Role and Technique for Spanning External Fixation

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WHEN TO DELAY FIXATION with spanning external fixation

- Severe Soft tissue injury
  - swelling
  - blisters
  - open wounds
  - compartment syndrome
- Shock and multi-system trauma
  - “Damage Control”
- Other
  - ? Most pilons
  - Knee dislocation
  - Severe elbow trauma

High velocity GSW to femur treated initially with ex fix, followed by delayed nailing

Dar GN, Turkish journal of trauma 15(6): 553-60, 2009
Temperature control

• Applied early during resuscitation
• Most studies involve femur fracture
• Risk-adapted approach
• What criteria?

Evaluation of criteria for temporary external fixation in risk-adapted damage control orthopedic surgery of femur shaft fractures in multiple trauma patients: "evidence-based medicine" versus "reality" in the trauma registry of the German Trauma Society.

Rixen D; Grass G; Sauerland S; Lefering R; Raum MR; Yucel N; Bouillon B; Neugebauer EA; Polytrauma Study Group of the German Trauma Society

The Borderline Patient

- (ISS) >20 with additional thoracic trauma AIS >2.
- Abd/pelvic trauma and haemorrhagic shock (initial systolic BP <90 mmHg).
- ISS >40
- CXR or CT evidence of bilateral pulmonary contusion.
- Initial mean pulmonary arterial pressure >24 mmHg.
- Pulmonary artery pressure ↑ during IM nailing >6 mmHg.

Damage Control

- ? Chest trauma: pulmonary contusion
- ?Moderate or Severe TBI: GCS 3-13
  - Flierl MA et al. JOT 24(2):107-114
Controversial
Inconclusive evidence

EXTERNAL FIXATION – Orthopaedic Advantages

• Maintains length and alignment
• Partial reduction of fracture via ligamentotaxis
• Stabilizes soft tissues and allows wound access

EXTERNAL FIXATION

Can be applied quickly
• Minimal blood loss
• ED application possible
• Flouro not necessary

Preserves Fixation Options
EXTERNAL FIXATION

- Femoral fractures stabilized 5-7 days
- Conversion to IM nail
- Minimal orthopaedic complications

-- Scalea J Trauma 2000
-- Nowotarski JBJS 2000

Principles

- Place pins as far from injury as possible
- Consider incision locations for definitive fixation
- Restore length and alignment
- Minimize pin number – don’t cluster
  - Goal is not to maximize stability
- Place clamps away from necessary Xrays
- CT and planning films after ex fix

Spanning the knee

- Anterior pins allow sitting and wheelchair mobility
- Use drill guides and careful soft tissue technique through Quadriceps
- Gentle traction over a knee bump avoids hyperextension
- Make sure connection clamp is not over fracture site
Temporary external fixation for the management of complex intra- and periarticular fractures of the lower extremity.

Haidukewych GJ
### Temporizing External Fixation of the Lower Extremity: A Survey of the Orthopaedic Trauma Association Membership

**Orthopaedics**
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#### Table 1
Survey Items With a High Rate of Agreement Among Orthopaedic Trauma Association Members

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Rating Average</th>
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<tbody>
<tr>
<td>A CT scan of complex posterior injuries should be obtained for prospective planning</td>
<td>4.6</td>
</tr>
<tr>
<td>A CT scan should be obtained after external closed reduction and fixator application</td>
<td>4.6</td>
</tr>
<tr>
<td>Soft tissue protection should be used when drilling and applying pins</td>
<td>4.1</td>
</tr>
<tr>
<td>It’s important to reduce length with closed reduction</td>
<td>4.3</td>
</tr>
<tr>
<td>Forced pins should be placed proximally for distal tibia fractures and distally for proximal tibia fractures</td>
<td>4.3</td>
</tr>
<tr>
<td>Tibial pins should be placed proximally for distal tibia fractures and distally for proximal tibia fractures</td>
<td>4.3</td>
</tr>
<tr>
<td>Avoid placing pins sites where they will later overlap plate placement</td>
<td>4.3</td>
</tr>
<tr>
<td>Articular surface configuration is preferred for deltoid tibial and ankle fractures</td>
<td>4.0</td>
</tr>
<tr>
<td>Femoral fracture</td>
<td>4.3</td>
</tr>
<tr>
<td>Intramedullary pins are preferred for femoral fractures</td>
<td>4.2</td>
</tr>
<tr>
<td>Ankle fracture configuration is preferred for tibial plateau and ankle fractures</td>
<td>4.0</td>
</tr>
<tr>
<td>Anterior tibia cortex is preferred for tibial plateau and ankle fractures</td>
<td>4.0</td>
</tr>
<tr>
<td>Anteromedial tibia cortex is preferred for tibial plateau and ankle fractures</td>
<td>4.0</td>
</tr>
<tr>
<td>Anterior tibia cortex is preferred for tibial plateau and ankle fractures</td>
<td>4.0</td>
</tr>
</tbody>
</table>

### Spanning the Ankle

- Tibia – calcaneus
- Articulated fixator with pins in talus/ calc
- Don’t forget the forefoot!
  - Equinus in ankle, or in midfoot
  - Pins in metatarsals
  - Foot plate

### Quick Temporary Ex-Fix

Anglen JO, Aleto T
Transarticular external fixation of the knee and ankle
“Transfixion” centrally threaded pin in the calcaneus
Two anterior-posterior tibial half pins
“A frame” or delta frame

Elevation above the heart – Use of foot pumps

Pre-drill 3.5 mm
Use drill guides
Place centrally threaded pin under power
Use of two transfixion pins

Watson JOT 1994

Reduction through ligamentotaxis

P3a  P3c
Subsequent procedures

• Temporary fixators can be safely prepped into the field using Alcohol, Iodine prep scrub and Iodine spray


Conversion to internal fixation

• Overlap of plates with pin sites does not seem to increase risk of infection

Laible C, JOT 2012, 26:92-97

• Infection rate after conversion to IM nail, goes up if delayed >28 days

Bhandari M et al. JOT 2005, 19:140-144

• If pin site infections, consider a “pin holiday” prior to nailing

Compartment Syndrome

• Temporary ex fix for Medial tibial plateau fx dislocation may contribute to development of compartment syndrome
  – Monitor carefully
  – Leave foot out

Stark E et al. JOT 2009 23:502-506

• Transient elevation of pressures seen after application of ex fix and restoration of length

Egol KA et al. JOT 2008 22:680-685
DVT

- Protocol of early joint spanning ex fix and LMWH resulted in DVT rates similar to historical controls


Thank You

I’ve had a wonderful evening.
Unfortunately, this wasn’t it. Groucho