External Fixation Indications and Techniques
Objectives

Identify the following as they pertain to external fixation:

- Advantages & disadvantages
- Indications
- Types of frames
- Biomechanics stability
- Pre-operative planning
- Common complications
External Fixator

A device placed outside the skin that stabilizes bone fragments with pins or wires connected to bars

“Relative stability “

Healing with callus
External Fixation
Advantages

- Minimal damage to blood supply
- Minimal damage to soft tissues
- Fixation is away from site of injury
- Good option when significant infection risk
External Fixation

Restricted joint motion
Pin tract infection
Cumbersome
Inadequate stability for certain fractures
Indications

Most commonly used:
- Tibia
- Distal radius

Less commonly used:
- Femur
- Humerus
- Forearm
Indications

Open fractures
Closed fractures with soft tissue compromise
Periarticular fractures
Polytrauma/Damage control
Pelvic fractures
Children’s fractures
Open Fractures

Avoids injury site

Avoids additional injury to soft tissues and vascularity
Open Fractures
Open Fractures

Segmental bone loss
Open Fractures

Fractures needing nerve or vessel repair
Closed Fractures with Soft Tissue Compromise

Swelling
Fracture blisters
Closed Fractures with Soft Tissue Compromise

Crush injuries
Burns
Closed Fractures with Soft Tissue Compromise

Compartment syndrome
Periarticular Fractures

Severe fractures with joint involvement and shaft extension
Periarticular Fractures

- Spanning ex-fix if axially unstable
Periarticular Fractures

Hybrid Fixator:
- Thin wires near joint
- Pins (Schanz Screws) in shaft
Periarticular Fractures

Reduce and fix the joint surface

Span the diaphyseal segment without disturbing soft tissues
Periarticular Fractures

External fixation can be combined with internal fixation
Polytrauma

Temporary stabilization of long bone injuries in unstable patient

- Minimally invasive
- Decreases bleeding
- Pain control
- Nursing care
- “Damage control”
Pelvic Fractures

Temporary stabilization for closed fractures
Controls hemorrhage
Decreases clot shear
Pelvic Fractures

Open pelvic fractures = “The lethal injury”
Pelvic Fractures

Quick application
Open or percutaneous pin insertion
Easily removed for definitive ORIF
Children’s Fractures

Femoral fractures
One alternative to weeks of skeletal traction
Used less with use of flexible nails
Children’s Fractures

Pin placement must avoid growth plate
Watch for pin tract infection
Occasional joint stiffness
External Fixation

Fixator construct will depend on treatment strategy:

- Emergency care
- Provisional care
- Definitive care
External Fixator Constructs

Uni-plane
Bi-plane
Multi-plane
Ring
• Uni-plane
• Bi-plane
• Multi-plane
Uni-plane Fixator
Single Bar
Uni-plane Fixator
“Z Frame”
Uni-plane Fixator
Double Stacked
Bi-plane Fixator
Multi-plane Fixator
Spanning External Fixation

Built as uni- and multi-plane constructs

Areas prone to soft tissue problems
- Knee
- Ankle
- Open Fractures

When multiple injuries prevent definitive fixation
Spanning Ex Fix

Adjunct to Internal Fixation
- Temporary
- Definitive
Increase Stability

**Pins**
- Larger diameter
- More pins
- Closer to fracture site
Increase Stability

Bars:
- Closer to limb
- More bars
- Second plane at right angle to decrease torsion (twisting)
Increase Stability

Rings:

- Smaller is stiffer
  - Use smallest diameter ring possible but allow for swelling
- More rings = more stable
External Fixation Anatomy

Safe pin placement
“Safe corridors”
Know your anatomy to safely place pins!
Intraop Setup

- Circumferential prep of entire limb
- Radiolucent table
- C-arm
Intraop Setup

Associated procedures
Irrigation
Debridement
Internal Fixation
Bone graft
Intraop Setup

Adequate fixator components
Cannulated screws
Large/small fragment sets
Intraop Technique

Keep bars close to bone but . . . allow access for soft tissue care
Allow for swelling
Can be re-adjusted as needed
Complications

- Neurovascular injury
- Pin loosening
- Pin tract infection
- Joint stiffness
- Malalignment
- Malunion
- Nonunion
Complications

Pin tract infections:
- Most common complication
- Avoid fracture area
- Don’t “burn” bone – pre-drill
- Insert pin completely
- Release skin
Complications

Know where pins are going!
THANK YOU!