Pilon Fractures: Tips for Staging

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Disclosures

• Please refer to program
Staged treatment and associated complications of pilon

Liporace FA, Mehta S, Yoon RS, Rhorer AS, Reilly MC

Abstract:

Historically, the treatment and outcomes related to pilon fractures have been variable despite anatomic reduction and fixation.

Early results with treatment via early primary open reduction and internal fixation yielded mixed clinical outcomes, especially suboptimal complication rates, including infection, malunion, and nonunion. Treatment with external fixation also exhibited similar outcomes with mixed support reported in the literature. Despite continued controversy, the advent of newer implant technologies, improved surgical techniques, and management with a staged protocol have resulted in encouraging clinical outcomes with minimization of postoperative complications. Crucial decisions made during treatment can help to maximize outcomes while minimizing complication rates. Particular attention to the fracture pattern with radiographic guidance can help direct surgical decision making with appropriate care given to optimize soft-tissue status. A variety of available incisions can facilitate proper bony and articular reduction. During the late and failed stages of fracture management, additional treatment options include external ring fixation, arthrodesis, and arthroplasty. As complications arise, meticulous, prompt care can help to achieve the best possible outcomes.
Why do we fix Pilon Fx’s?

- Restore mechanical axis
- Restore extremity length
- Restore articular surface
- Allow for ankle motion?
- Decrease chance for arthritis?
- Decrease pain long term?
- Allow for WB’ing
• Ruedi & Allgower

• I: Non displaced

• II: Displaced

• III: Comminuted or Impacted Fx

Swiontkowski et al, JOT, 1997
Agreement / kappa value: 0.41 – 0.57
MODERATE AGREEMENT
Rank Order Classification

- 3 Ortho Traumatologists
- 25 cases
- Least → Worst Injury
- Pre-op & Post-op evaluation

High inter- & intra-observer reliability!

Fibula Fracture?

- If present
  - Valgus + Axial Load
  - More w/ C-type

- If absent
  - Varus + Axial Load

- If type C fx
  - Less implication on severity of injury

What do we do with it?
Initial GOAL

• Soft tissue management

• Restore Mechanical axis
  – Length
  – Alignment

• ± Fibula Plating

• Relax soft tissues → AT LENGTH

• Address open injuries
Temporizing Ex-fix

- Get length and alignment
- Avoid Zone of injury
- Stable construct
- Maintain neutral foot
  - Keeps tissue length
  - Avoids contracture
  - Decreases later problems

Why staples night 1?

Pins in zone of injury
Talus Subluxed anteriorly
Temporizing Ex-fix

• Get length and alignment
• Avoid Zone of injury
• Stable construct
• Maintain neutral foot
  – Keeps tissue length
  – Avoids contracture
  – Decreases later problems

Alignment??
The medial tibia is NOT straight!!
Length ??
The fibula is short!!!
Temporizing Ex-fix

- Ex-fix placement
  - Out of zone of injury
  - “Safe Zone”
    - Proximal
      - Distal to tibial tubercle
    - Distal
      - Talar neck
      - Calcaneus
        » Posterior tuberostiy
        » Anti-equinus
Temporizing Ex-fix

- Structures at risk
  - Lateral plantar nerve
  - Most posterior lateral plantar nerve
  - Medial calcaneal nerve

- Posterior:
  - 1/2 A-C
  - 1/3 A-B
Medial ExFix ???
Medial ExFix ???

• Merits for Varus Instability

• Potential Issue if Talar Pin Infection
Temporizing Ex-fix

• Fix the fibula acutely?
  – Helps with alignment
  – Maintenance soft tissue

• Fix the fibula ever?
  – Definitive ORIF
  – Definitive Ex-fix

• Why fix the fibula?
  – Lateral column stability
Temporizing Ex-fix

• Fix the fibula acutely?
  – Helps with alignment
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• Fix the fibula ever?
  – Definitive ORIF
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• Why fix the fibula?
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• Do you know your definitive incision?
A prospective study evaluating incision placement and wound healing for tibial plafond fractures.

- 46 pilon fx’s
- ~ 5.9 cm btw approaches
- 70%: 5-7 cm
- 14%: <5 cm
- 2 sig. wound complications
CT Scans – After initial reduction

- Tornetta and Gorup, CORR, 1993

22 patients

Increased fragments in 12

Increased impaction in 6

Operative plan changed in 14 (64%)

Additional info gained in 18 (82%)
CT Scans – After initial reduction

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Articular Injury

- Major Fragments
  - Anterolateral Articular (Chaput)
  - Medial Malleolus
  - Posterior Articular (Volkmann’s)
Acute ORIF definitively ???
Rüedi and Allgöwer

- 60/84 low energy twisting
- 74% good functional results
- 90% return to work
- Low complications
  - 5% infection
  - 12% wound problem

Injury 1969, 1973

Low Energy Boot-top Injury
The Results of Early Primary Open Reduction and Internal Fixation for Treatment of OTA 43.C-Type Tibial Pilon Fractures: A Cohort Study

Tim O. White, MD, FRCS Ed (Tr&Orth), Pierre Guy, MD, MBA, FRCSC, Cameron J. Cooke, MD, FRACS, Stephen A. Kennedy, MD, Kurt P. Droll, MD, FRCSC, Piotr A. Blachut, MD, FRCSC, and Peter J. O’Brien, MD, FRCSC

95 patients
70% ORIF within 24 hours
88% ORIF within 48 hours
6 infections (4 open injuries)

TABLE 1. Inclusion and Exclusion Criteria Set on the Original 268 Pilon Fractures Treated During the Study Period, Defining the Cohort for Analysis

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTA Type C #</td>
<td>Local soft tissue factors</td>
</tr>
<tr>
<td>Definitive treatment at institution</td>
<td>Systemic factors</td>
</tr>
<tr>
<td>Minimum 1-year follow up</td>
<td>Implant availability, proximal fracture extension</td>
</tr>
</tbody>
</table>

Conclusions: Provided surgery is performed expeditiously by experienced orthopaedic trauma surgeons, most tibial pilon fractures can be stabilized by primary ORIF within a safe and effective operative window with relatively low rates of wound complications, a high quality of reduction, and functional outcomes that compare

STANDARD OF CARE???
Surgical Timing

- Patience
- Timing critical
- Avoid 1-6 days
- Await soft tissue envelope (10-21 days)

Highest wound complications <7 days after injury
Wagner HE and Jakob RP: Unfallchirurg 1986
Delayed Surgery / Higher Energy

Mast 1988

Helfet 1994

Sirkin, Sanders 1999

“Wait until it is SAFE!!!”
Staged Protocol Popularized

- 4 – 43C1
- 10 – 43C2
- 42 – 43C3

- 34 closed fx’s
  - **Avg 12.7 day delay**
    - 5 minor wound issues tx’d non-op
    - 1 osteomyelitis

- 22 open fx’s
  - **Avg 14 day delay**
    - 2 minor wound issues tx’d non-op
    - 1 ROH & IV Abx
    - 1 amputation

Sirkin MS, et al: JOT 1999
Early Limited Internal Fixation

- Night 1
- Meta-diaphyseal spikes
  - May simplify definitive reconstruction
  - May protect soft tissues

Night 1: I&D open wounds, limited fixation
Post-op CT
Day 5: Repeat I&D w/ fibula plate
Day 12: FINAL PROCEDURE
Choosing the surgical approach

- CT scan helpful
- Choices
  - Anteromedial
  - Direct Anterior
  - Anterolateral
  - Posterolateral
  - Posteromedial
- Can Stage between approaches
Fixation Strategy – Going from the FRONT
Once the TISSUES STABILIZED
(Anteromedial, Anterior, Anterolateral)

• “Open the book”

• Posterior Fragment as reference

• Lag Fixation of Articular Surface

• “Close the book”
Anteromedial Approach
Anterior Approach

- **Intervals**
  - EHL/TA
  - EHL/EDL
  - EDL/peroneous tertius

- **Proximal to ankle joint NV bundle between TA and EHL**

- **Distal to ankle joint NV bundle between EHL and EDL**
Anterolateral (Bohler’s) Approach

• **Incision in line with 4th MT**

• Centered at the ankle joint

• **Protect the sup. peroneal nerve**

• Incise the extensor retinaculum

• Elevate anterior compartment
Temporizing Ex-fix vs Femoral Distractor when going from the front

- Can be useful
- Pin position determines “pull” & “visualization”
- Both give distraction
Fixation Strategy

• Go through the front
• Work from back to front
• Joint distraction
  – Ex-fix
  – Femoral Distractor
An adjunct to percutaneous plate insertion to obtain optimal sagittal plane alignment in the treatment of pilon fractures.
Liporace FA, Yoon RS.
ACUTELY go Posterior?

EARLY \{PRE-DEFINITIVE\} go Posterior?
Posterolateral Approach

- Prone or lateral positioning
- Incision between the FHL and the peroneal tendons
- Protect the sural nerve
- Interval btw peroneals and FHL
- Elevate FHL off posterior tibia
Posterolateral Approach

• *14 complications in 9 patients
  – 19 patients
  – 13 month f/u
  — 47% complication!

Posteromedial Approach

- Prone or “figure 4” positioning
- Btw Achilles and PM tibia
- Identify the NV bundle
- Free structures from fx site
- **Extra-articular reduction**
- **Visualization of joint through the fracture only**
TA – within a few hours of injury
Discuss

“CONSTANT FRAGMENT”
TA – 1 week
TA – 2 weeks
TA –6 wks, follow-up

Postero-medial Incision
TA – 10 months
“Incisional VAC”

- Gommoll et al. JOT 2006
  - 35 patients
  - 22-80 yo
  - Heterogeneous group
  - NO COMPLICATIONS

- Stannard et al. J Trauma 2006
  - Prospective, randomized
  - Tib Plat, Pilon, Calcaneus
  - No signif. difference but trend to improved results
“Incisional VAC”

• Use intervening non-adhesive dressing
• No direct contact of sponge with skin
• 75mmHg
• 2-4 days

Webb LX, Use of VAC in managing Orthopaedic wounds – Experience in 191 cases. Presented at the Symposium on Vacuum Assisted Closure and Management of Wounds: June 26, 2000; Hilton Head, SC
Incisional VAC Practical benefits

- “Sealed Dressing”
  - ICU patients
  - High risk patients
- Low complications of dressing
  - Peri-incisional blisters
  - Maceration minimally
- Decreased post-op drg
  - VAC vs gauze post-op
  - 1.8 vs 4.8 days

- Stannard J et al: J Trauma 2006
THANK YOU