe and effective.

Thank You