

*Options for limb
reconstruction due to
severe bone loss*

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CELLR, Dallas, Texas



Segmental Bone Loss

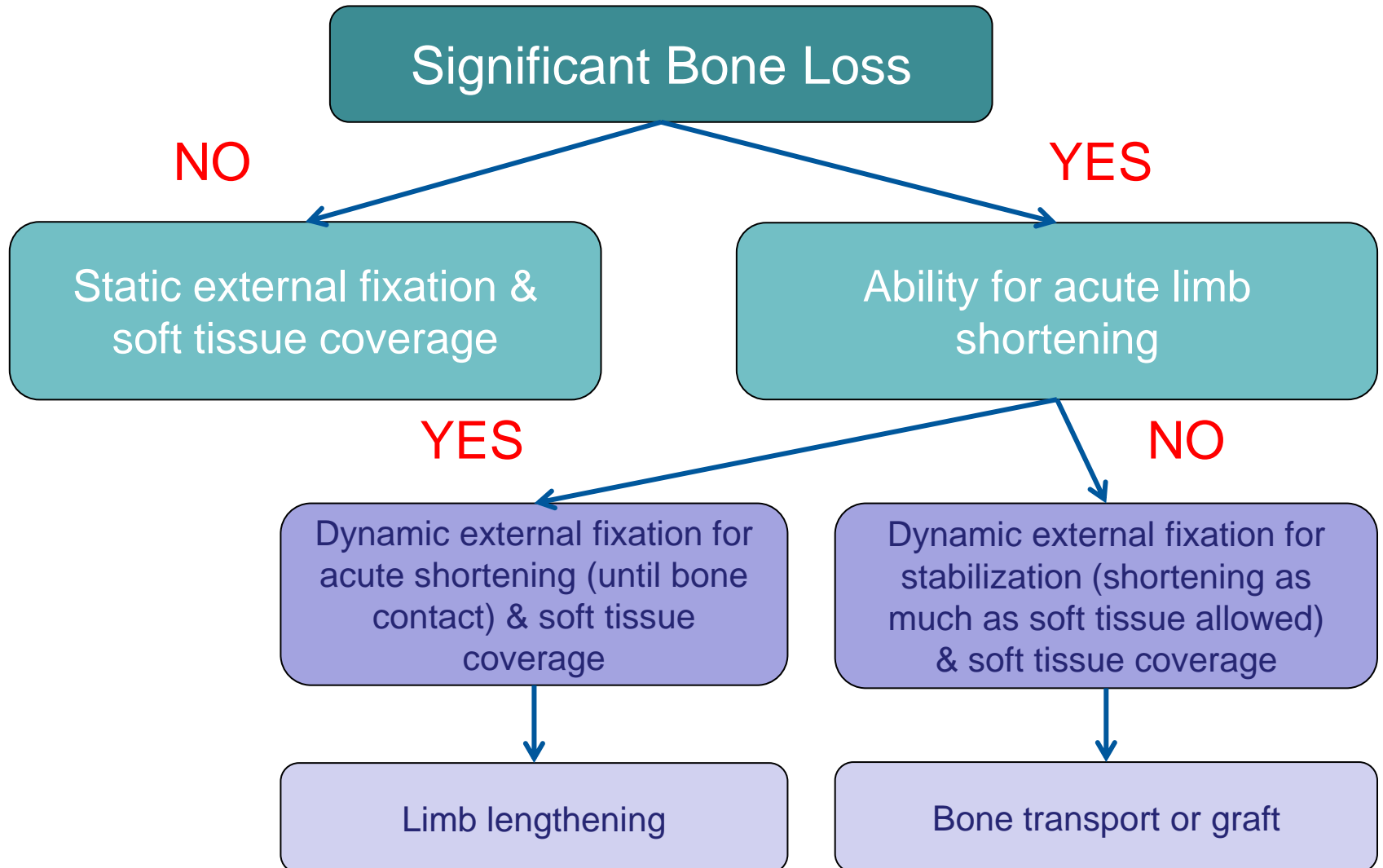


- Trauma
- Infection
- Tumor
- Congenital anomalies
- CPT
- Other lesions

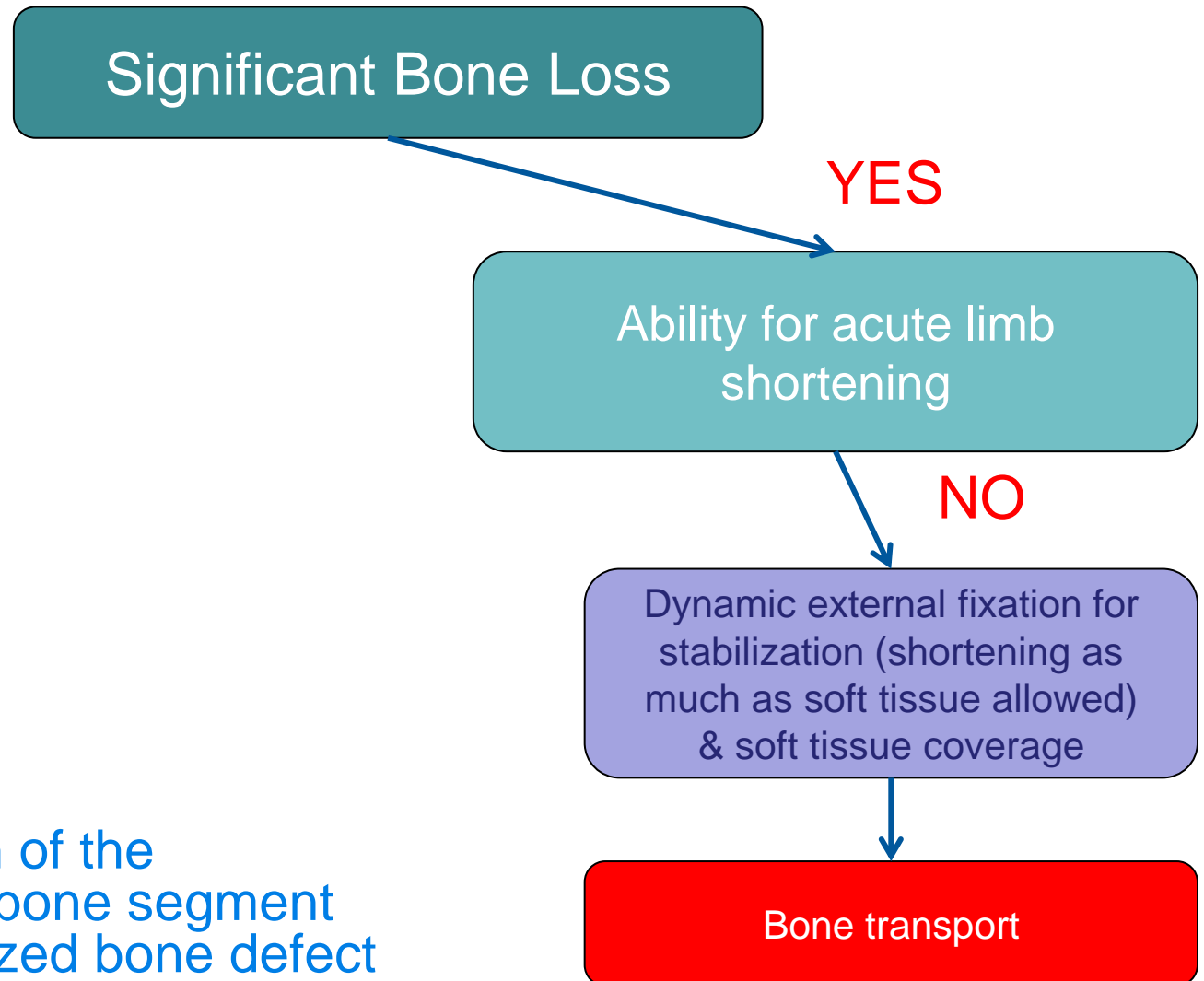
Associated Soft Tissue Defect



Treatment Algorithm

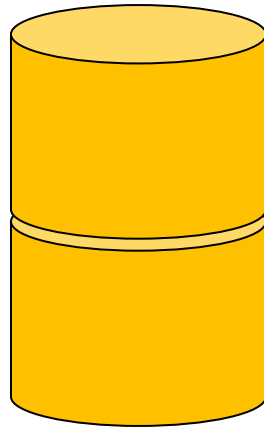


Treatment Algorithm



Transportation of the osteotomized bone segment through stabilized bone defect

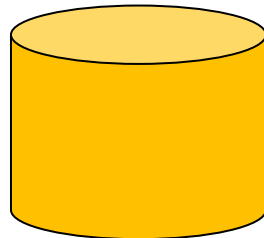
Segmental Bone Transport



Host bone segment

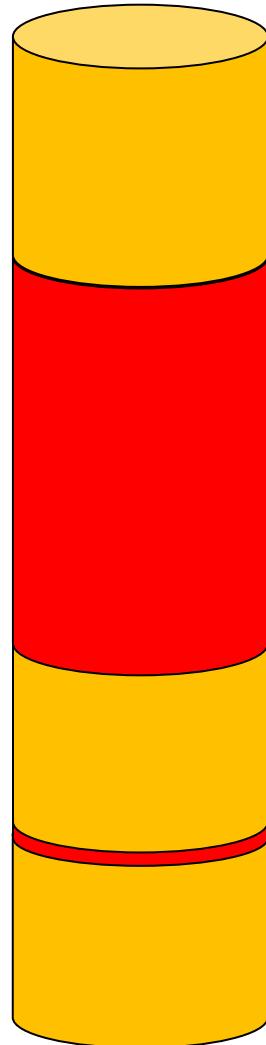


Transport bone segment



Target bone segment

Segmental Bone Transport



← Host bone segment

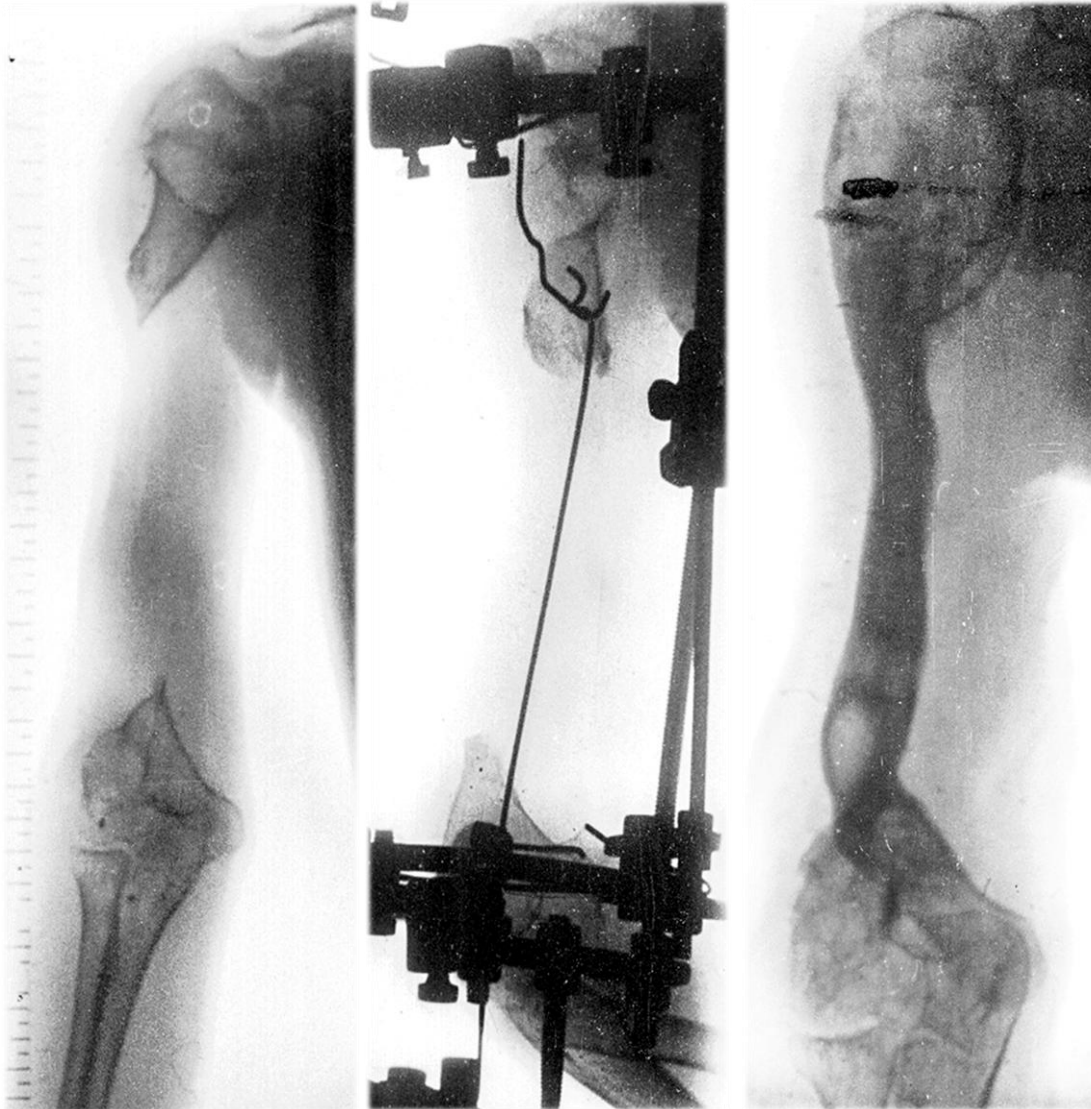
← Distraction site

← Transport bone segment

← Docking site

← Target bone se

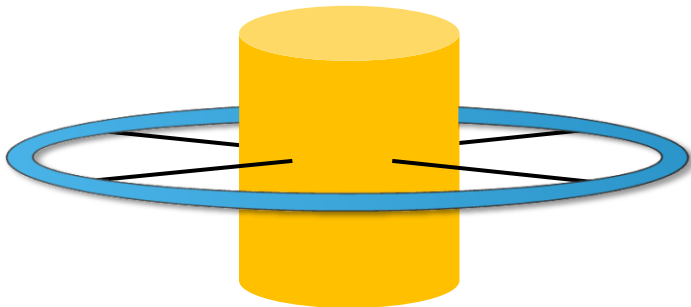
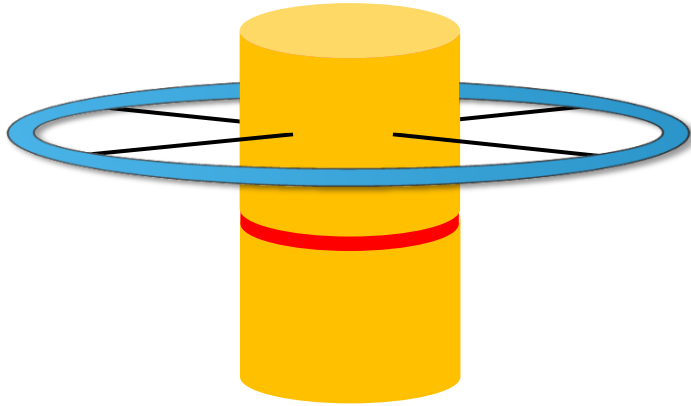
Original Ilizarov Bone Transport



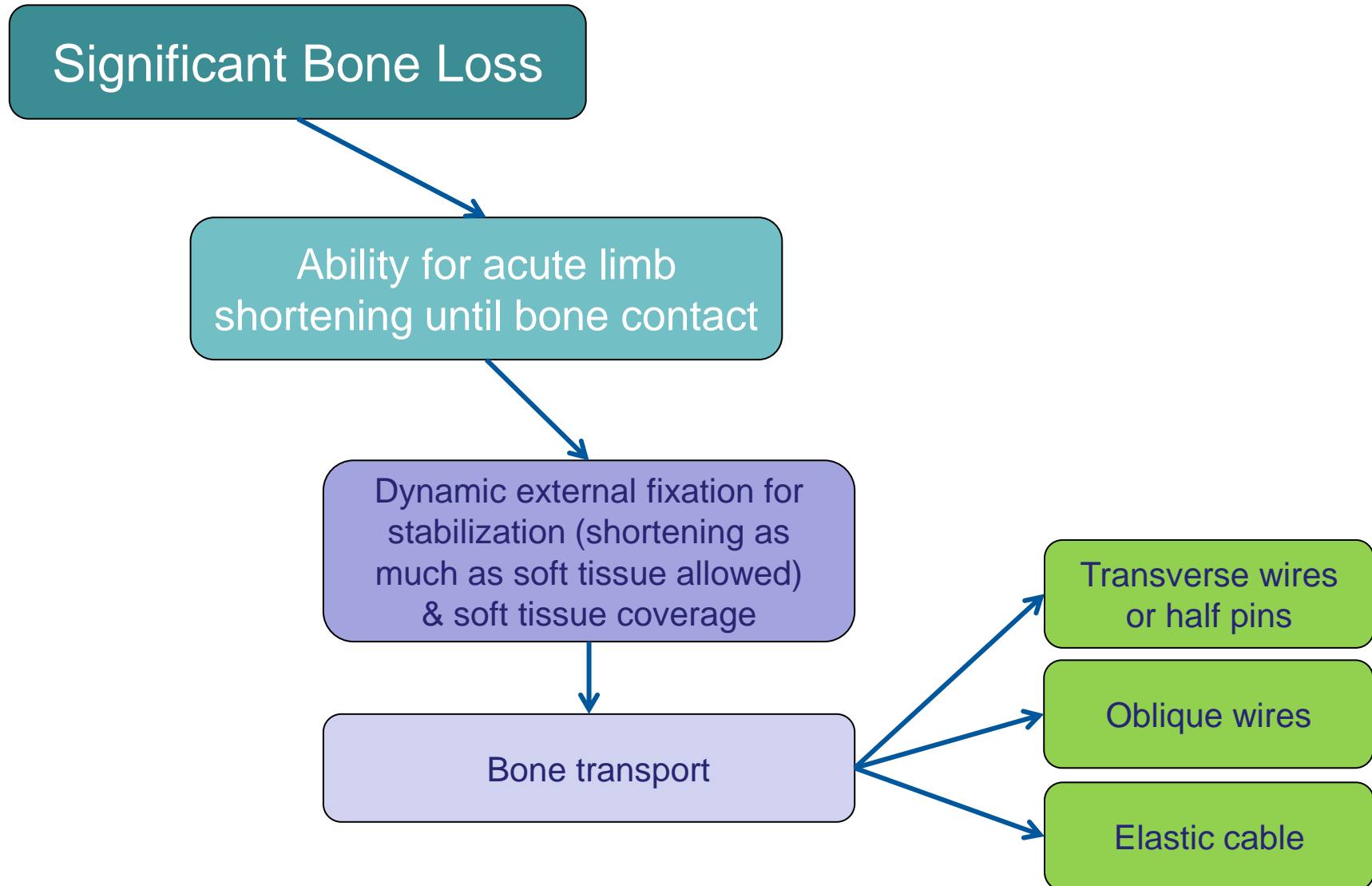
Russian Patent SU 313,533
Ilizarov GA. Method of substitution
of the defect of long tubular bone
Submitted Jan 1, 1967

Ilizarov GA, Lediaev VI.
Replacement of defects of long
tubular bones by means of one of
their fragments. Vestn Khir 1969,
102(6):77-84

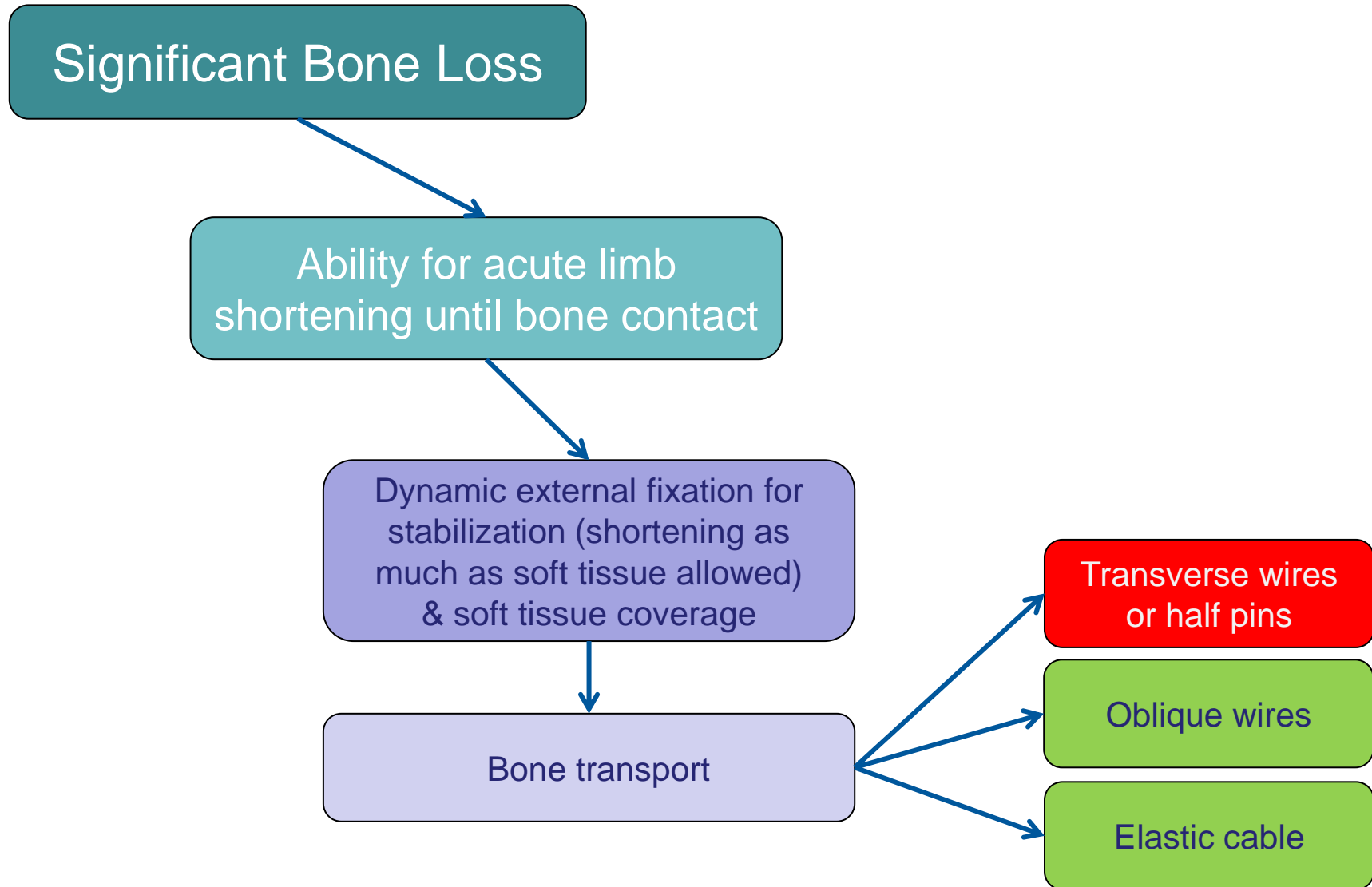
Bone Defect Stabilization



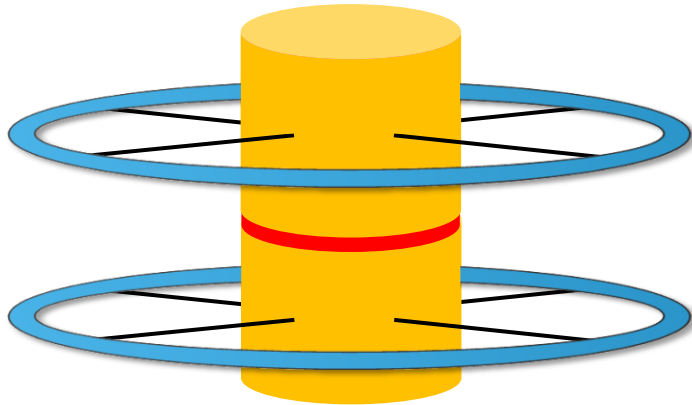
Bone Transport Techniques



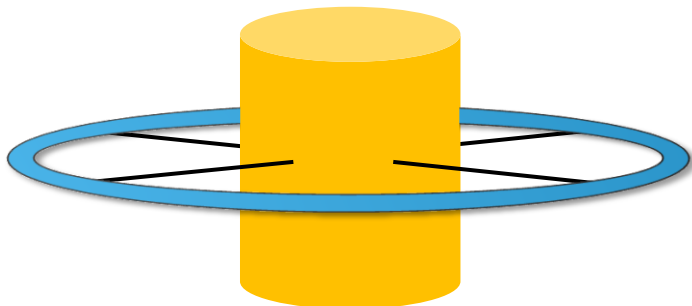
Bone Transport Techniques



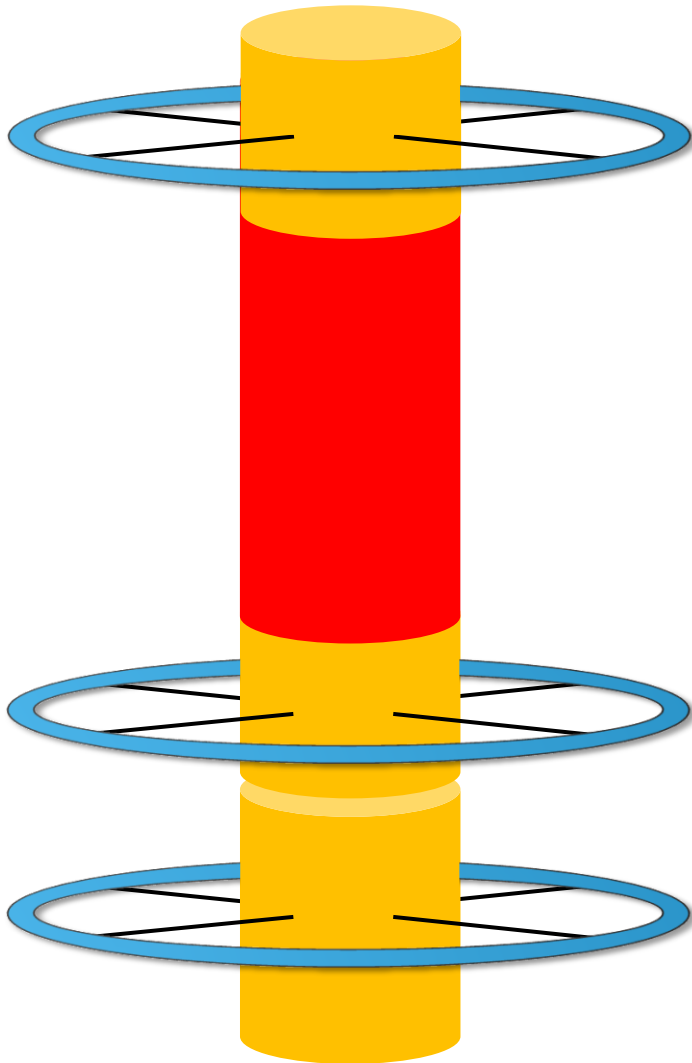
Transverse WR/HP Bone Transport



- External fixation
- Osteotomy

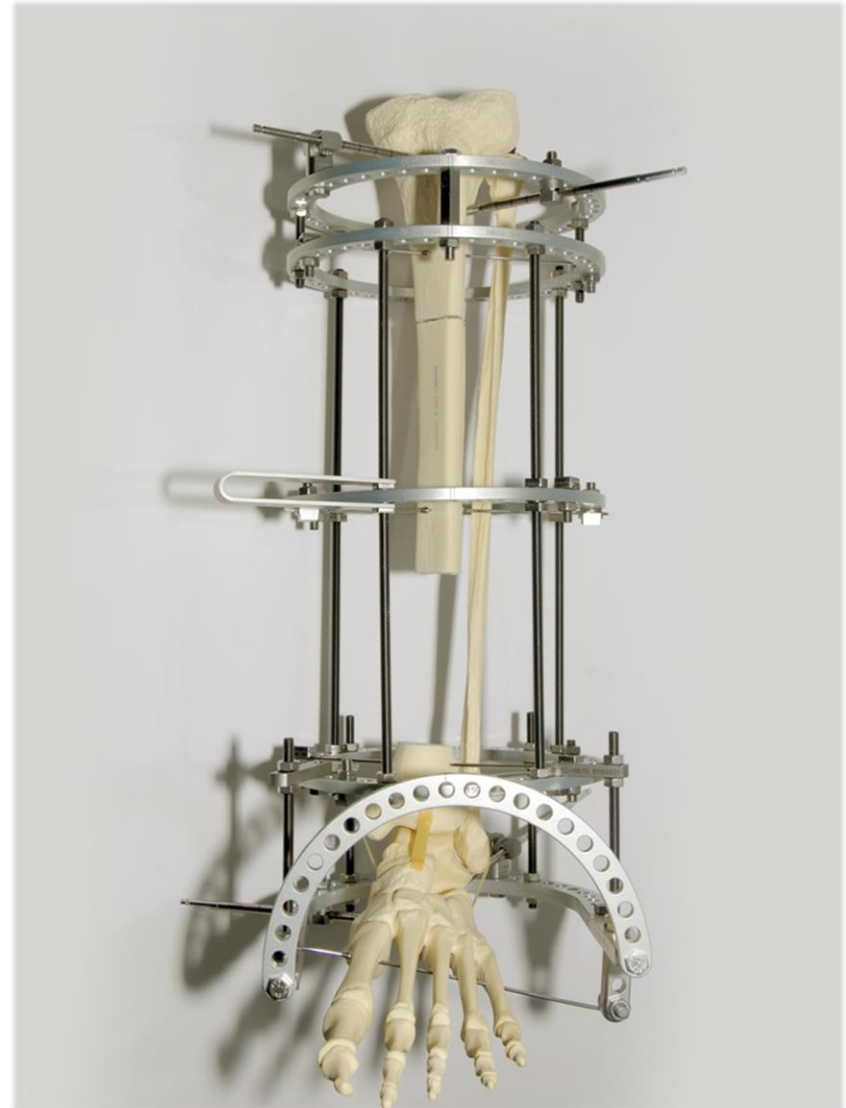
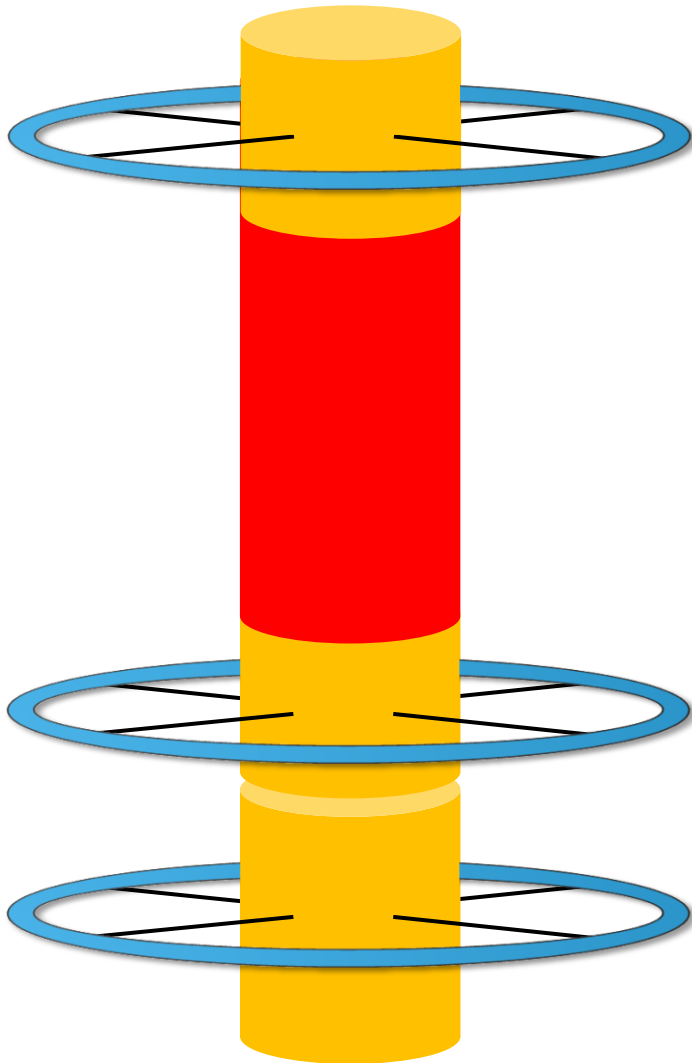


Transverse WR/HP Bone Transport

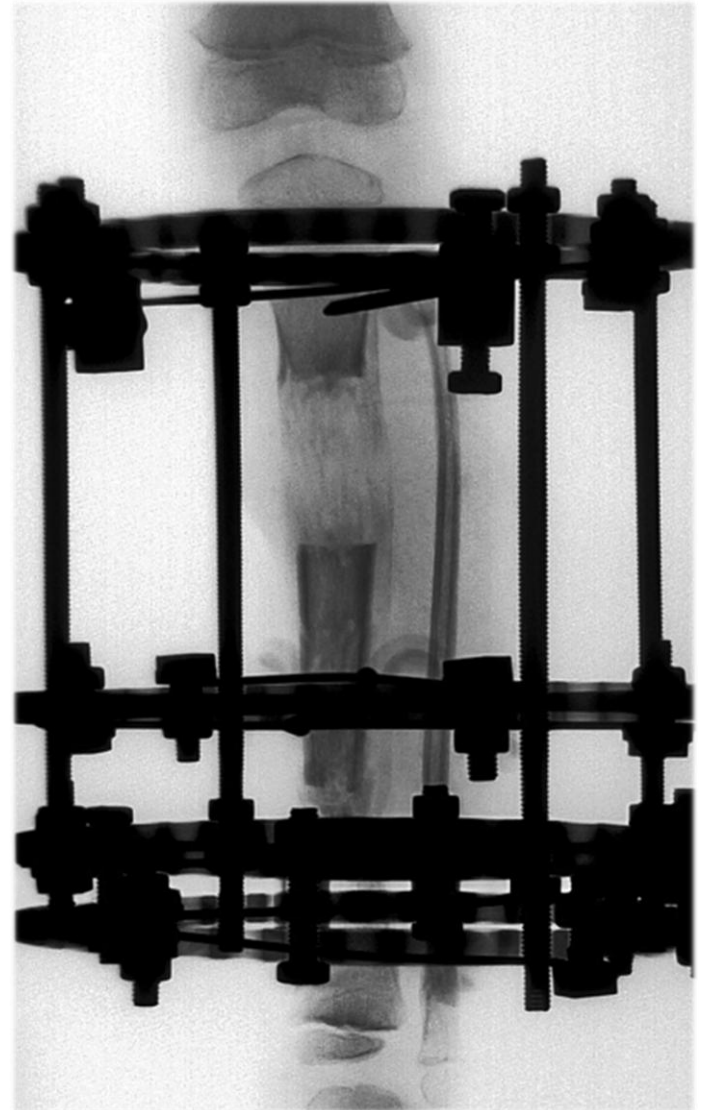
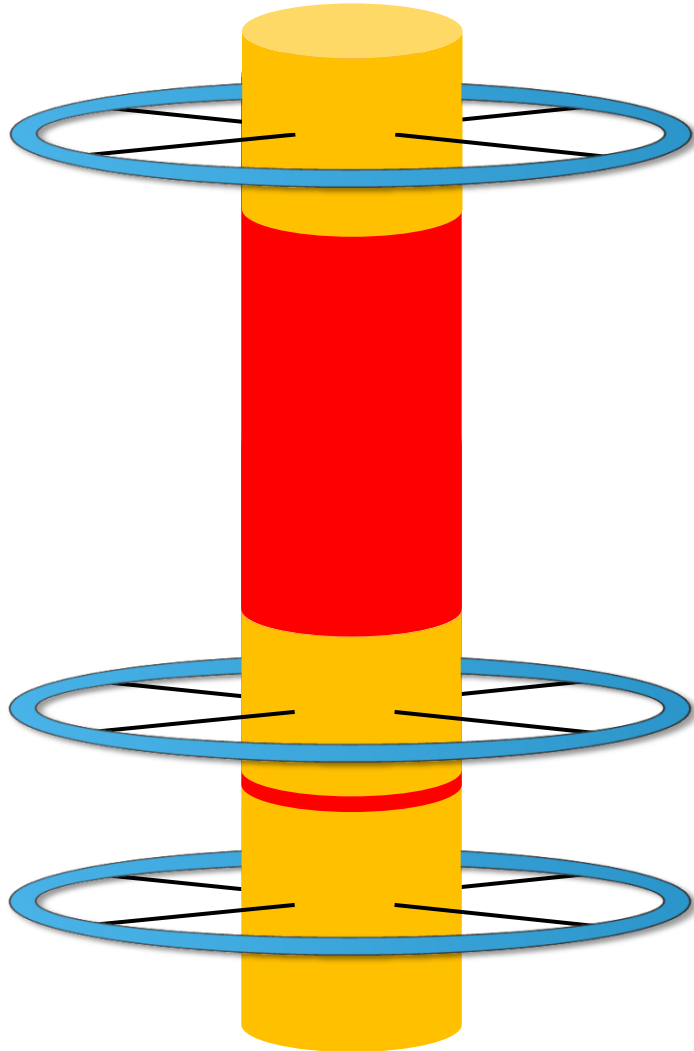


- External fixation
- Osteotomy
- Bone transport

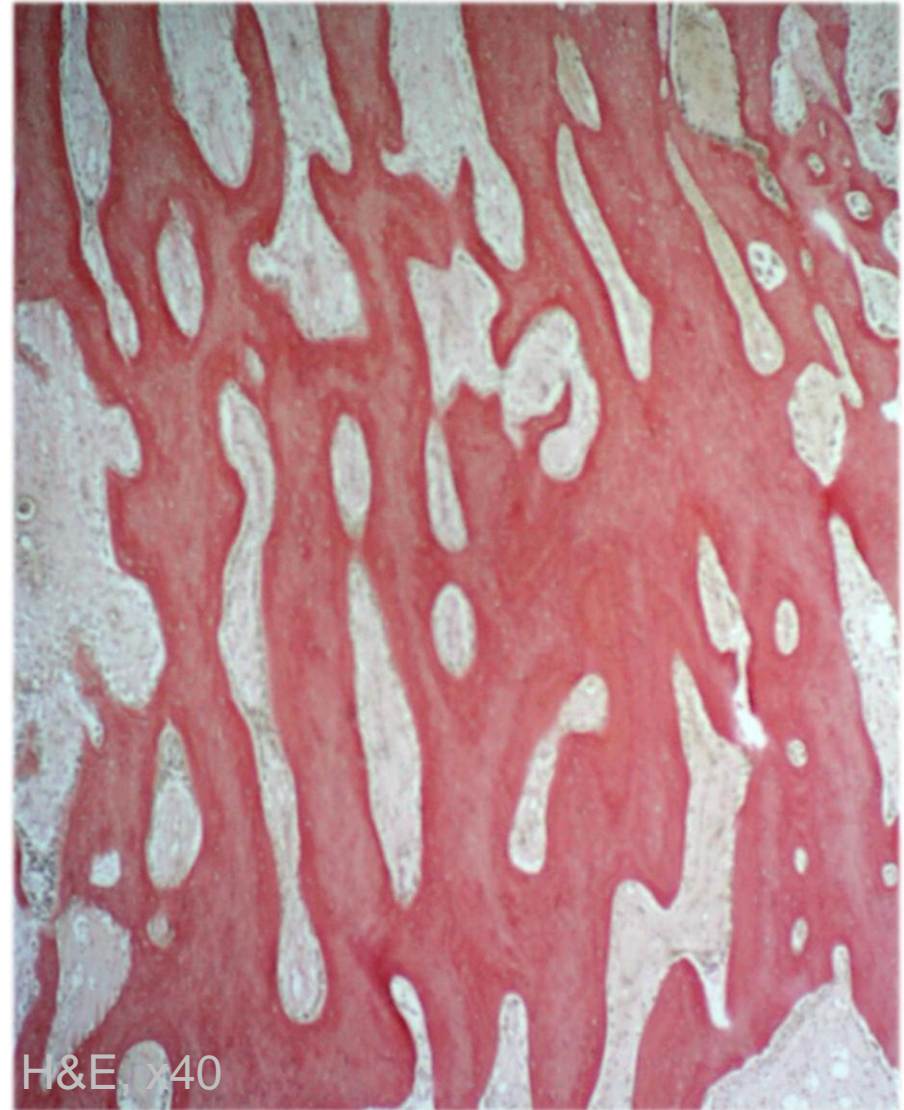
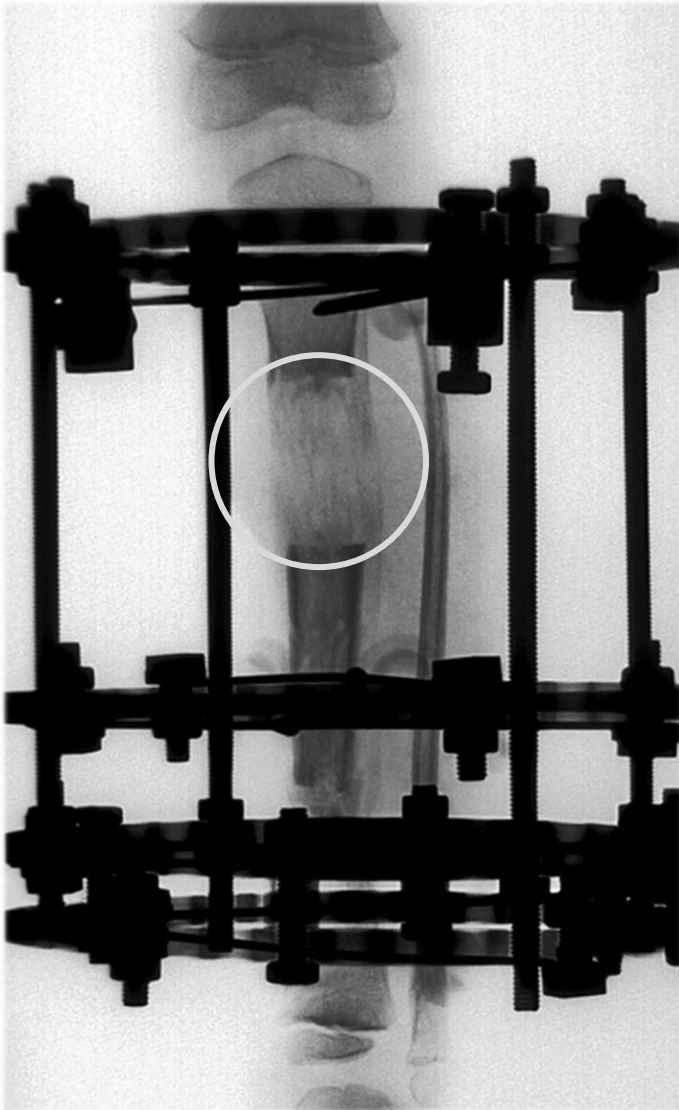
Transverse WR/HP Bone Transport



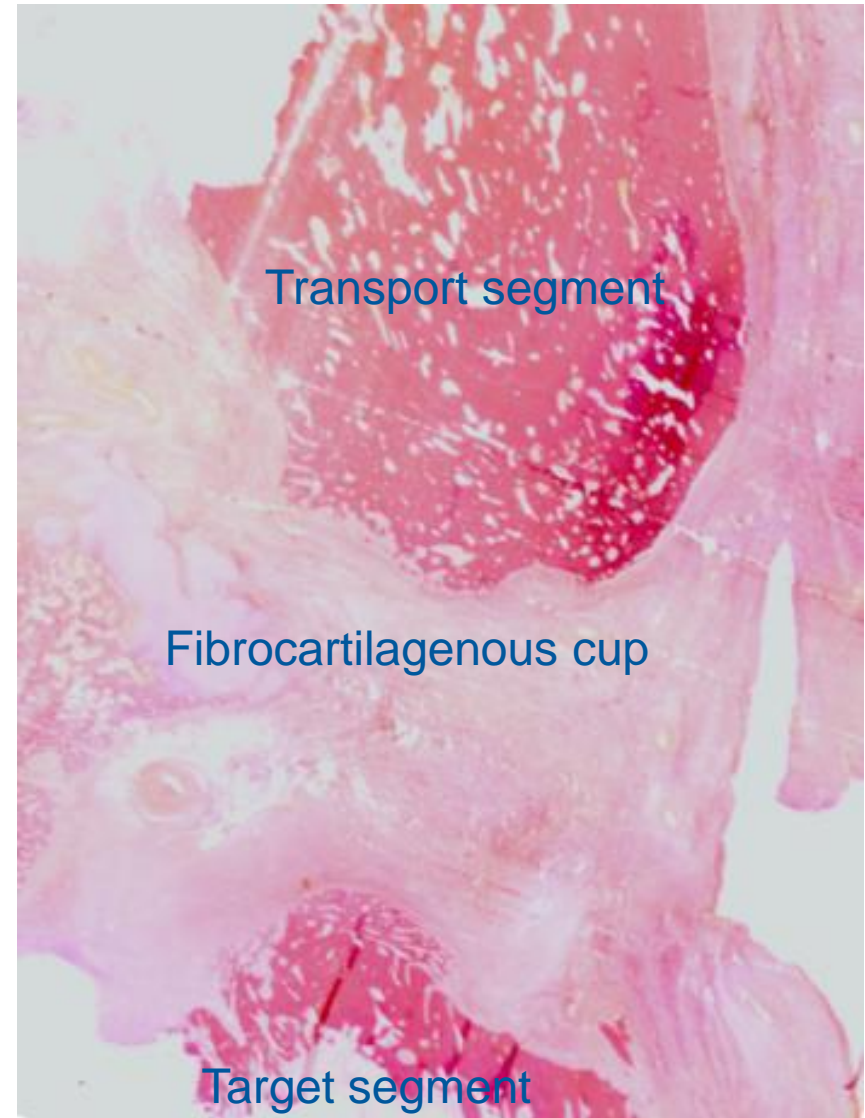
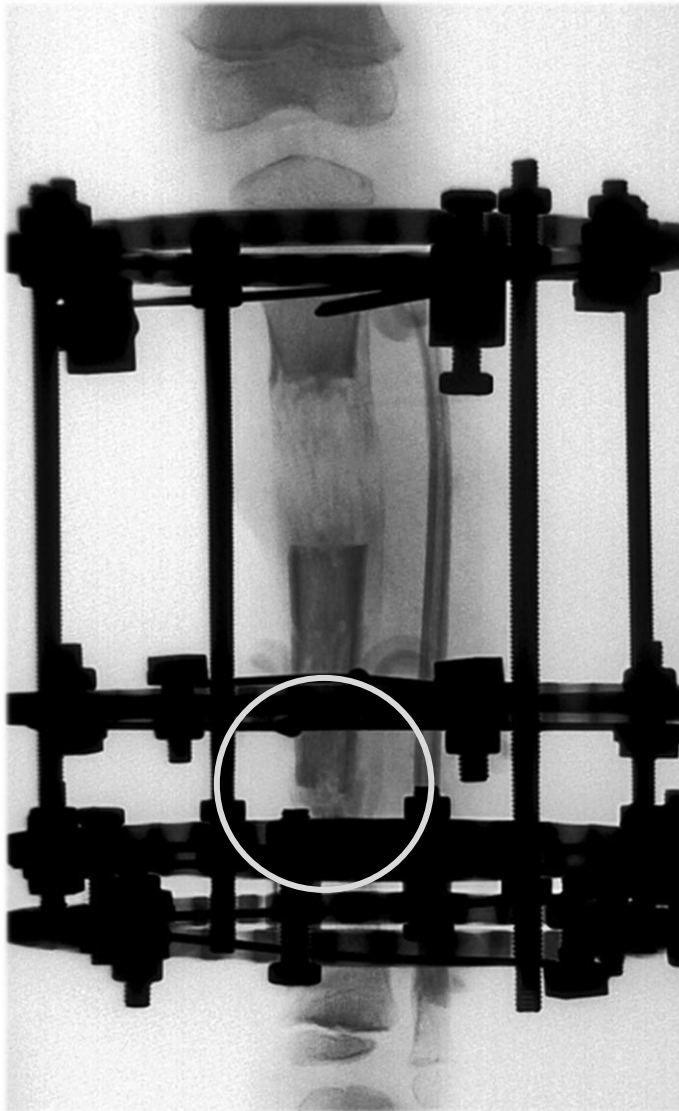
Bifocal Osteosynthesis



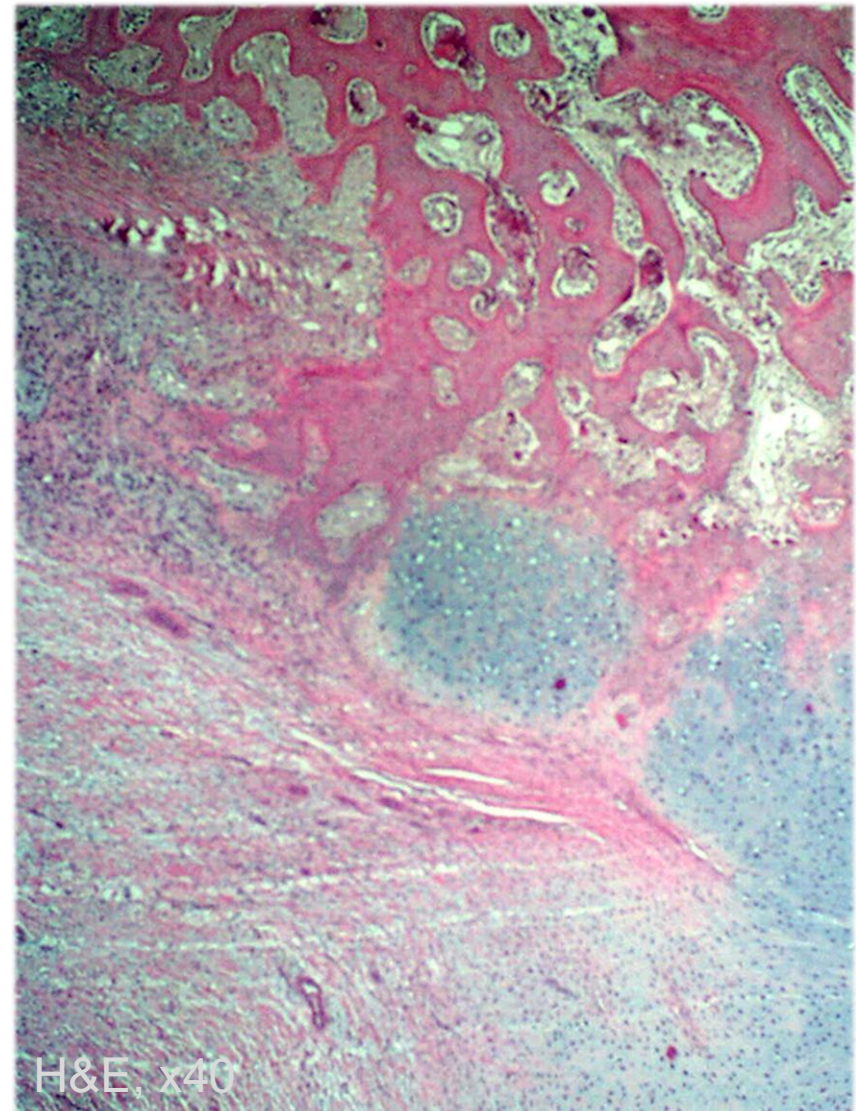
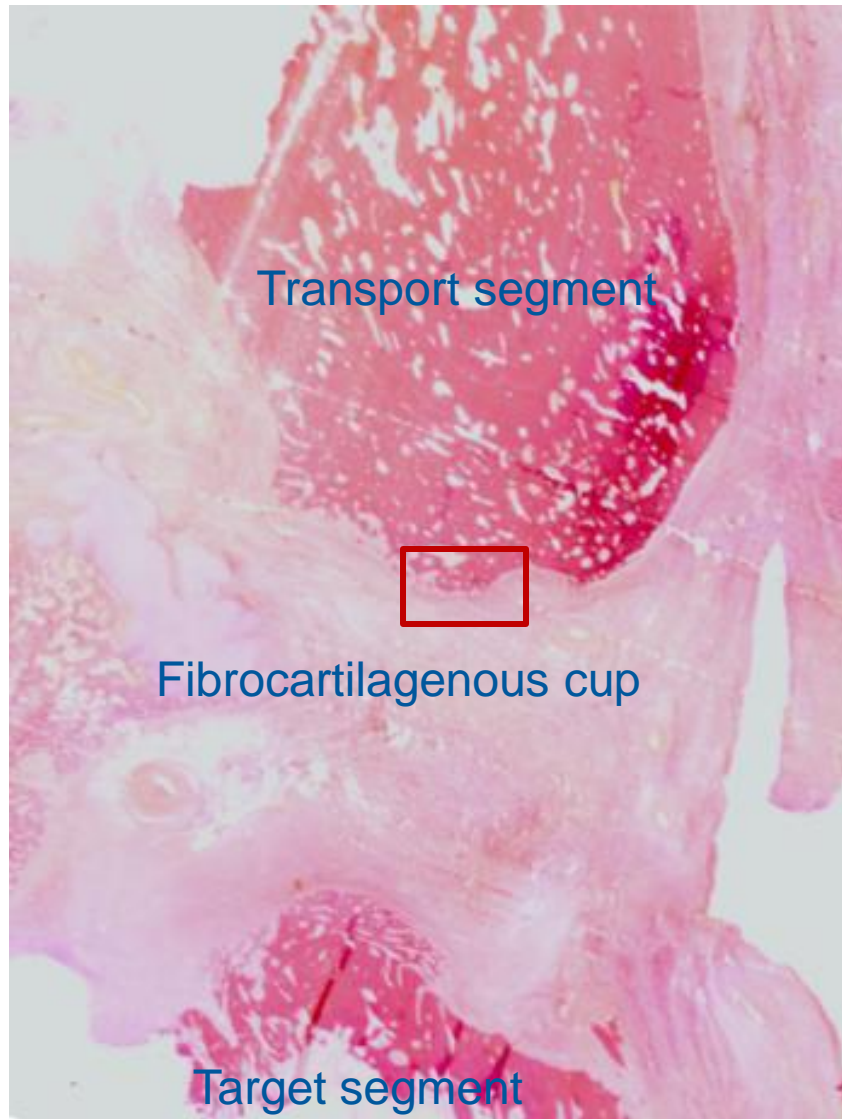
Distraction Osteogenesis



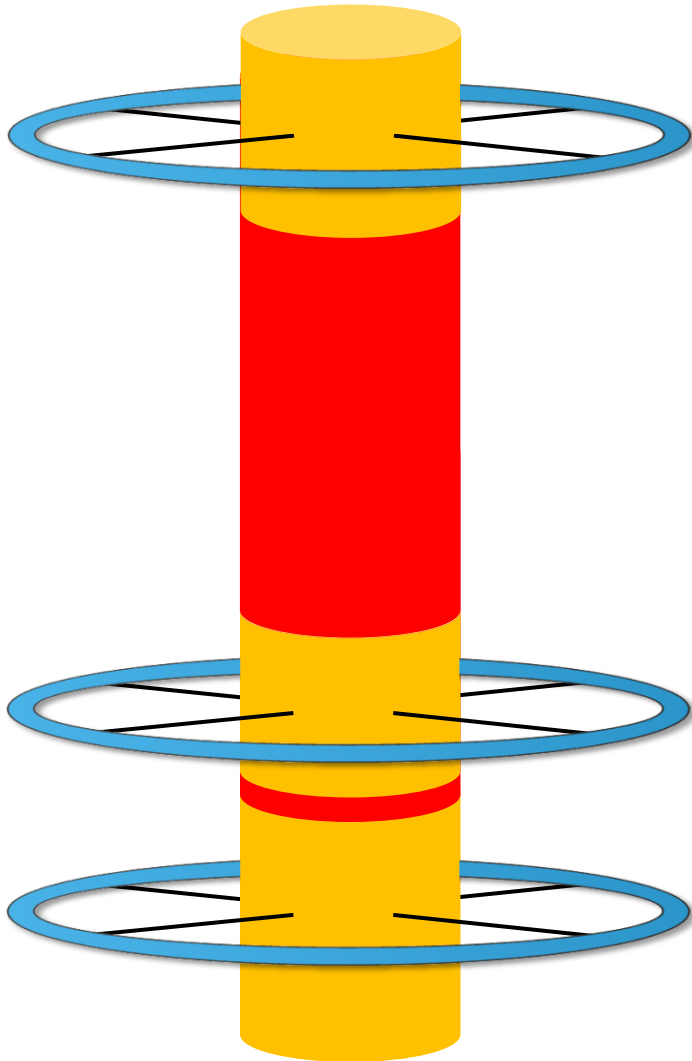
Compression Osteogenesis



Transformational Osteogenesis

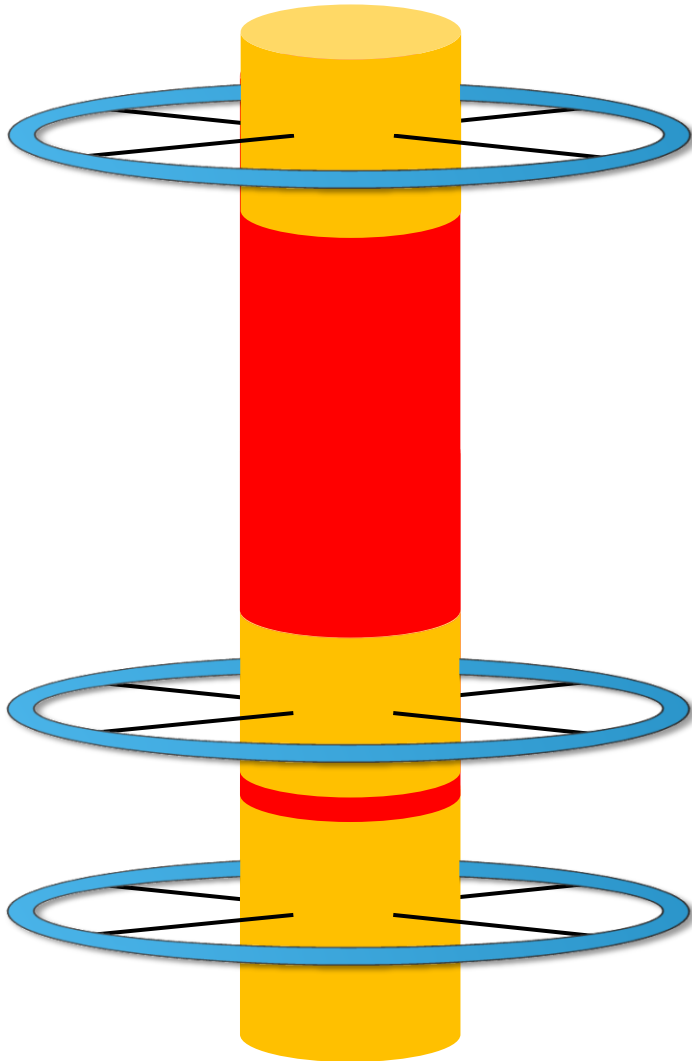


Transverse WR/HP Bone Transport



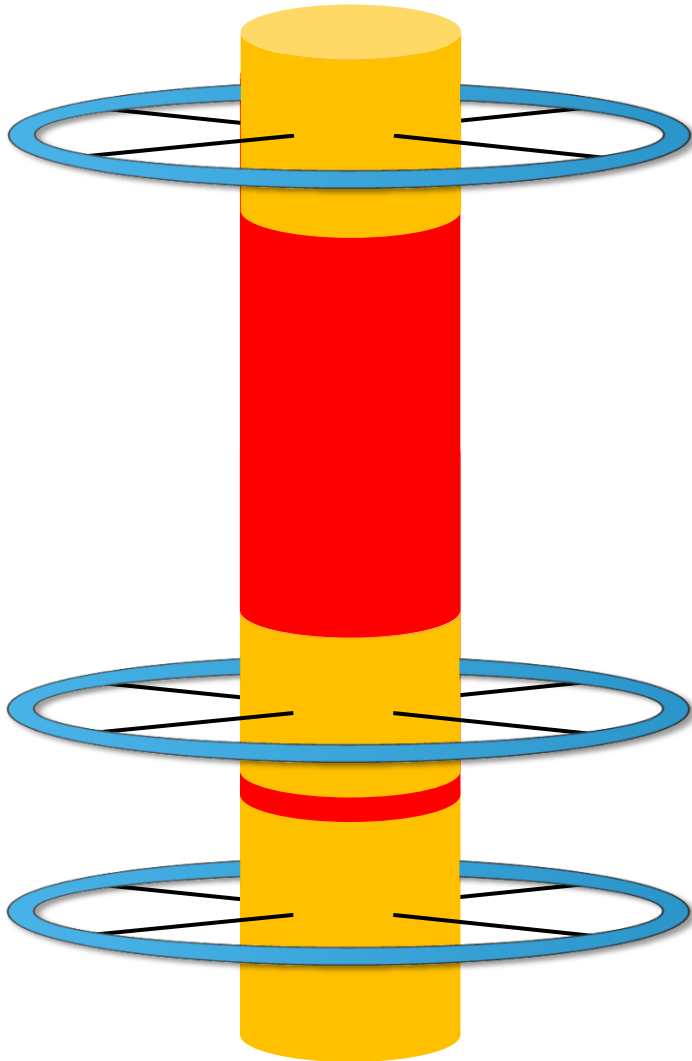
- External fixation
- Osteotomy
- Bone transport
- Docking site debridement & compression
- Bone grafting
- Consolidation of distraction regenerate

Advantages



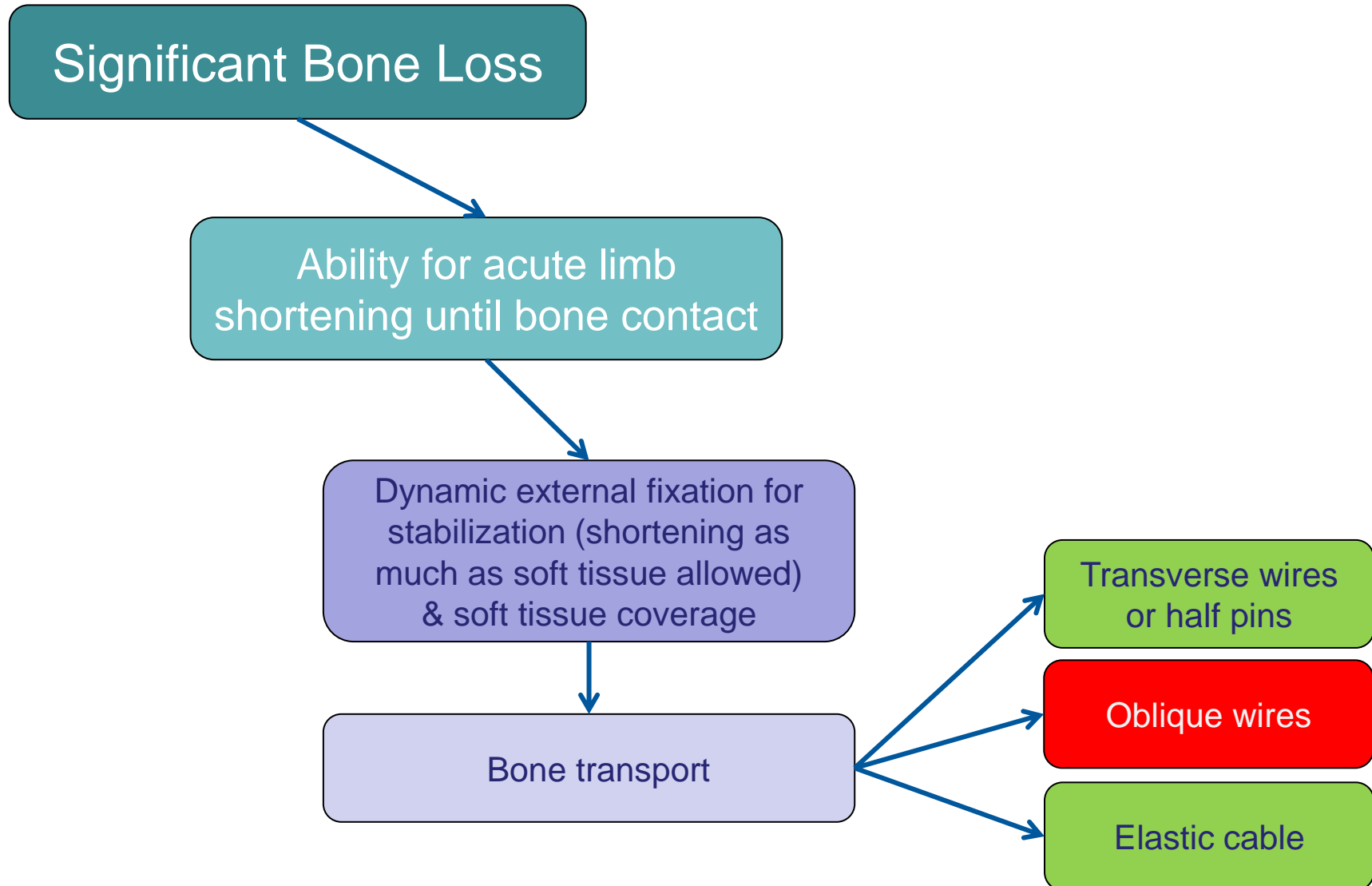
- Superior alignment
- Docking site stability
- No wire re-insertion

Limitations

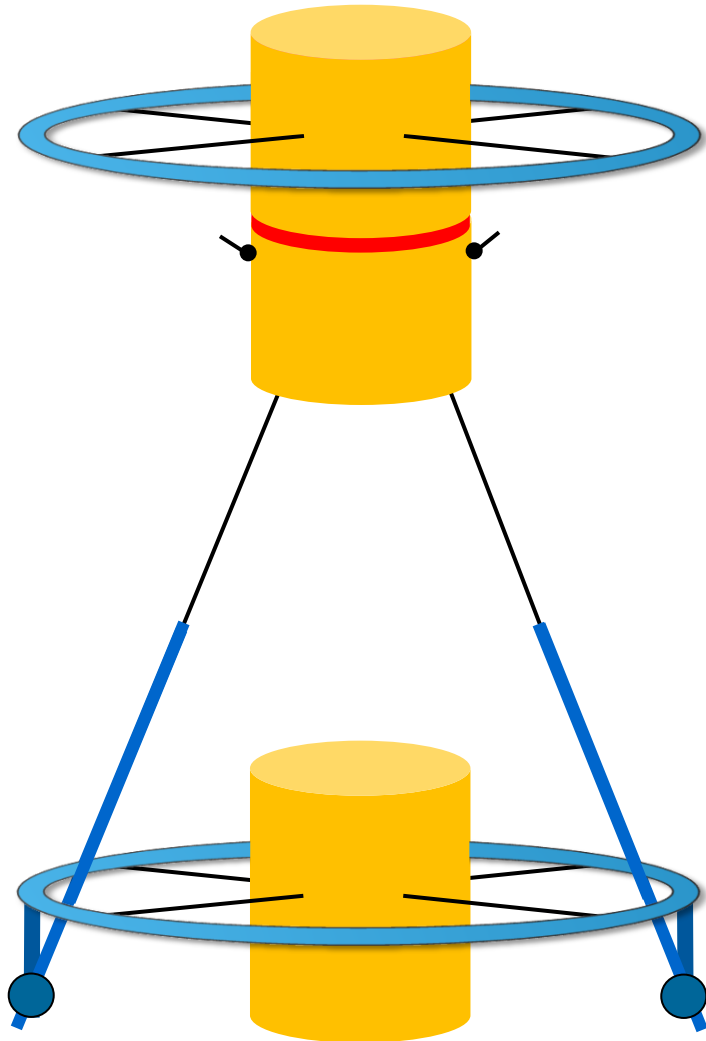


- Superior alignment
- Docking site stability
- No wire re-insertion
- Longitudinal scarring
- Soft tissue coverage compromise

Bone Transport Techniques

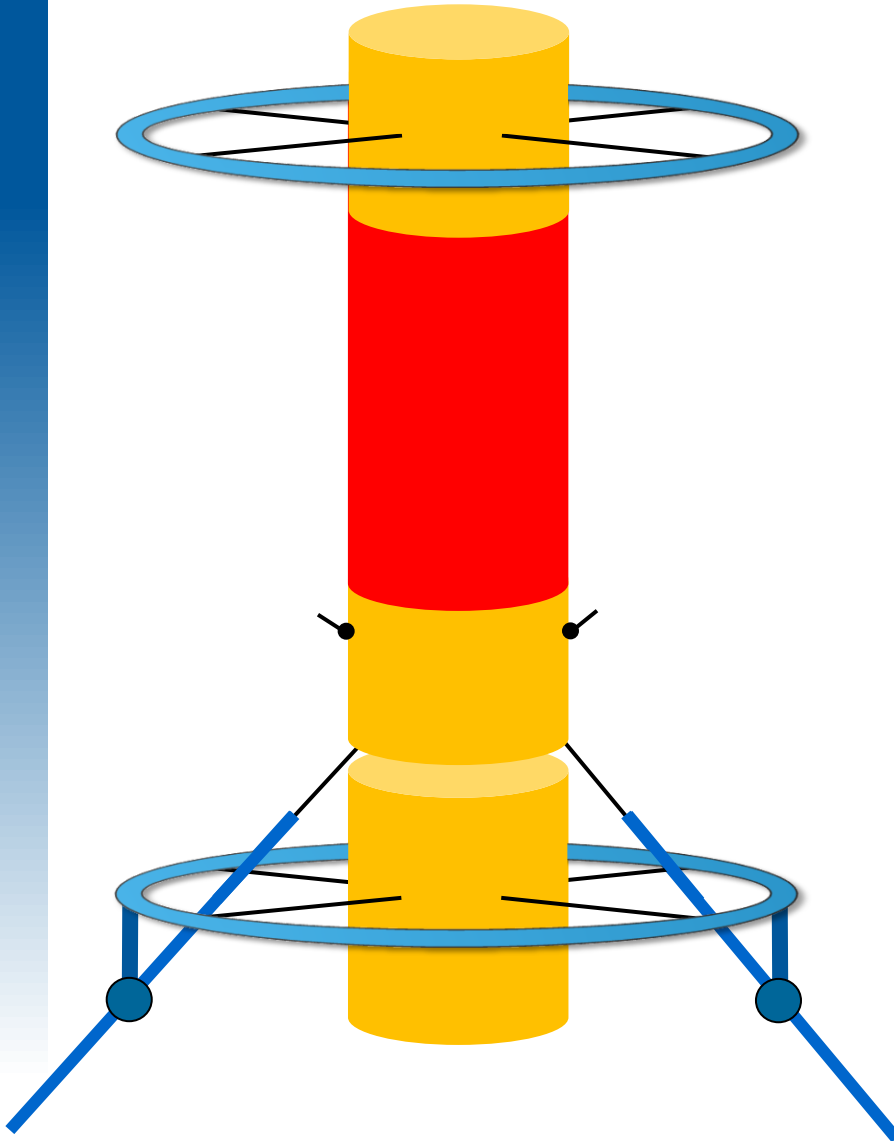


Oblique Wires Bone Transport



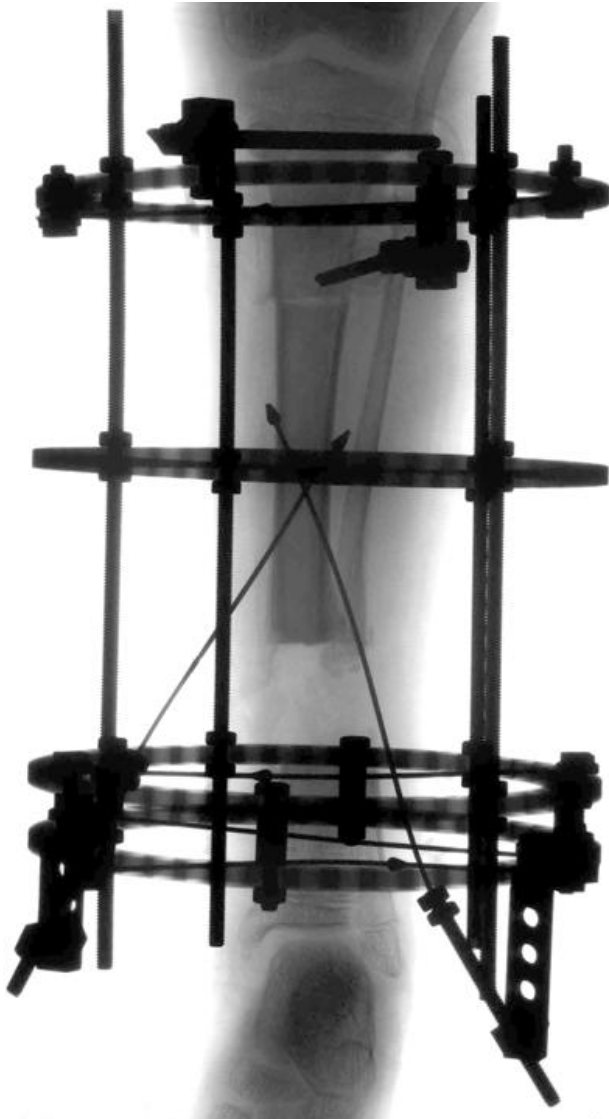
- External fixation
- Oblique wires
- Osteotomy

Oblique Wires Bone Transport



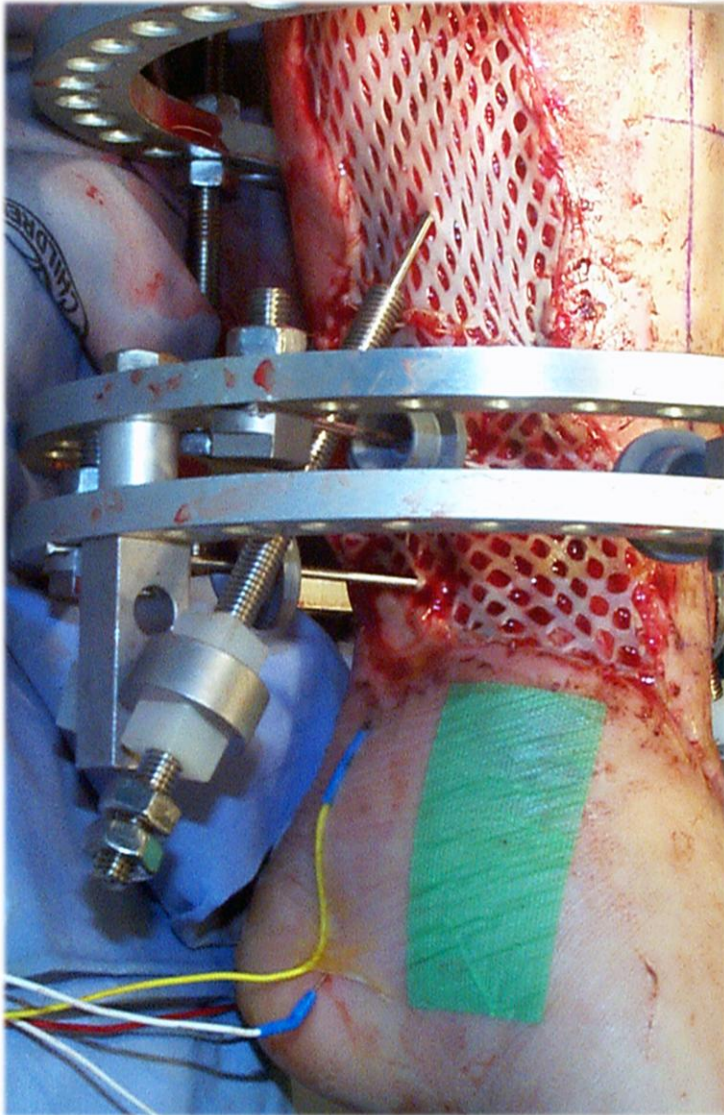
- External fixation
- Oblique wires
- Osteotomy
- Bone transport

Advantages



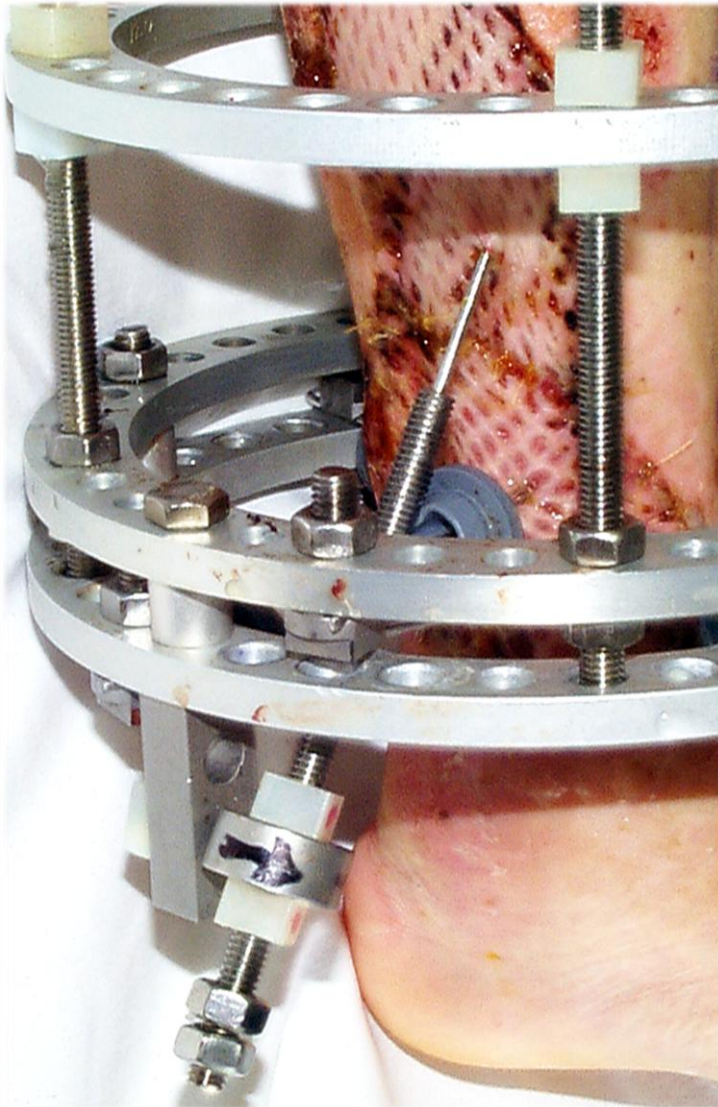
- Small skin penetration
- Less pin track infection

Oblique Wire Bone Transport



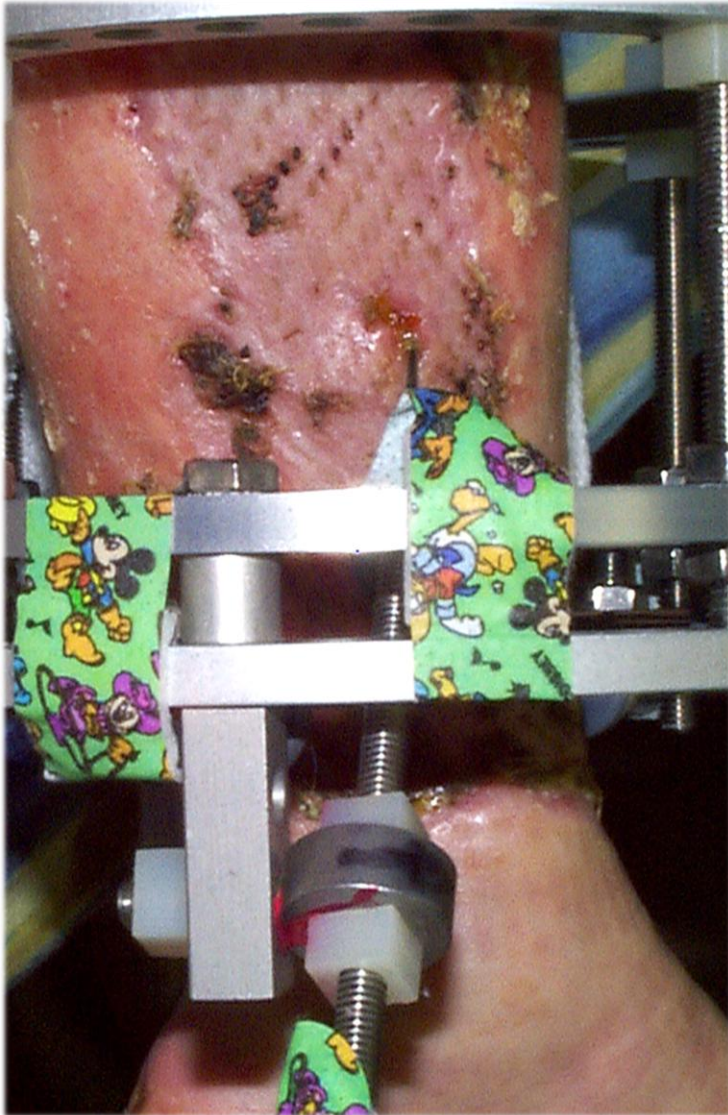
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Oblique Wire Bone Transport



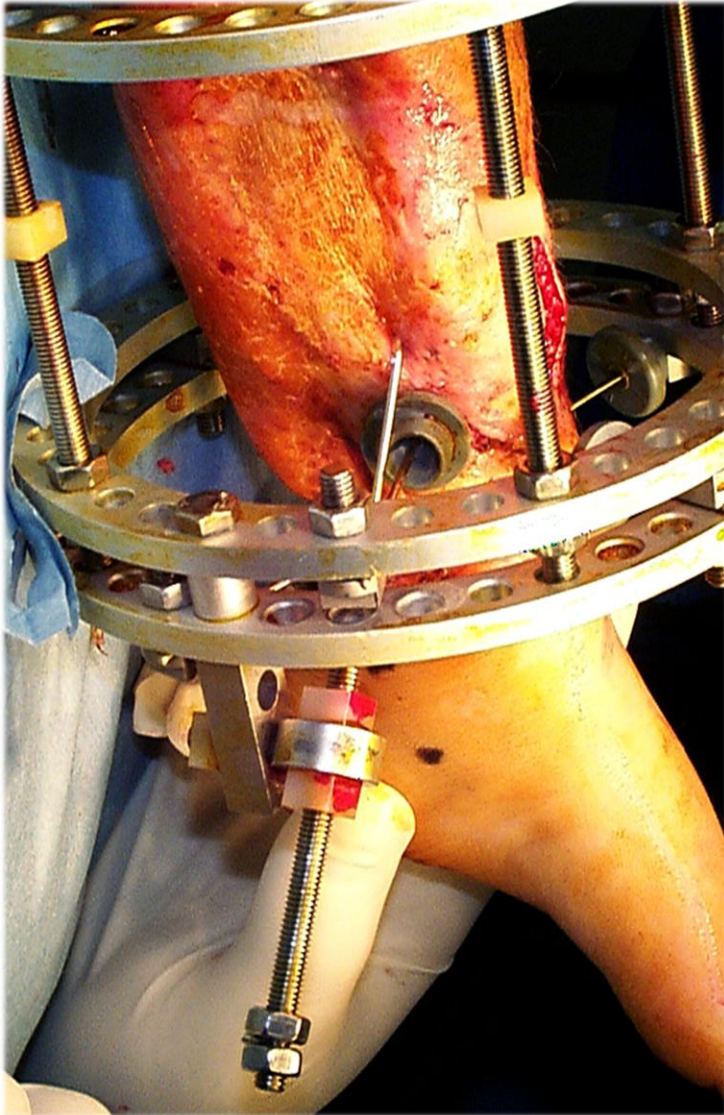
- Small skin penetration
- Less pin track infection

Oblique Wire Bone Transport



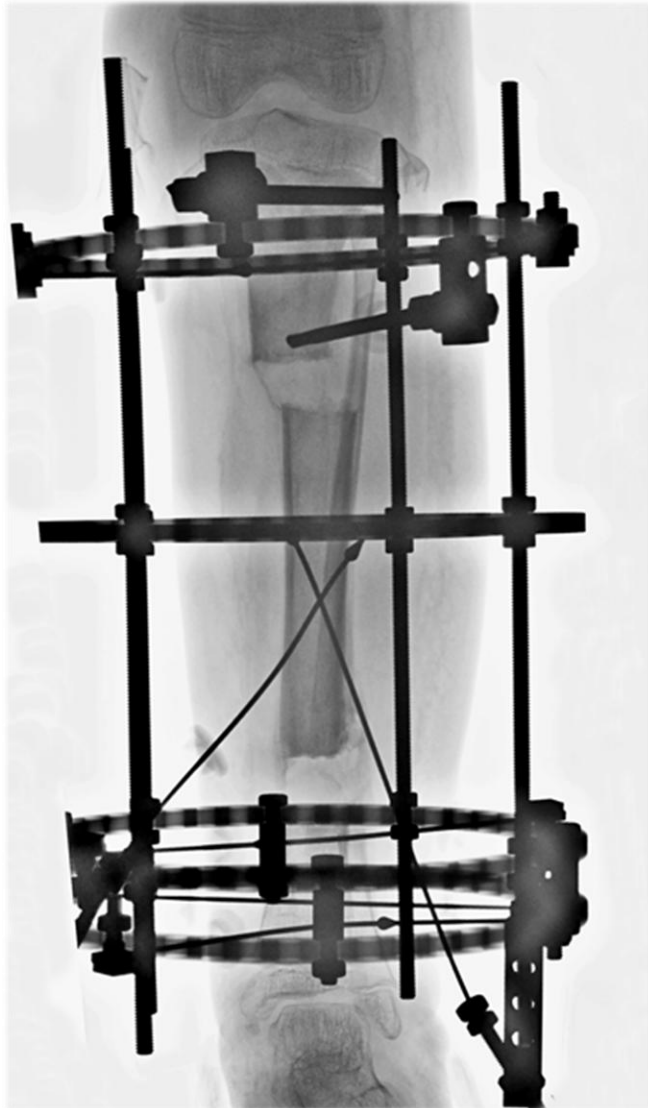
- Small skin penetration
- Less pin track infection

Oblique Wire Bone Transport



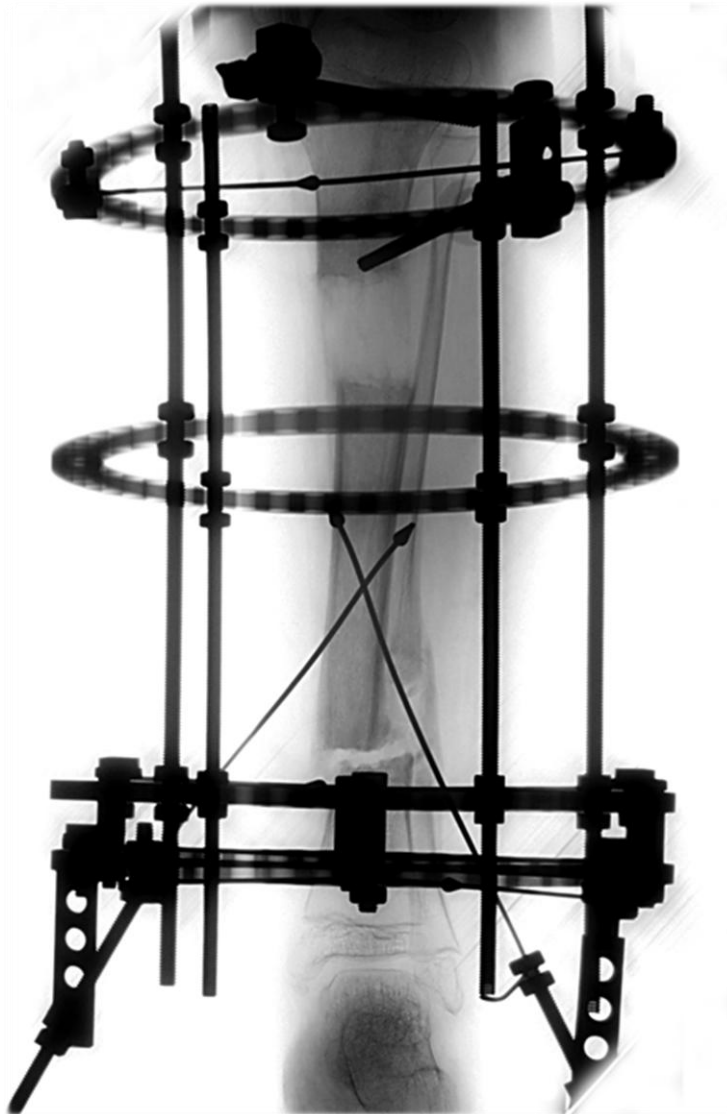
- Small skin penetration
- Less pin track infection

Limitations



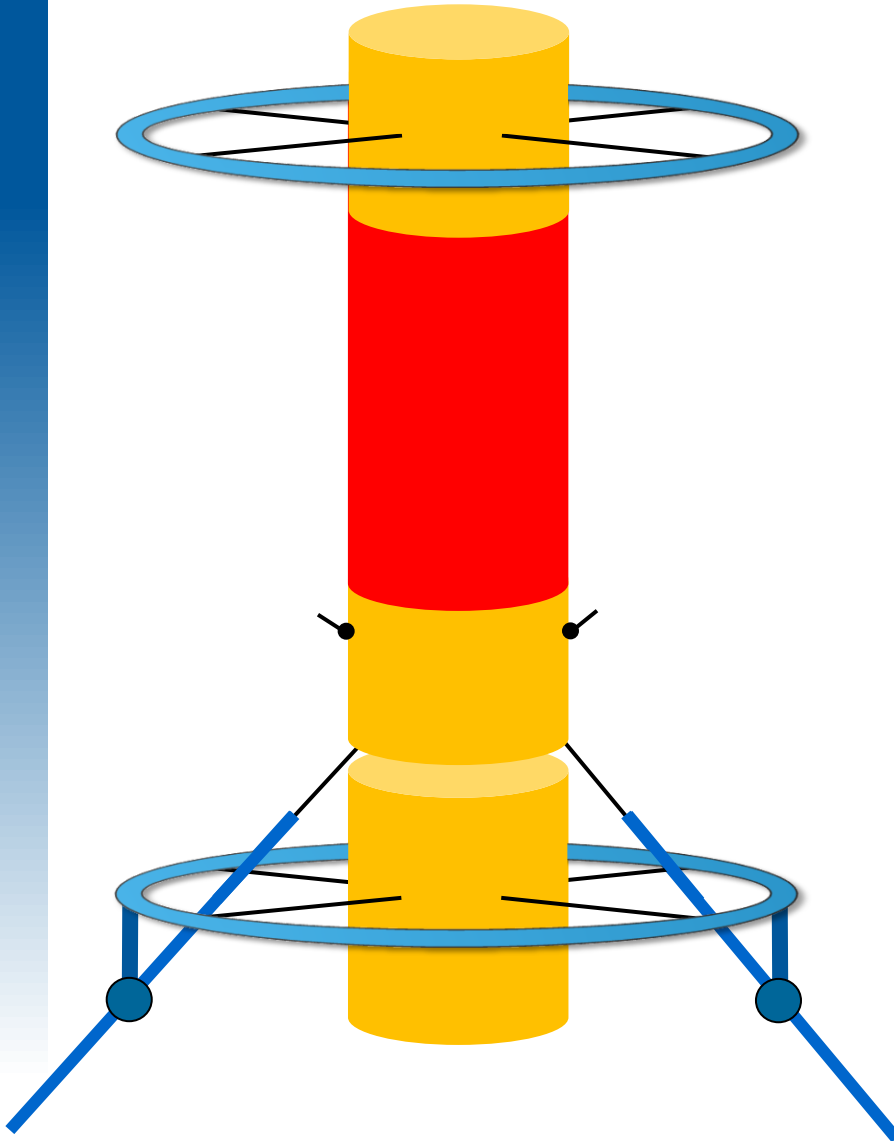
- Small skin penetration
- Less pin track infection
- Transport path deviation

Limitations



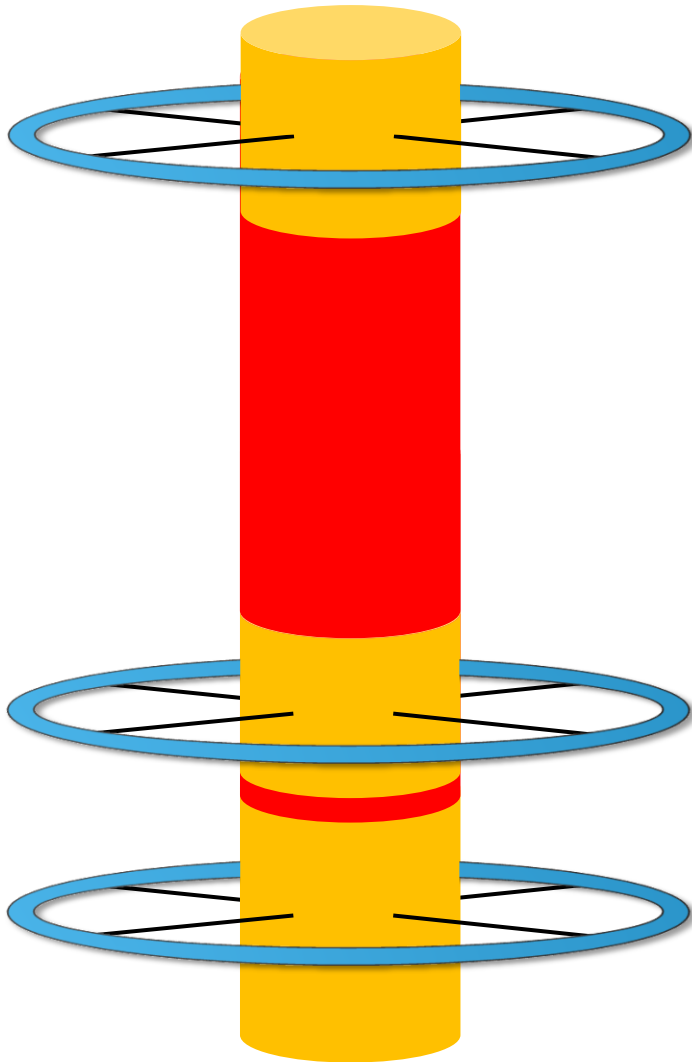
- Small skin penetration
- Less pin track infection
- Transport path deviation
- Docking site compression

Oblique Wire Bone Transport



- External fixation
- Oblique wires
- Osteotomy
- Bone transport
- Transverse wires

Oblique Wire Bone Transport



- External fixation
- Oblique wires
- Osteotomy
- Bone transport
- Transverse wires
- Docking site debridement & compression
- Bone grafting
- Additional distraction

Patient



- 9-year-old boy
- Stiff tibial non-union
- One year after trauma
- S/p open Grade II fracture
- Initial debridement
- Hoffmann external fixation

Attempted IM Nailing



- Non-union debridement
- Fibular osteotomy
- Reaming of the tibia
- Flexible Ender nail fixation
- Local bone grafting
- Long-leg cast immobilization

Infected Tibial Pseudoarthrosis



- Wound dehiscence
- Infected non-union
- Irrigation & debridement
- Ender nails removal

Infected Tibial Pseudoarthrosis



Infected Tibial Pseudoarthrosis

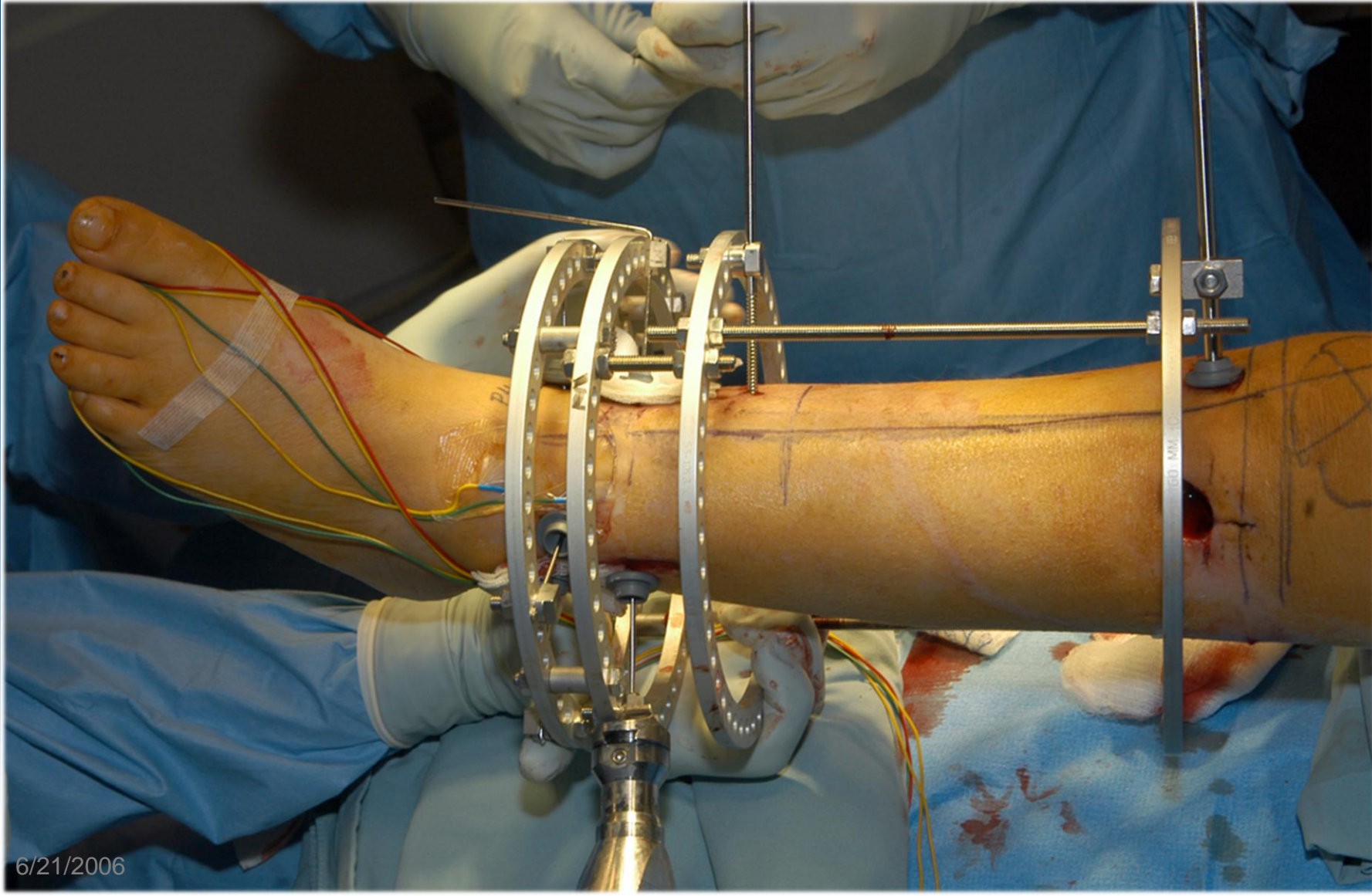


Segmental necrosis of the
distal tibia 5-6 cm
confirmed by MRI

Intraoperative Frame Assembly

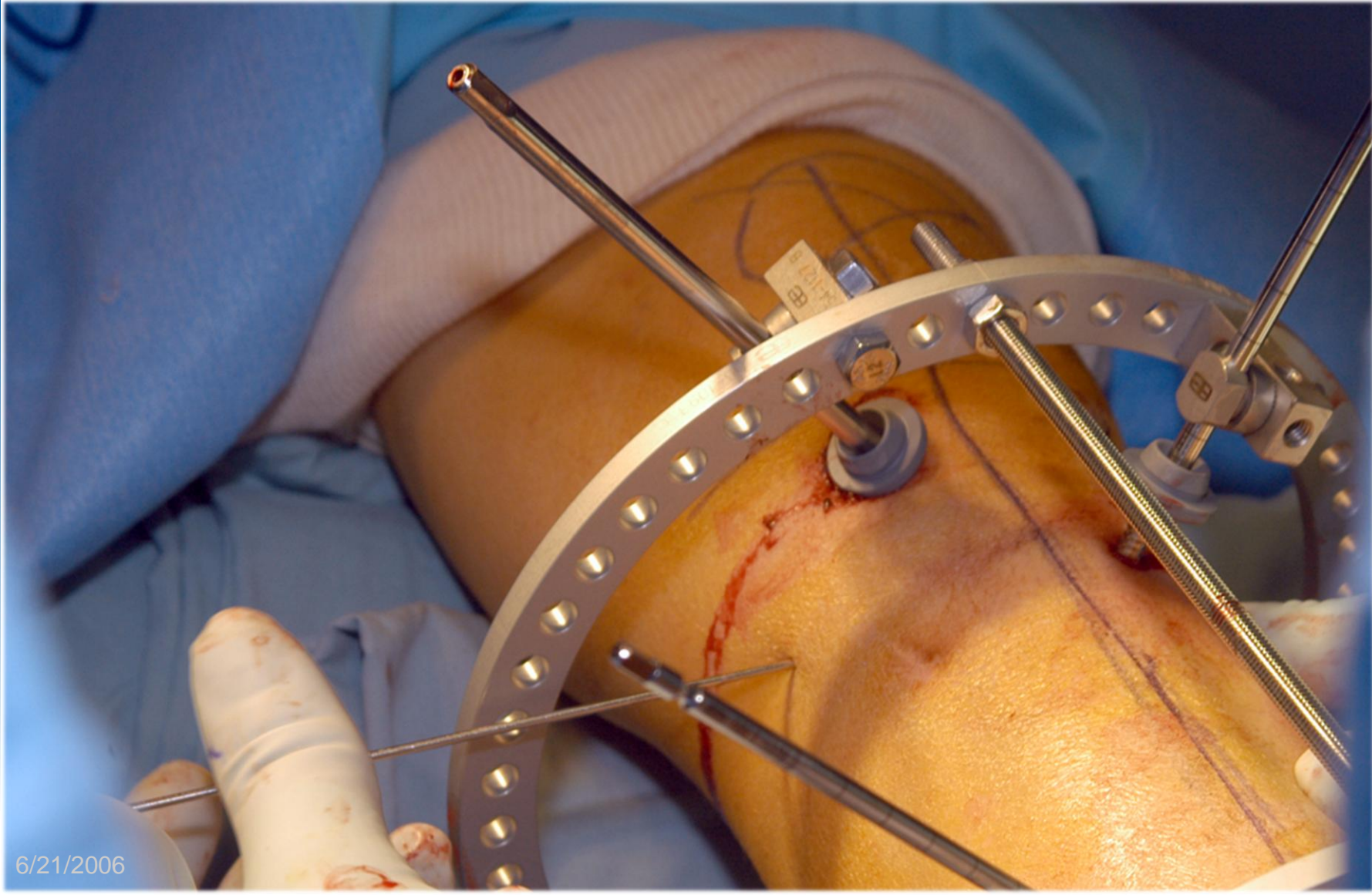


Bone Defect Stabilization

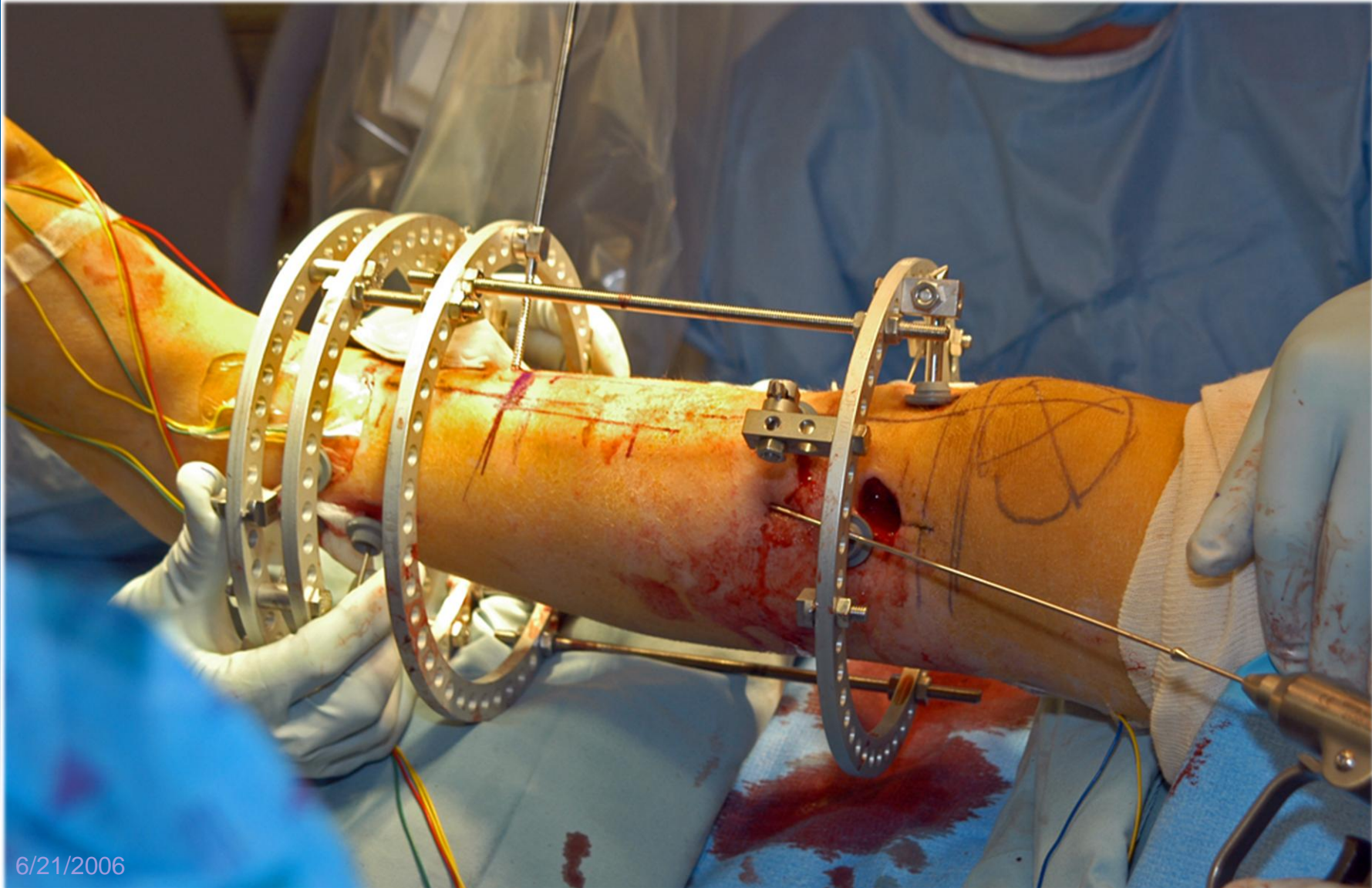


6/21/2006

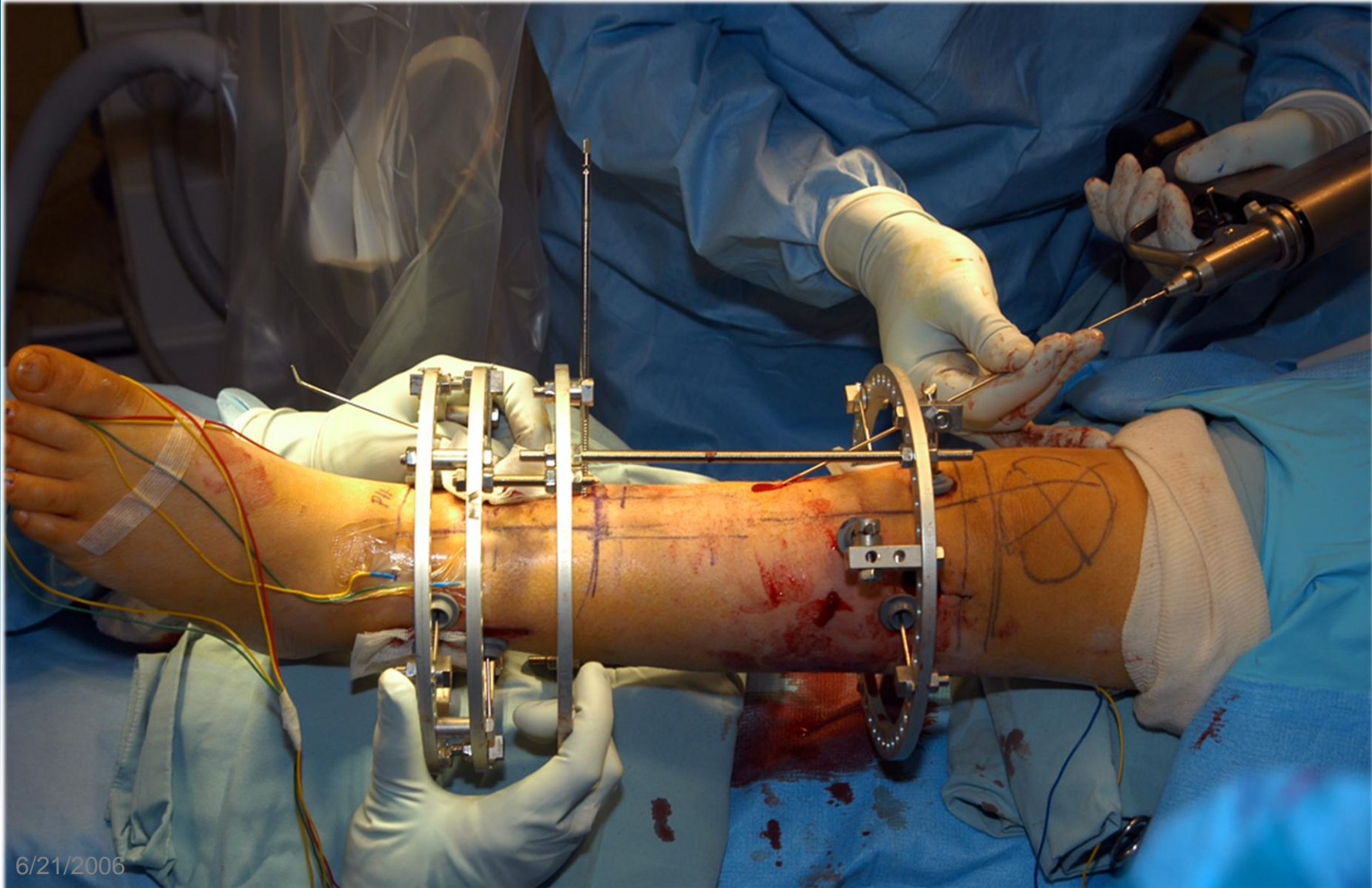
Bone Defect Stabilization



Oblique Wire Insertion



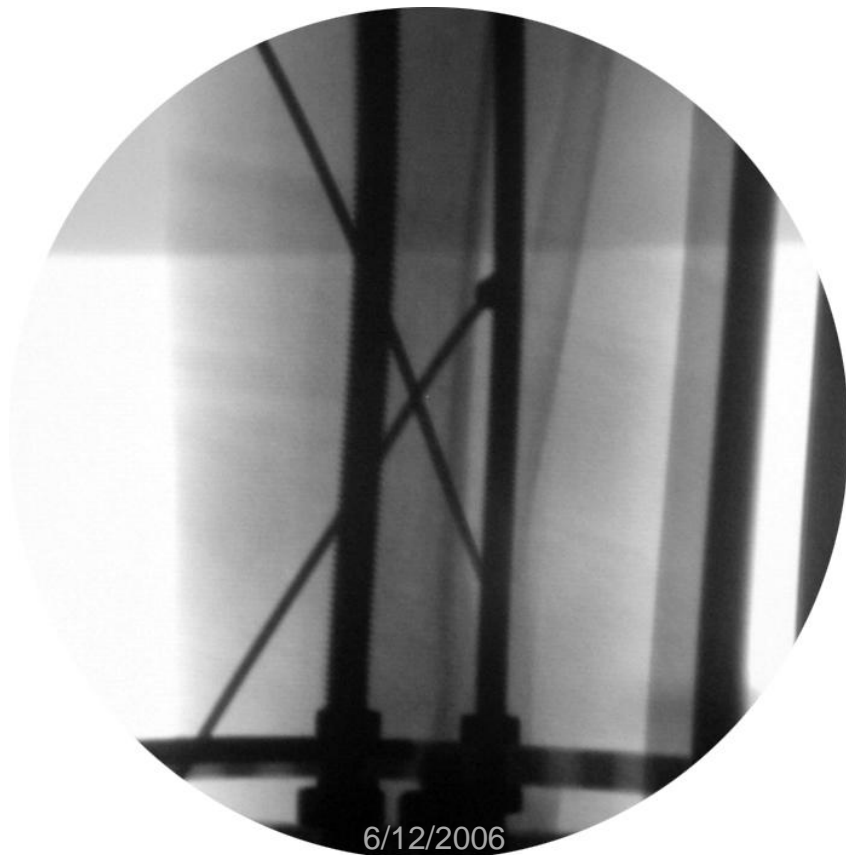
Oblique Wire Insertion



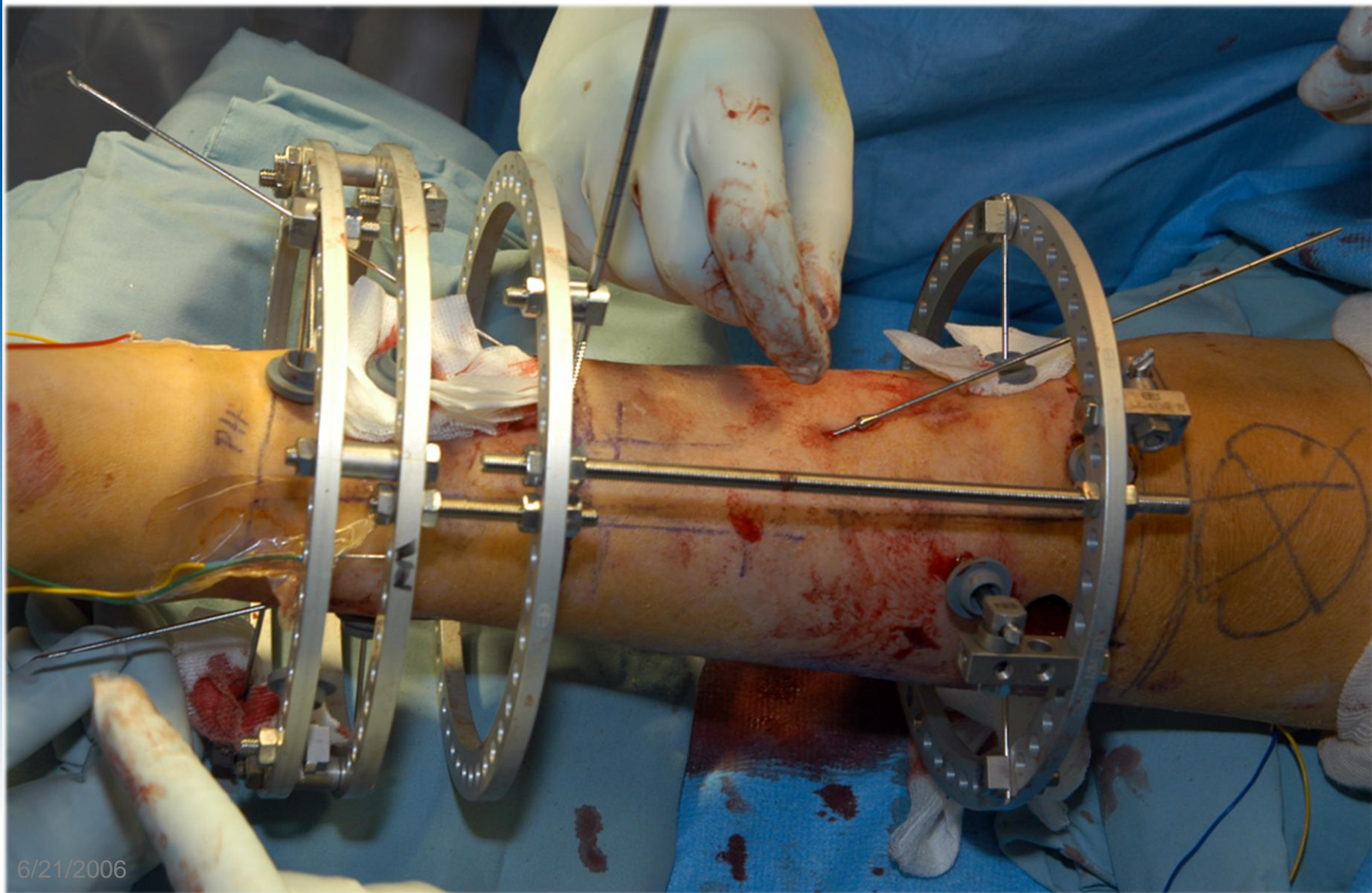
Oblique Wire Insertion



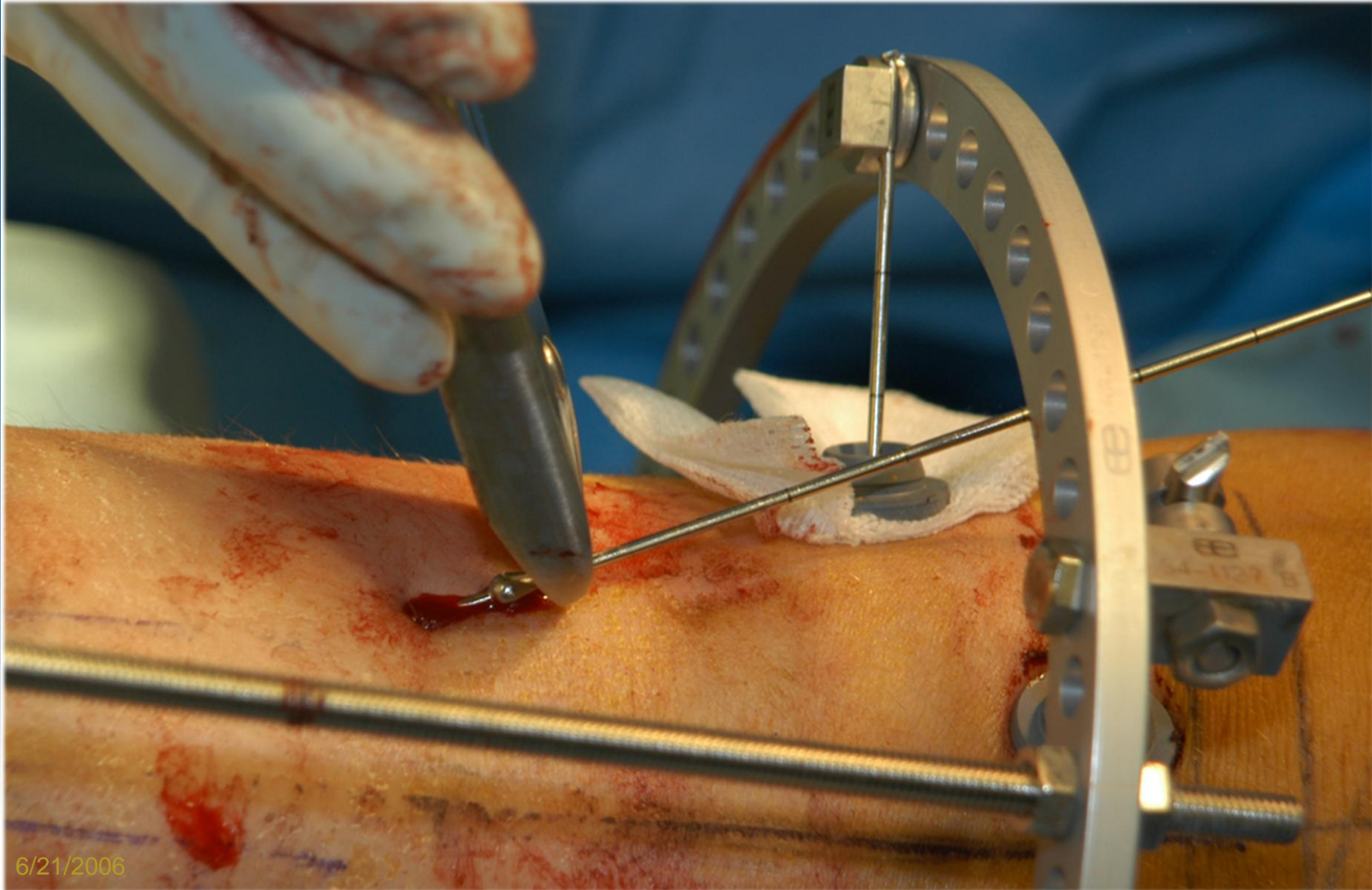
Oblique Wire Insertion



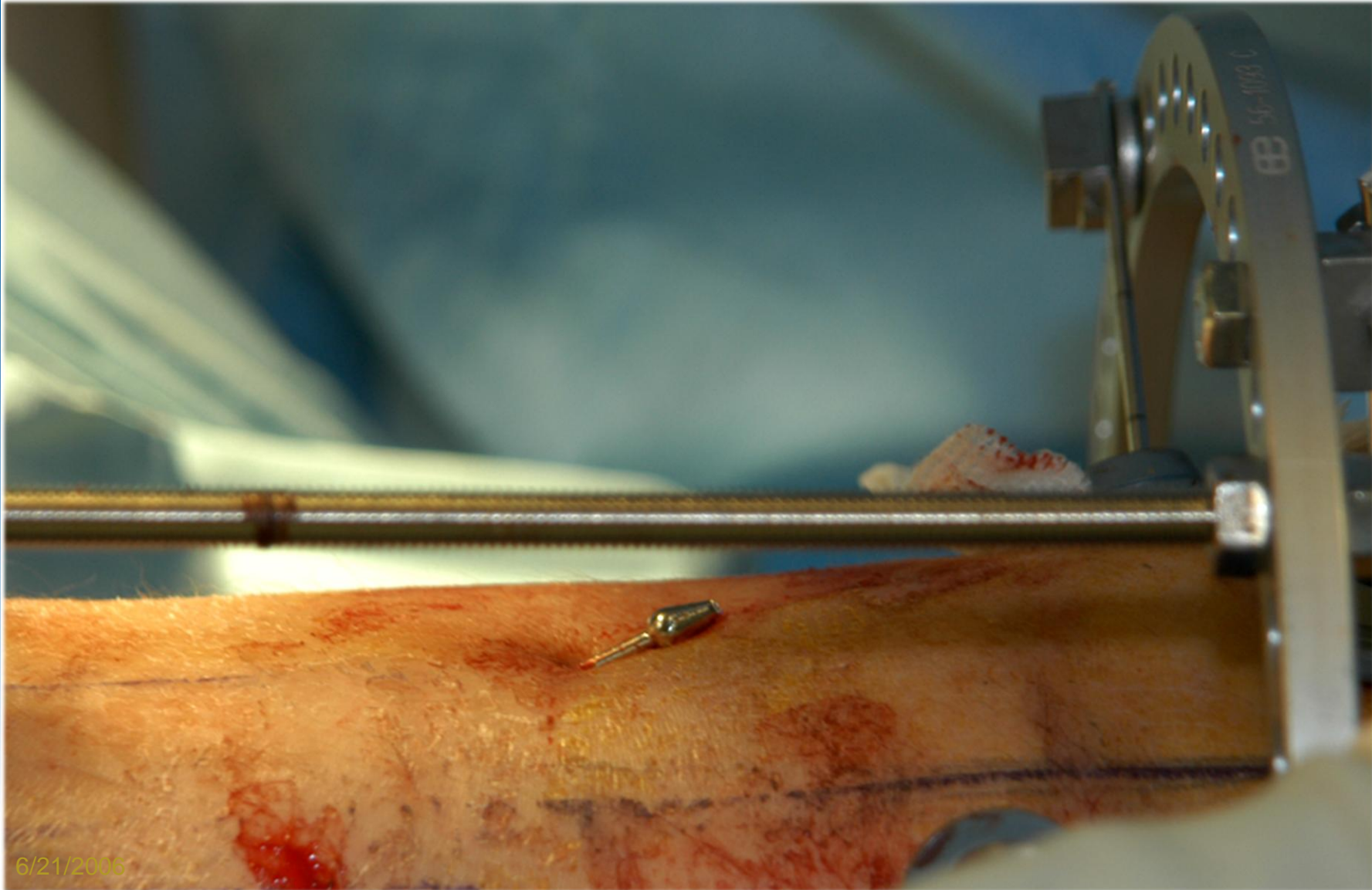
Oblique Wire Insertion



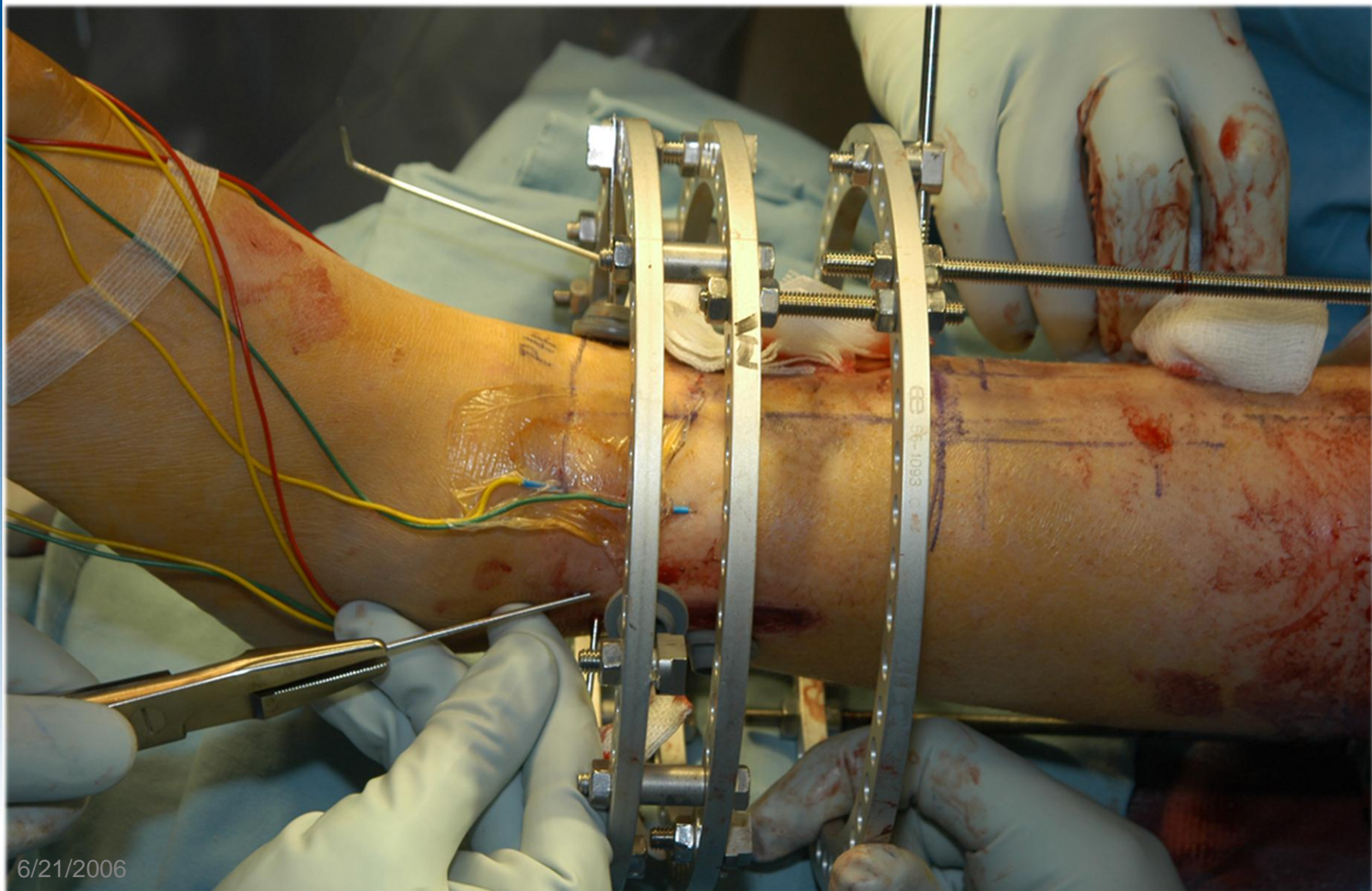
Oblique Wire Insertion



Oblique Wire Insertion

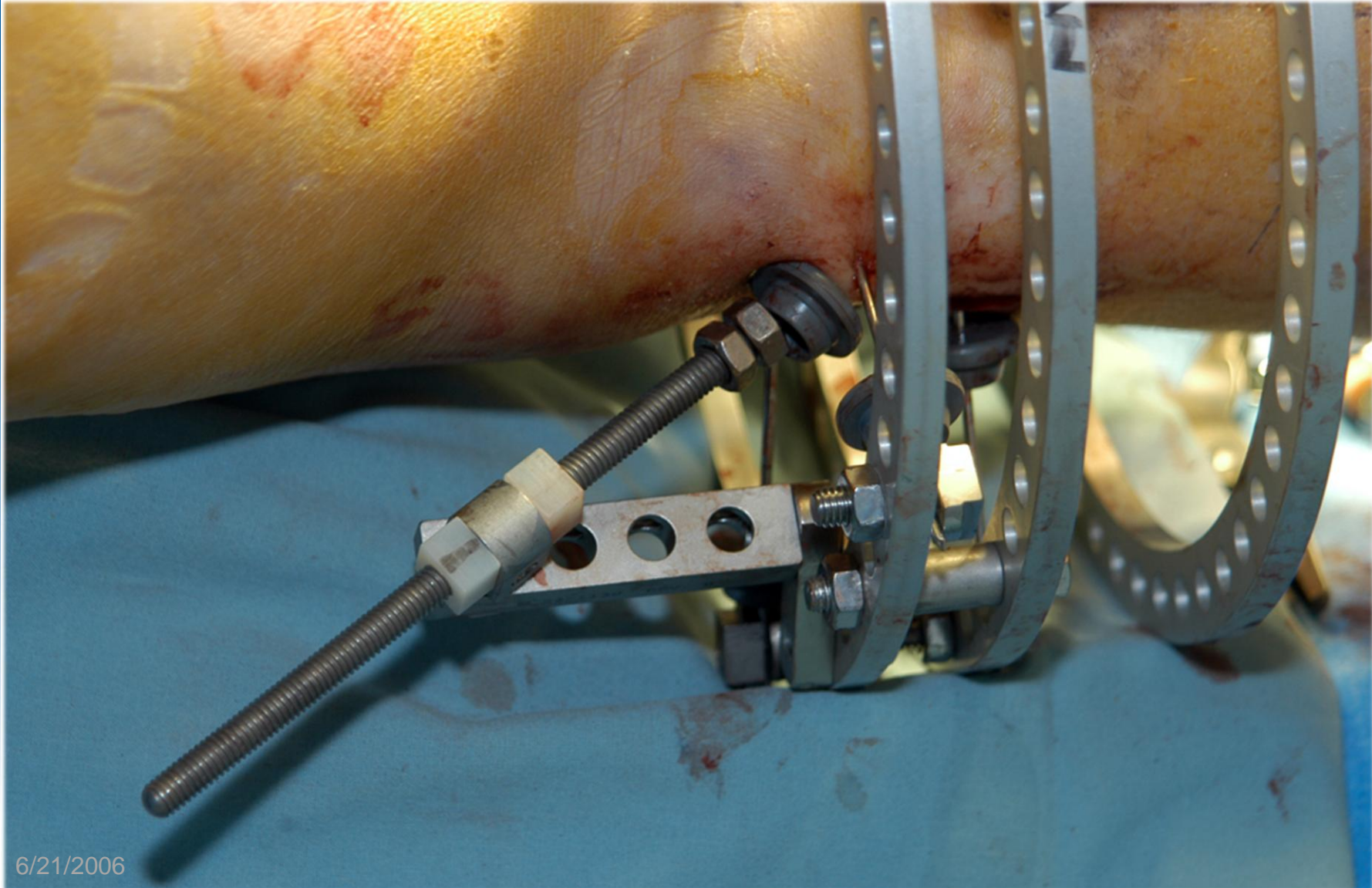


Oblique Wire Insertion



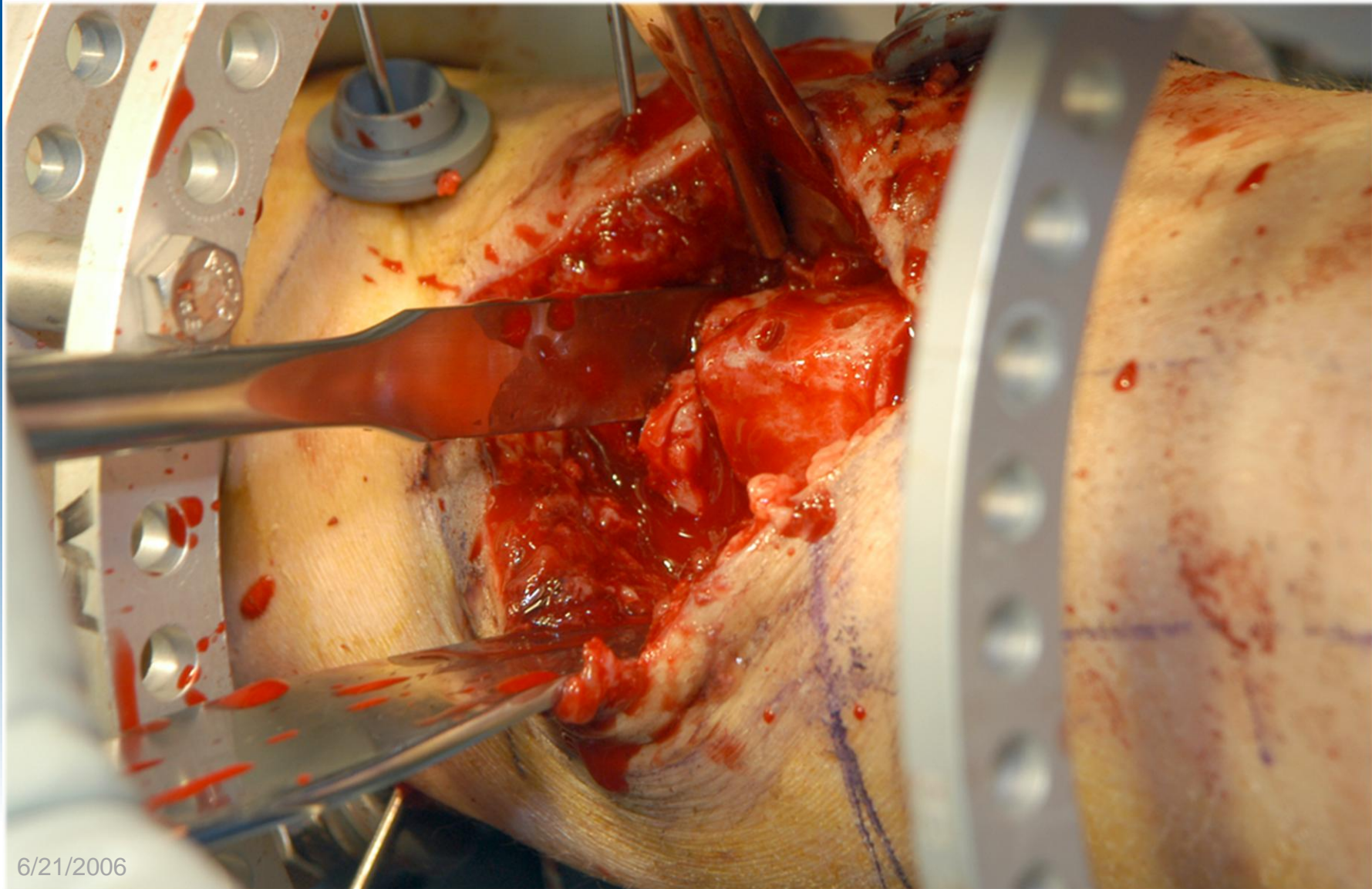
6/21/2006

Transport Module Assembly

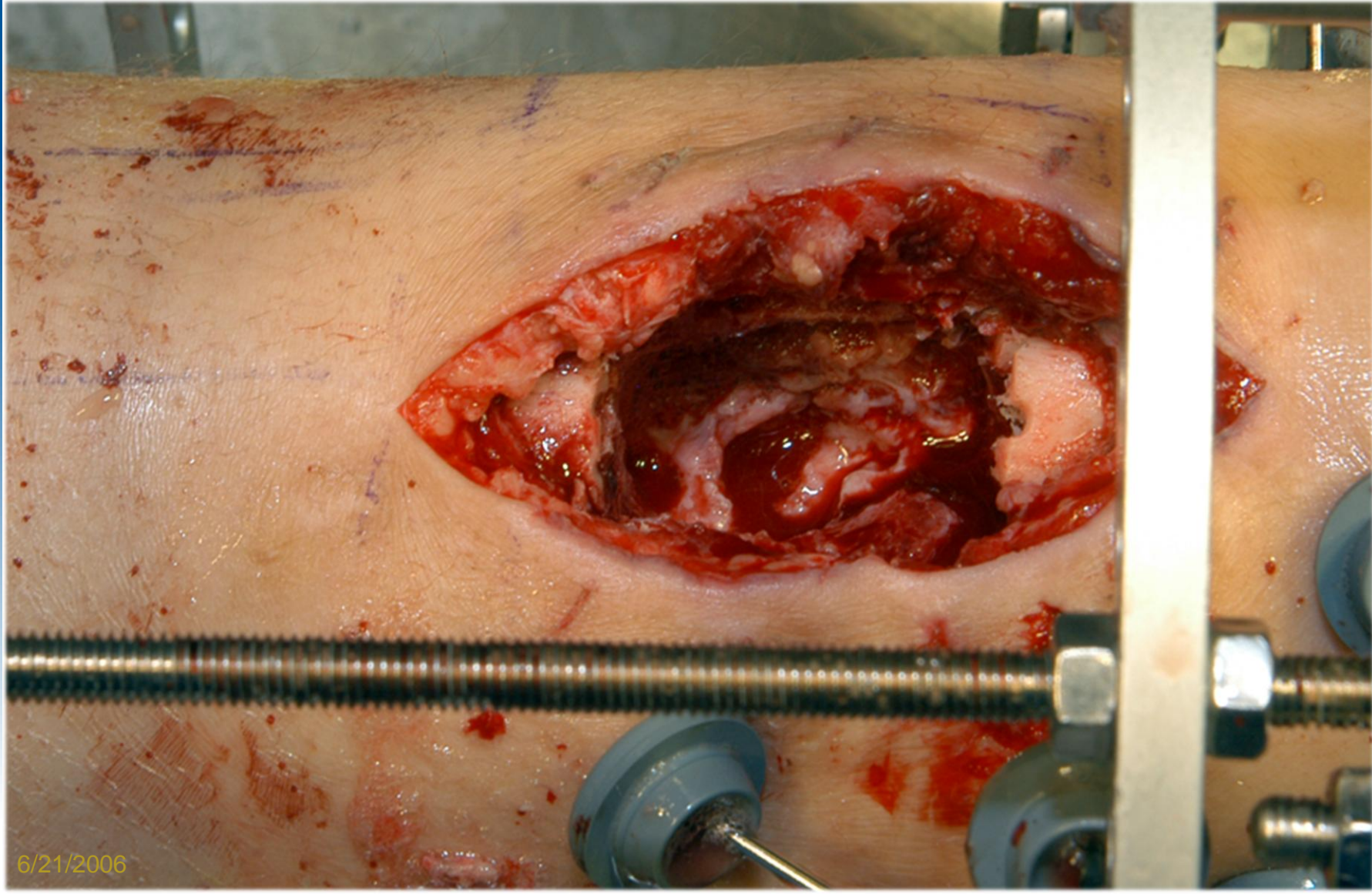


6/21/2006

Nonunion Resection

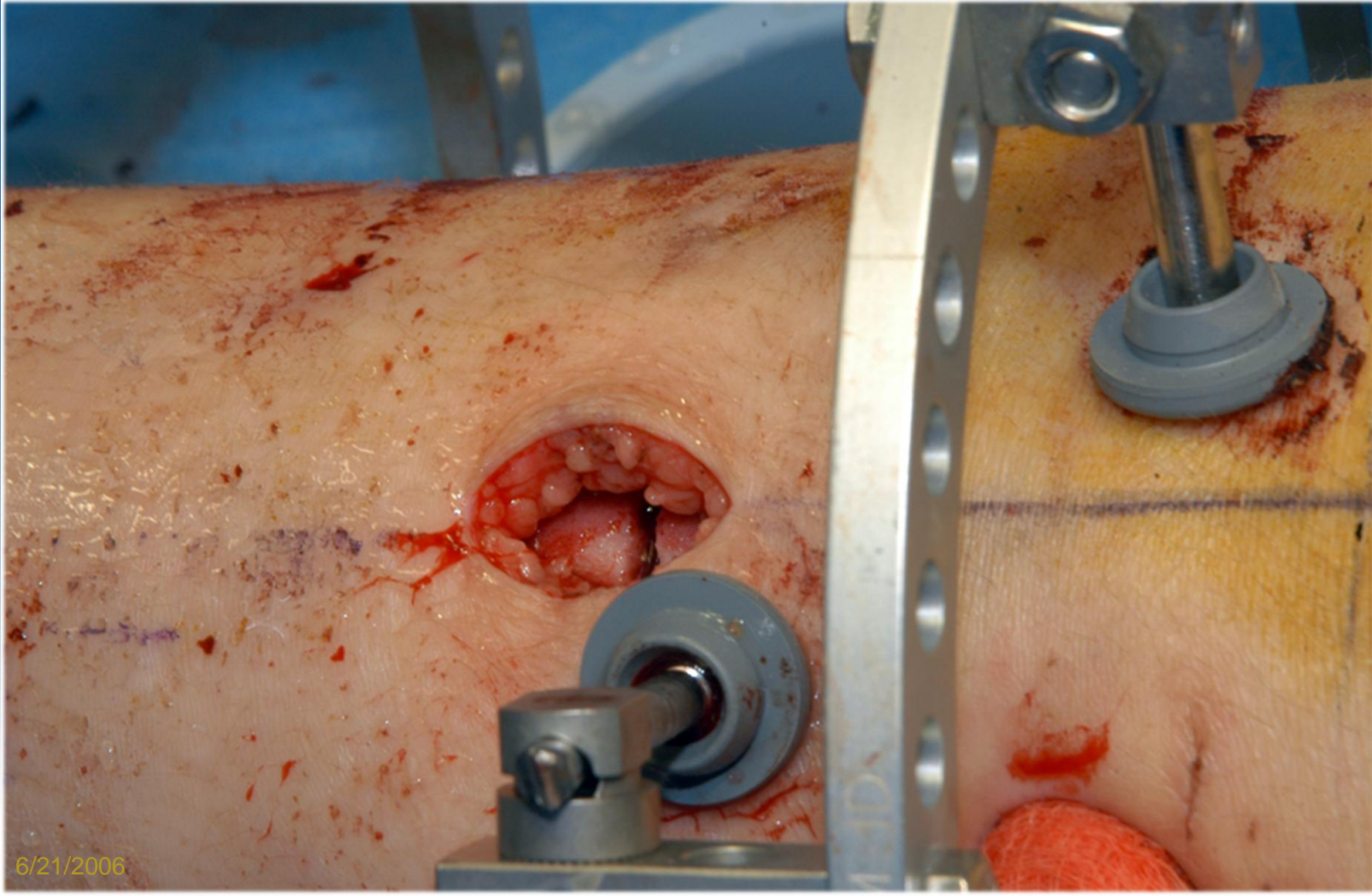


Segmental Bone Defect



6/21/2006

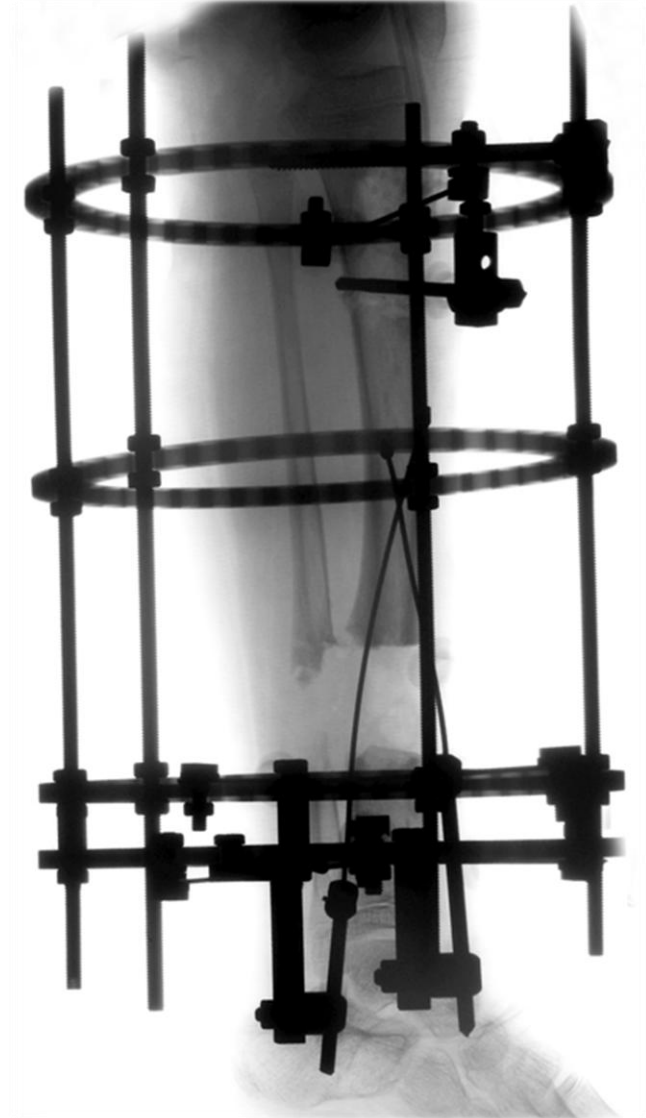
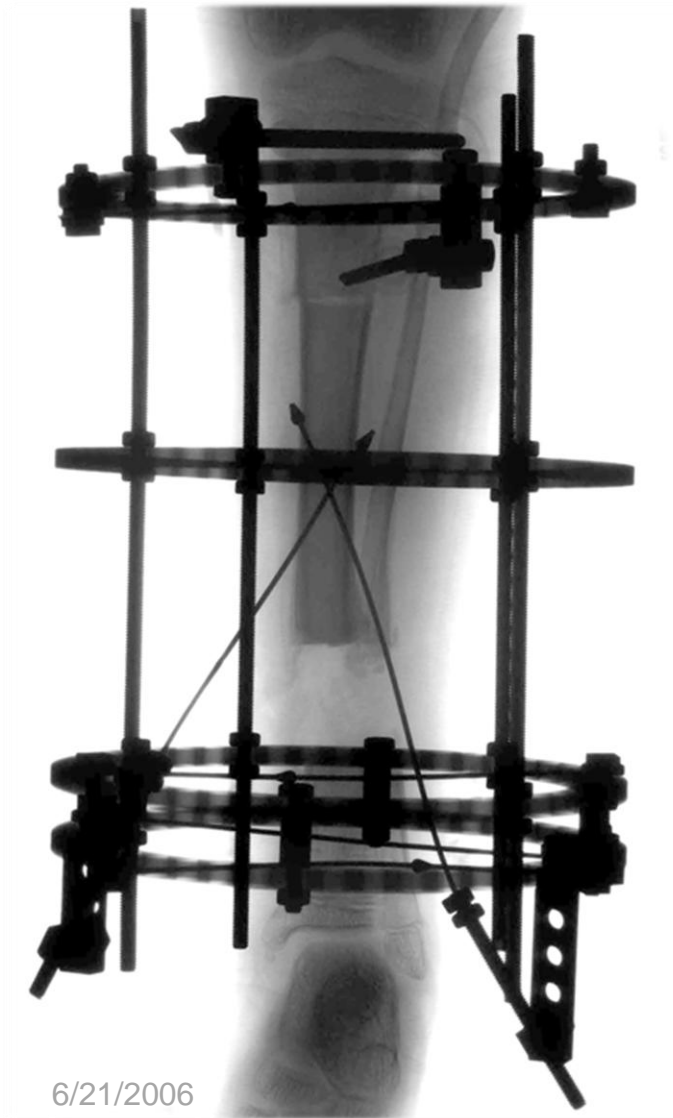
Proximal Tibial Osteotomy



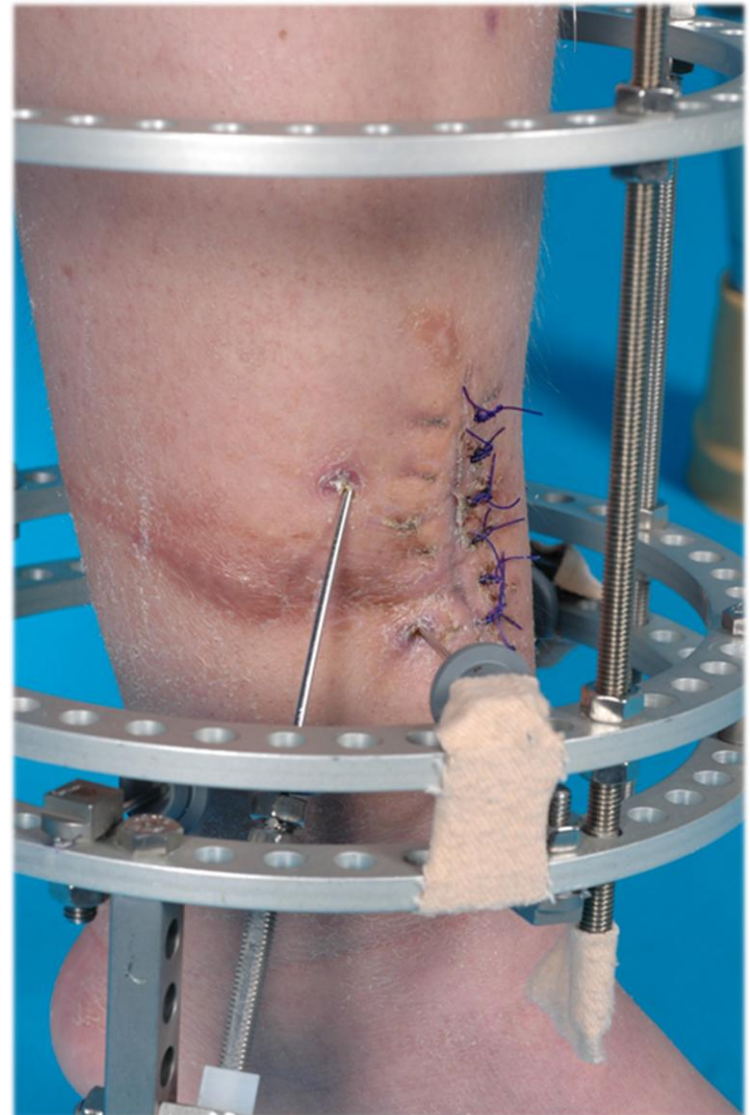
Final Frame Assembly



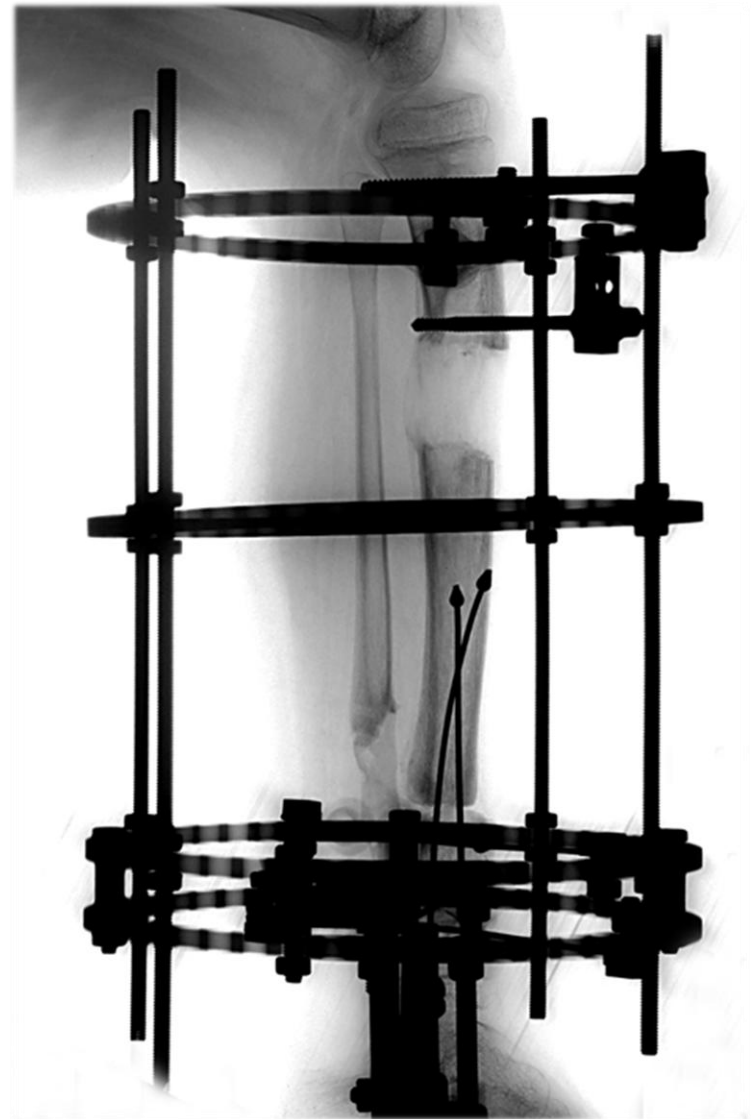
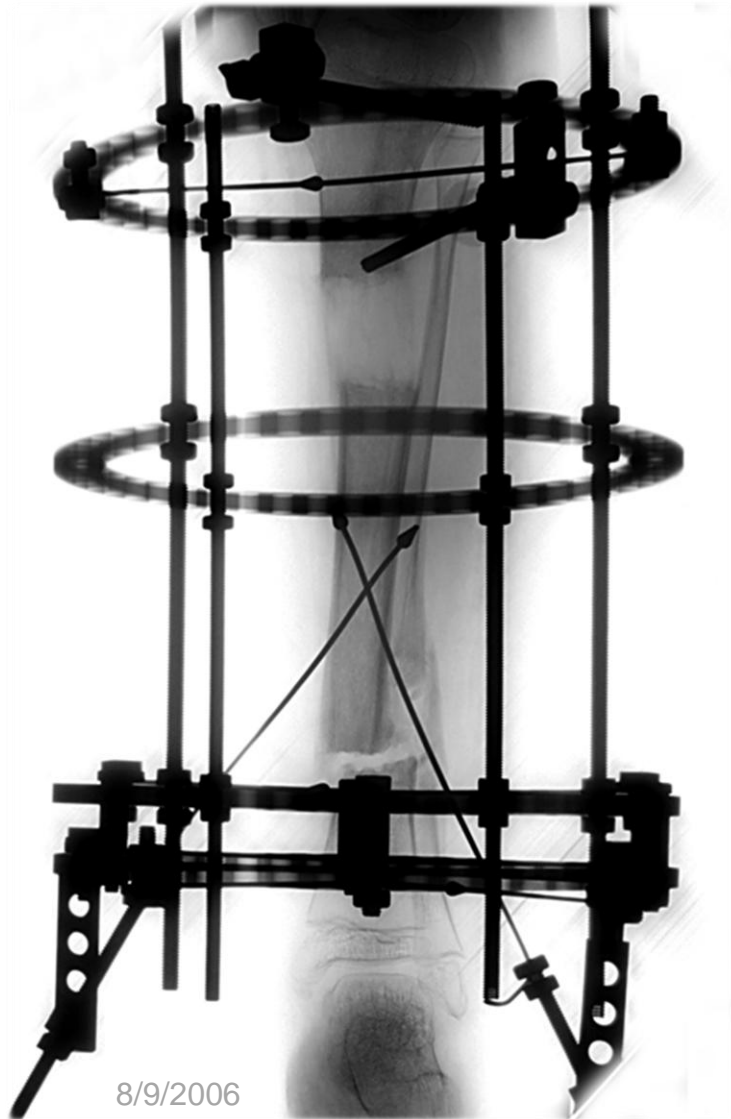
Oblique Wire Bone Transport



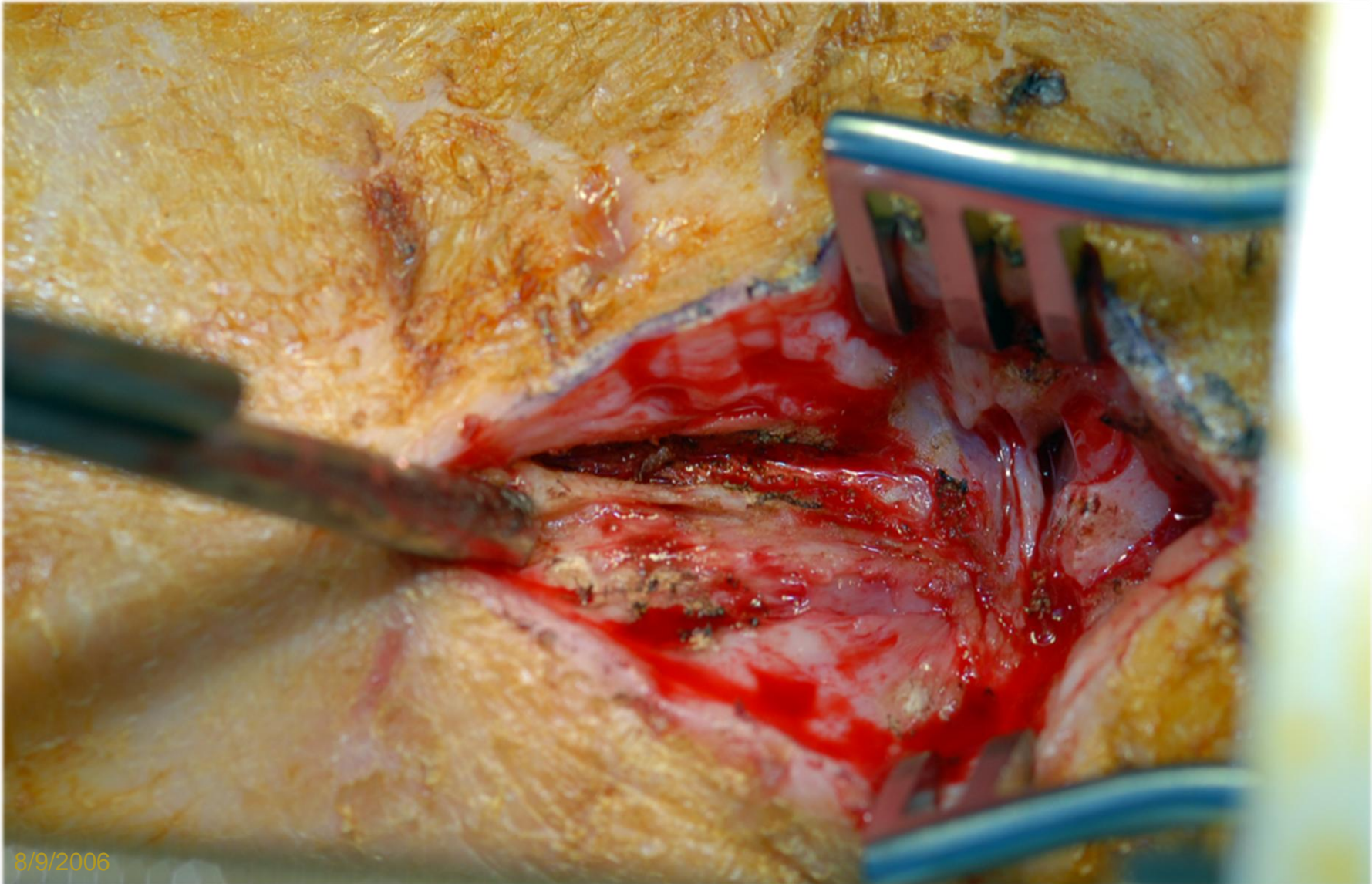
Oblique Wire Bone Transport



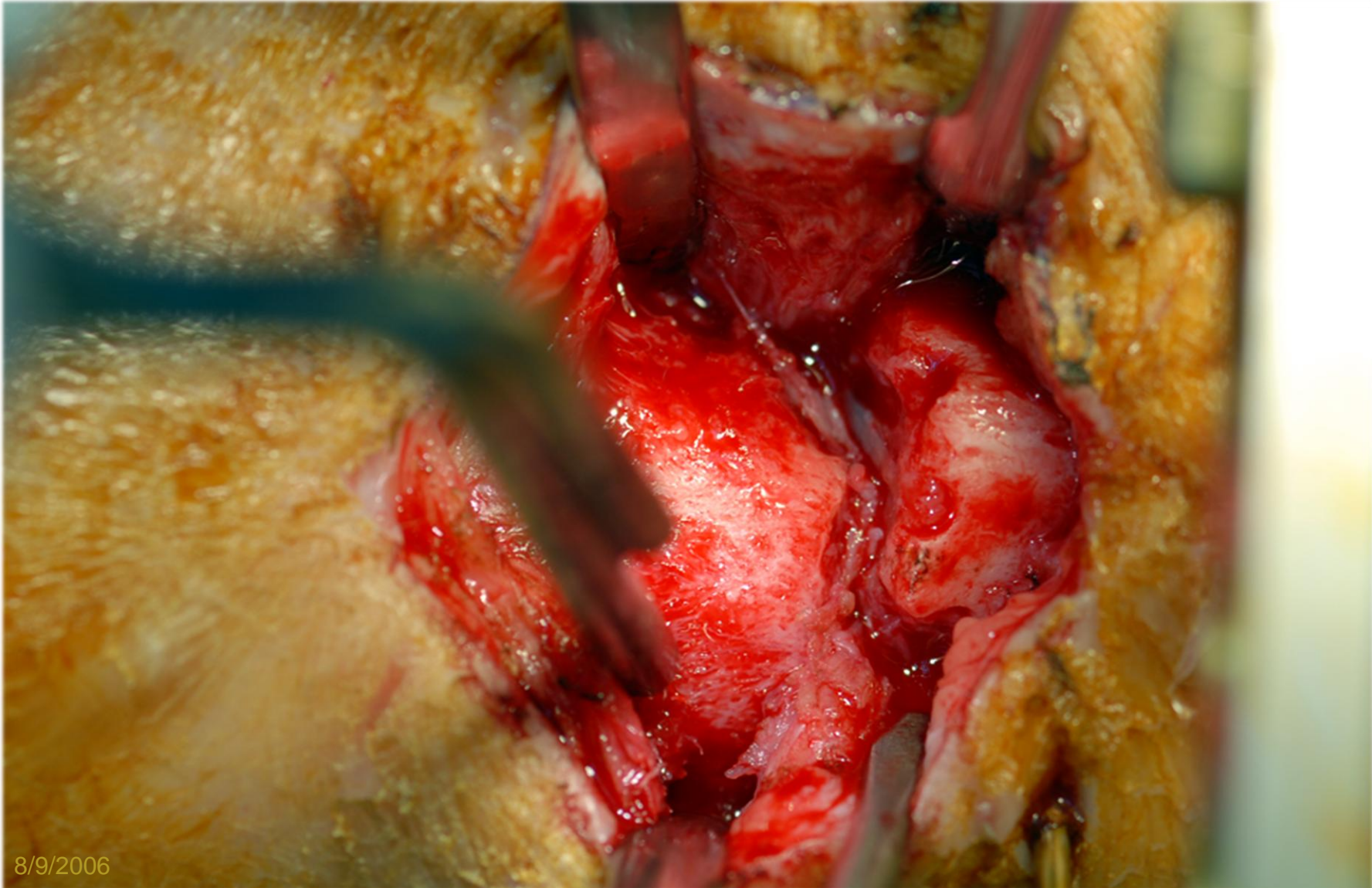
Oblique Wire Bone Transport



Docking Site Debridement

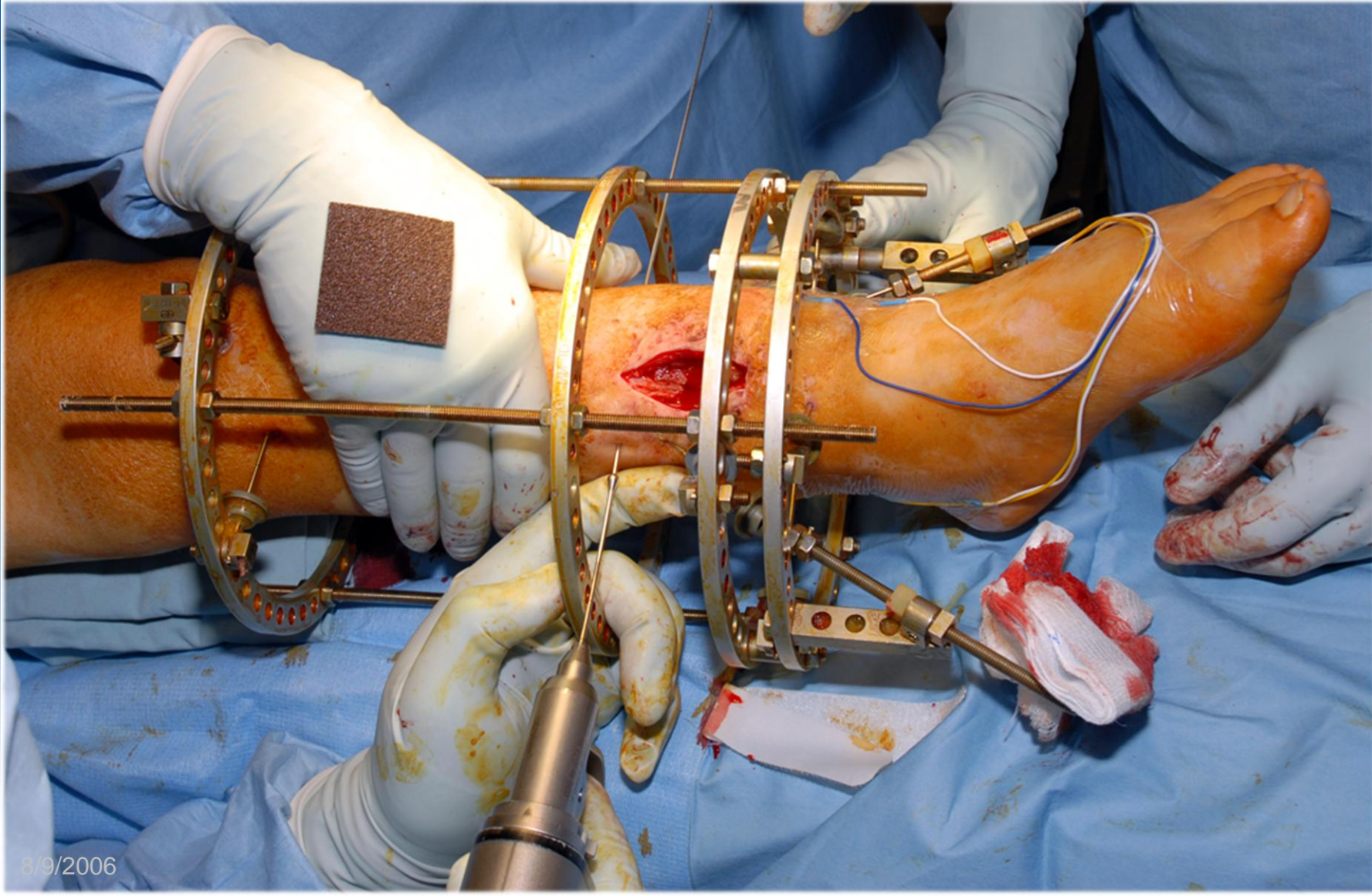


Docking Site Debridement

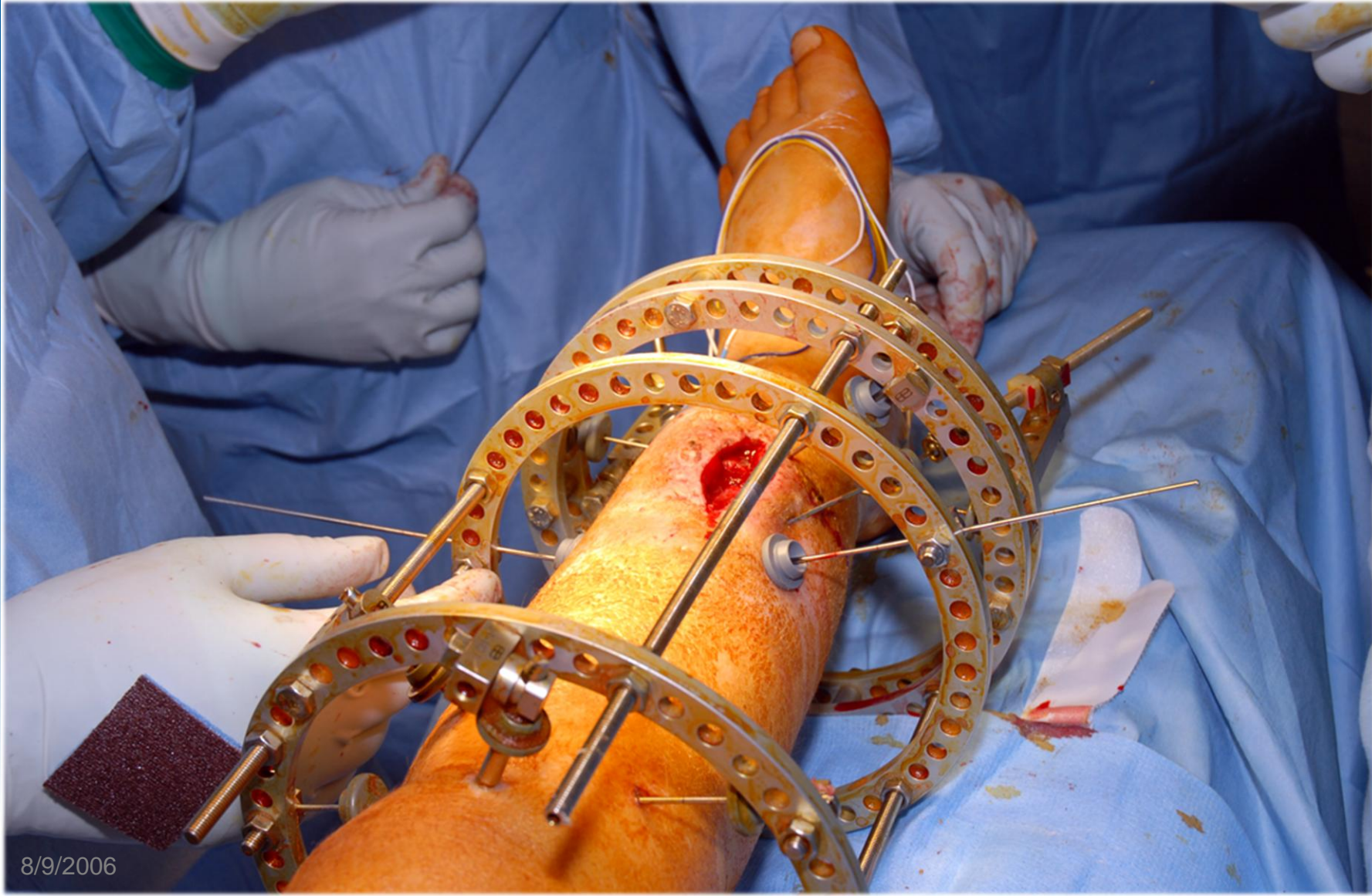


8/9/2006

Reduction Wire Insertion

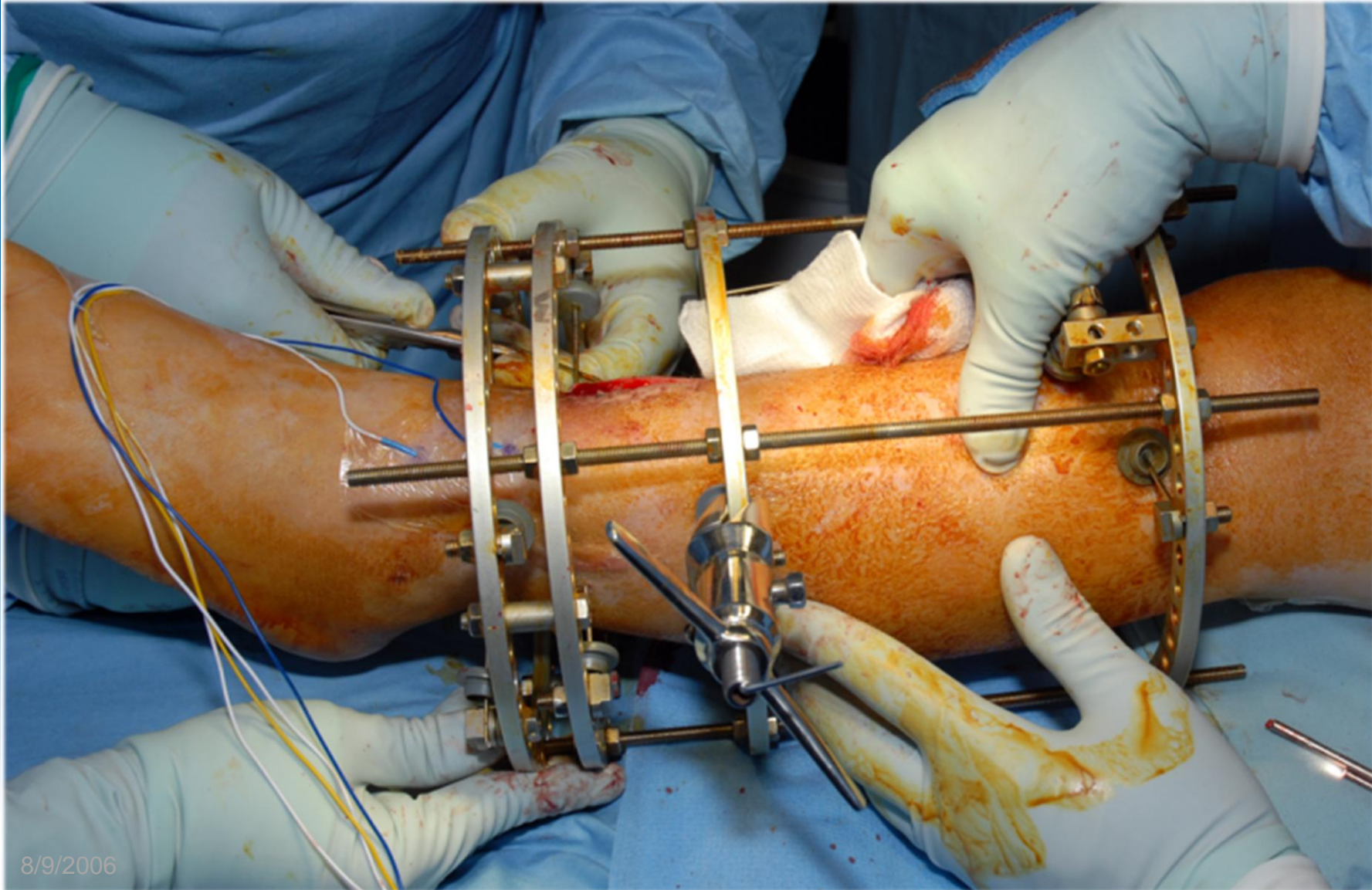


Reduction Wire Fixation

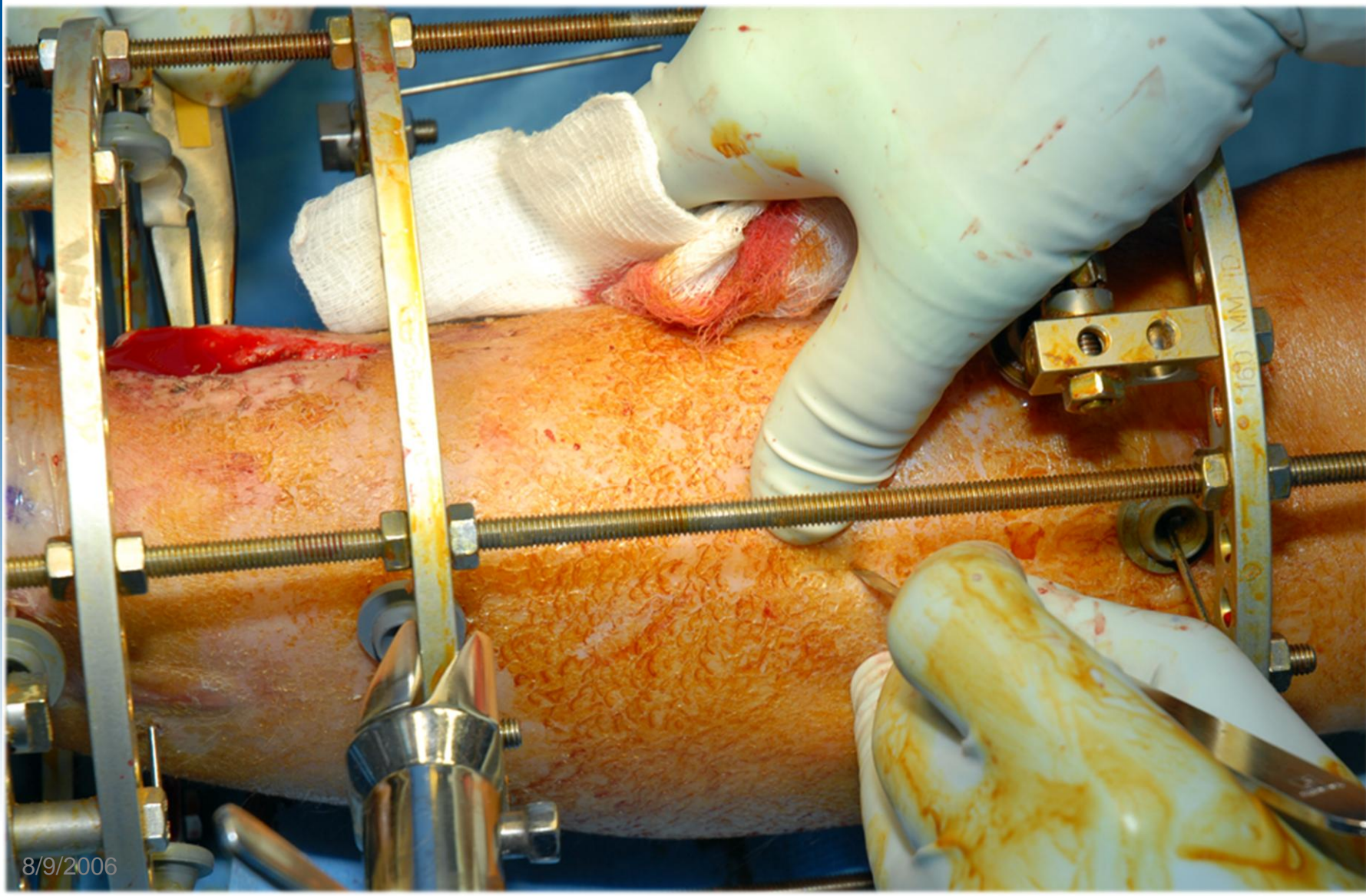


8/9/2006

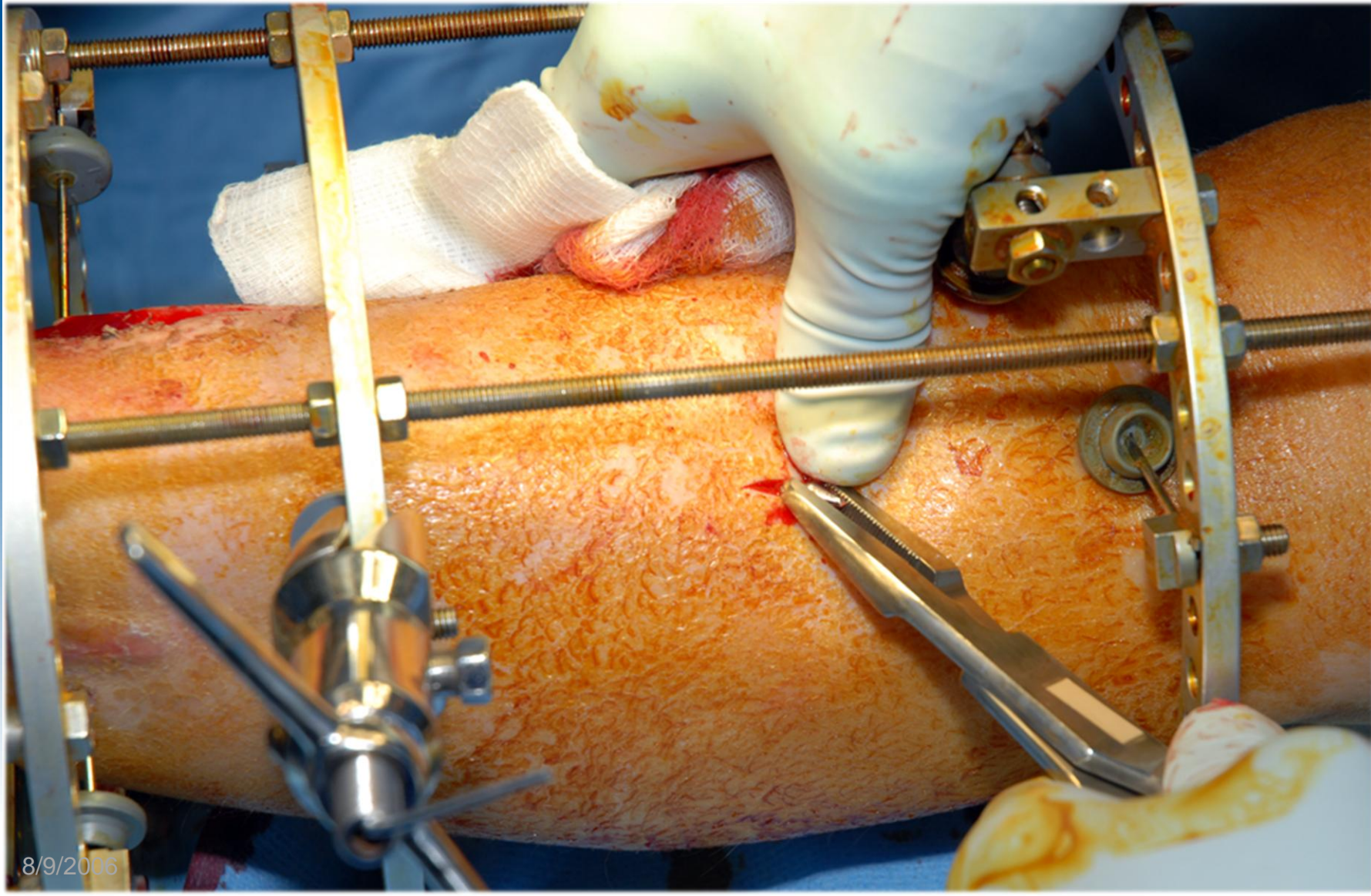
Oblique Wire Removal



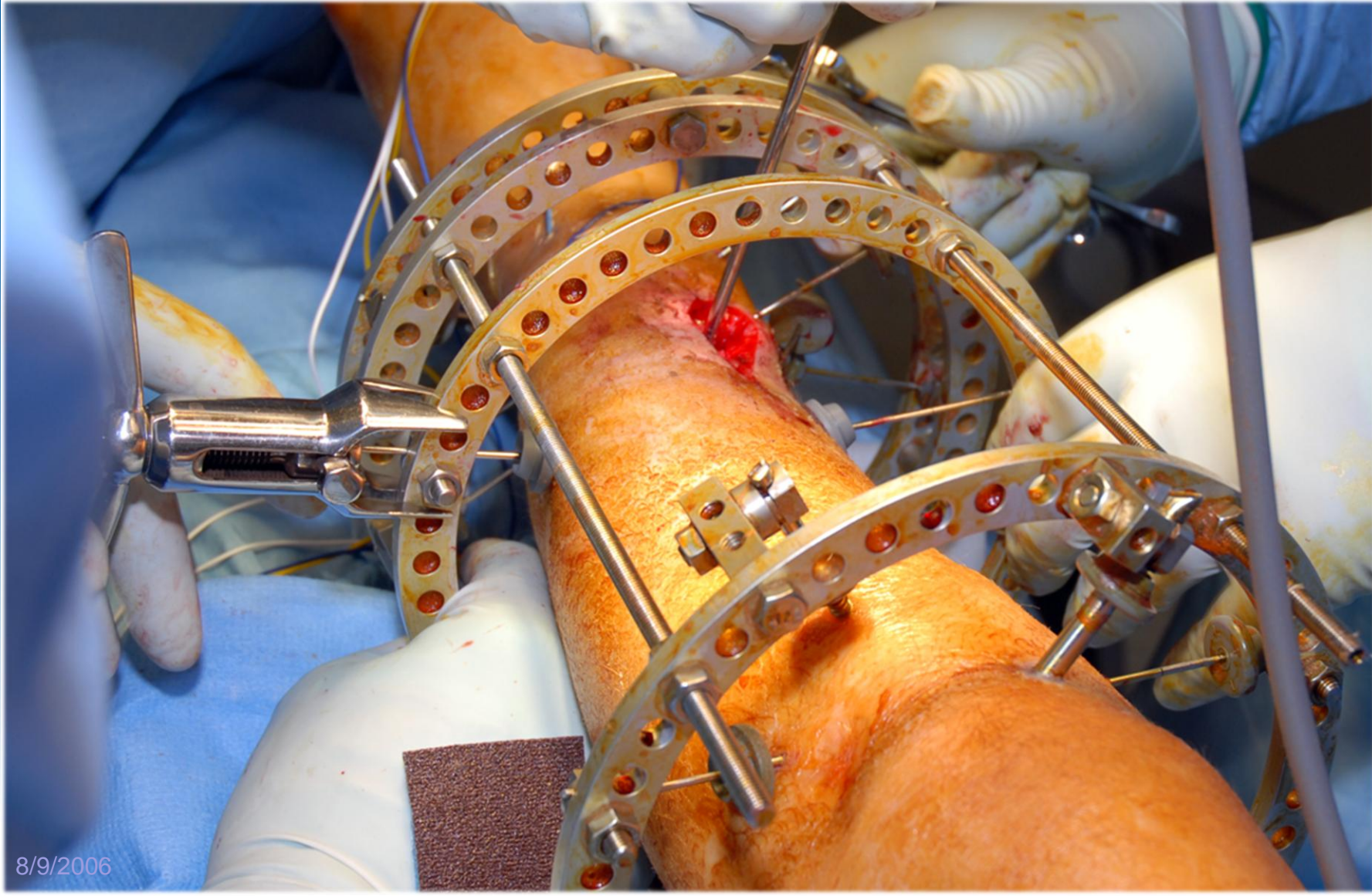
Oblique Wire Removal



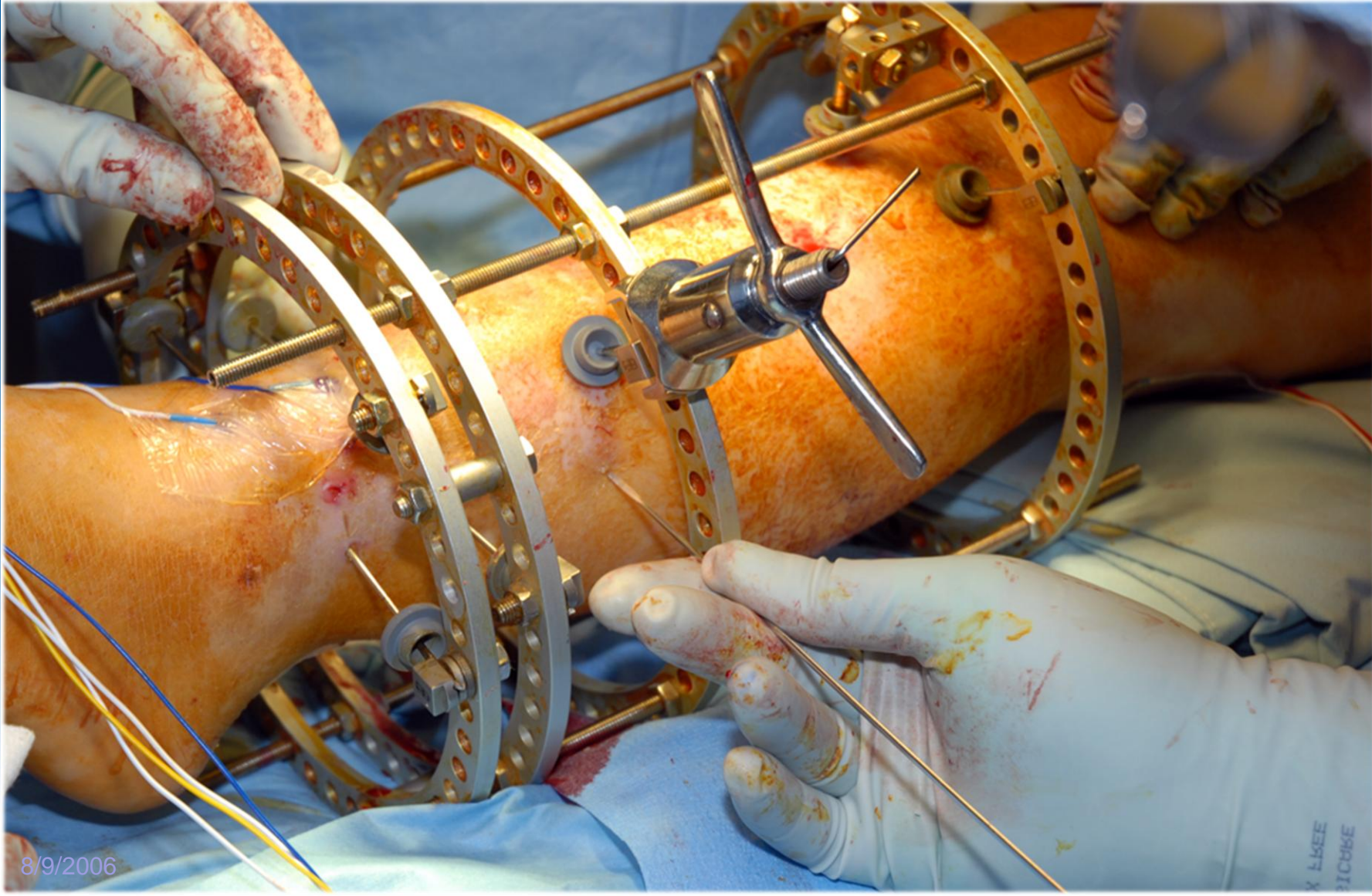
Oblique Wire Removal



Docking Site Reduction



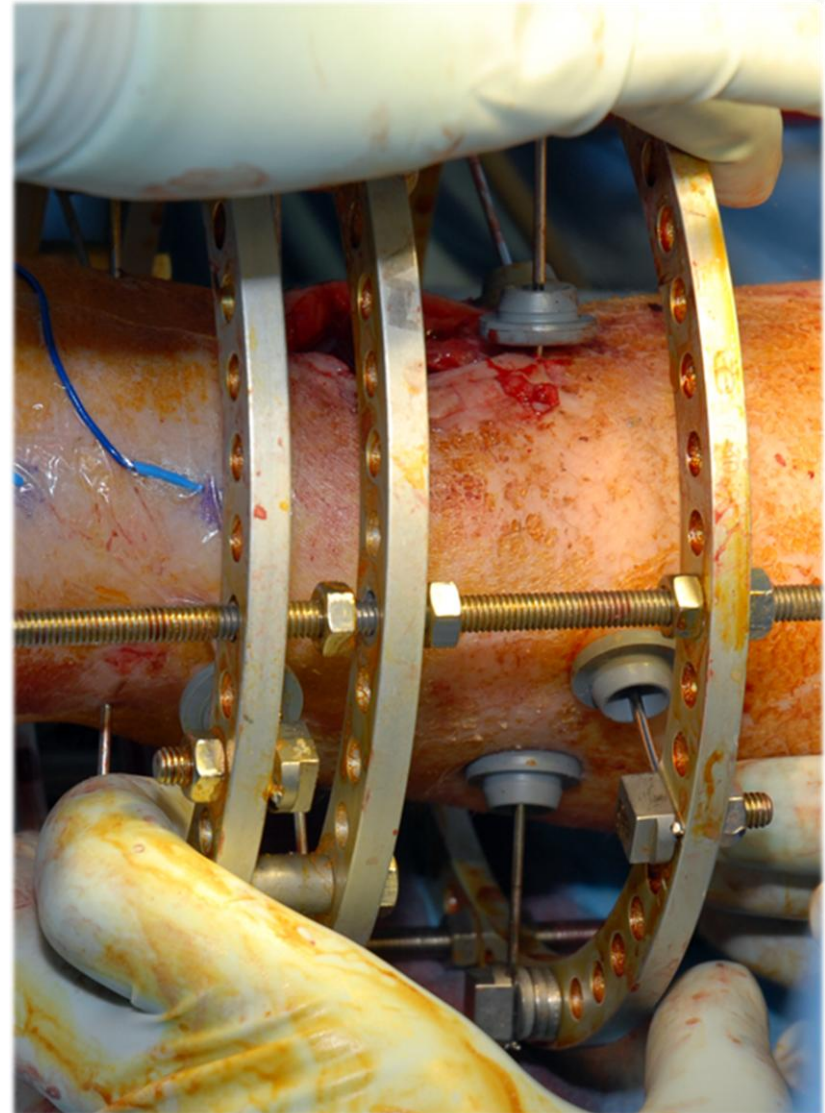
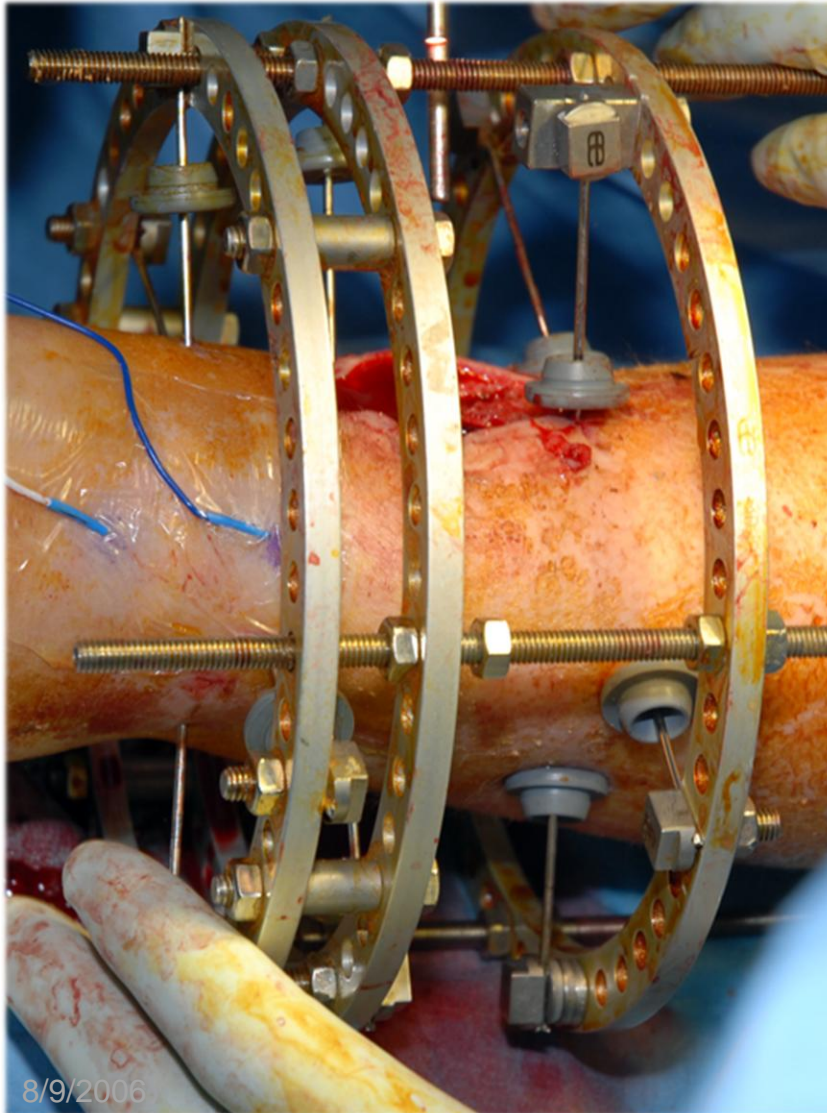
Docking Site Stabilization



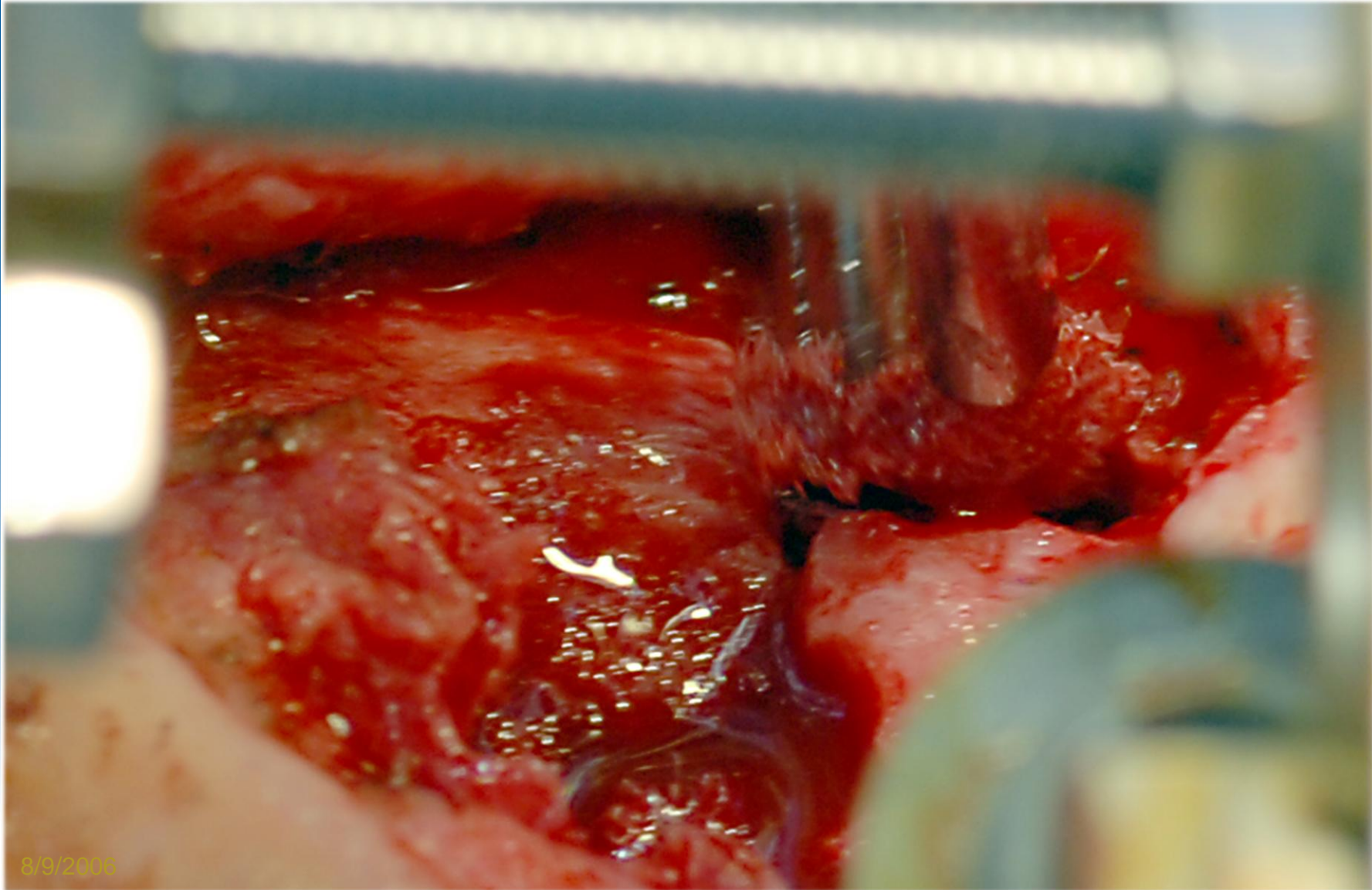
8/9/2006

X FREE
PICURE

Docking Site Compression



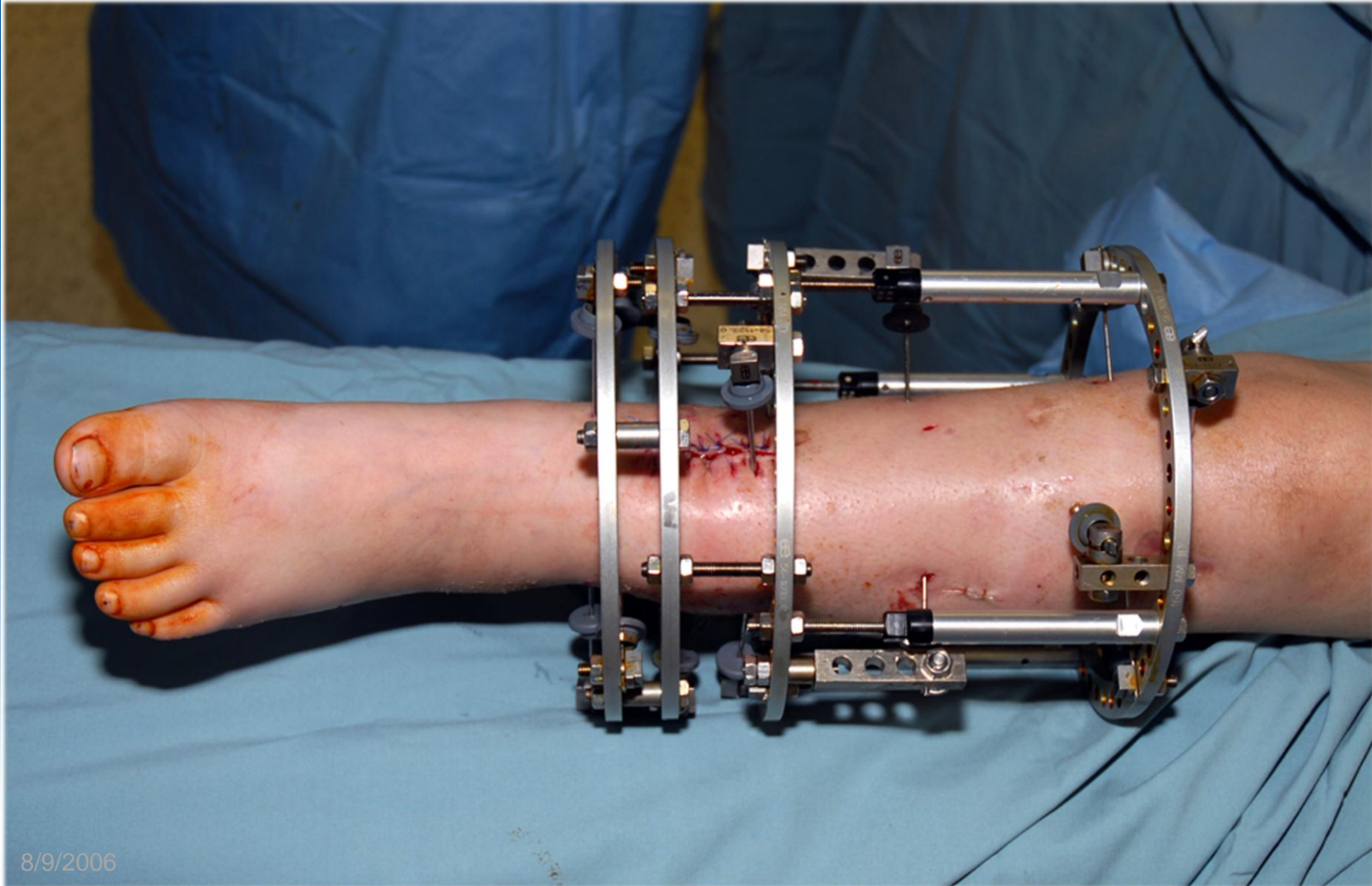
Iliac Crest Bone Grafting



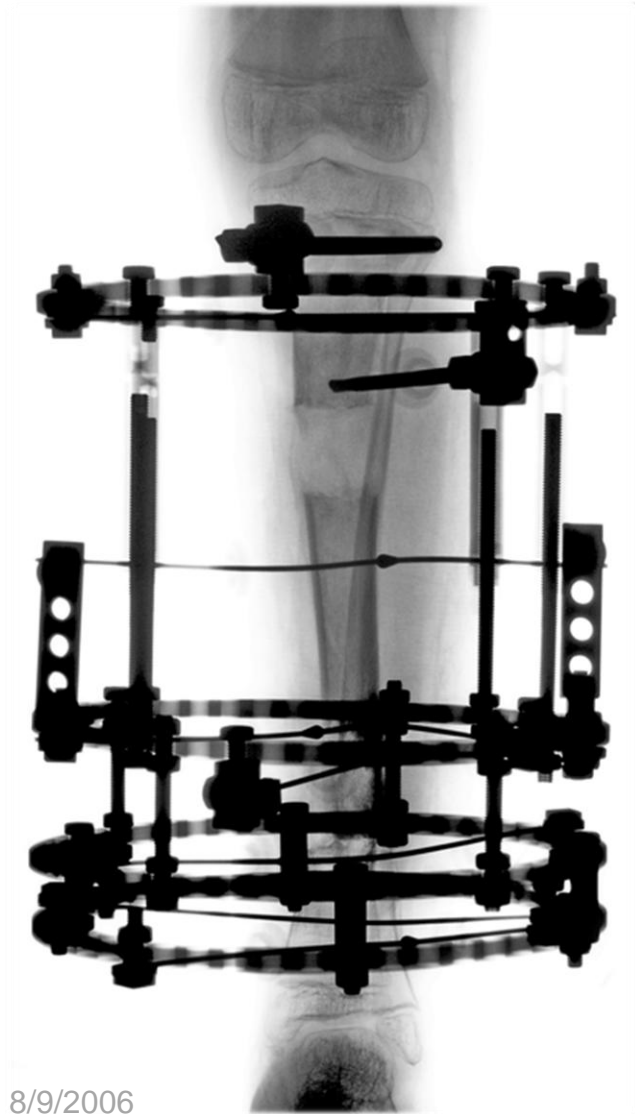
BMP Placement



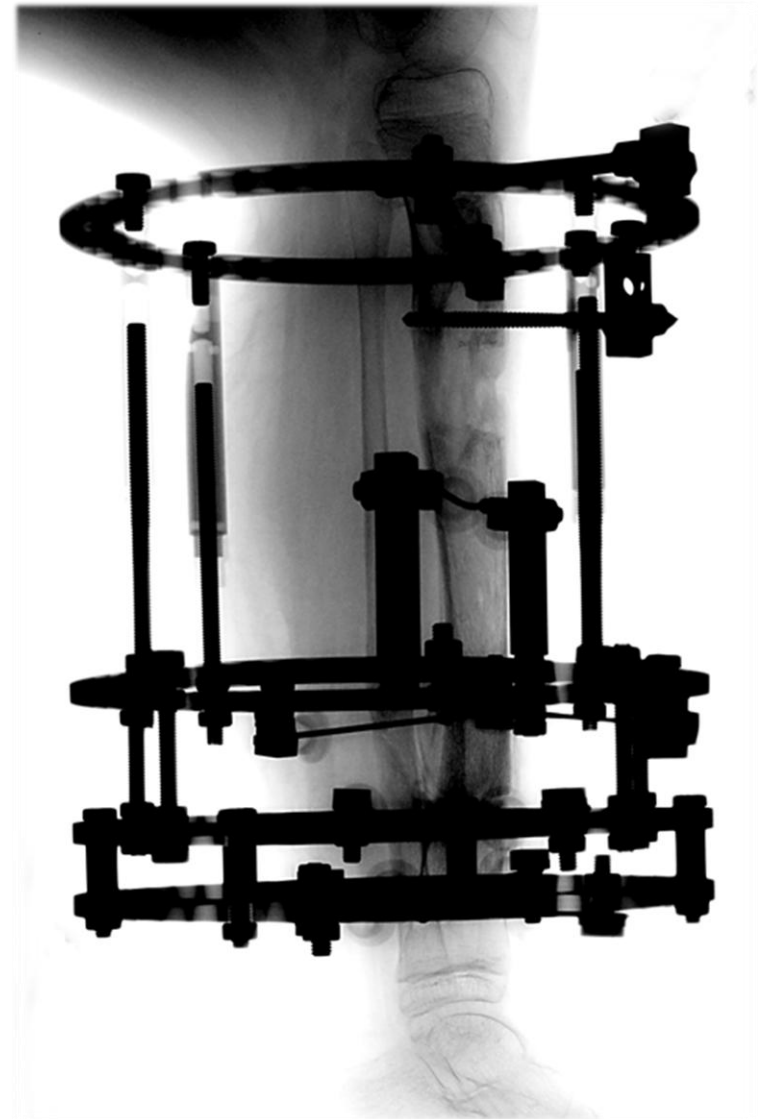
Frame Modification



Consolidation Period



Consolidation Period



Outcome



9/20/2012

Outcome

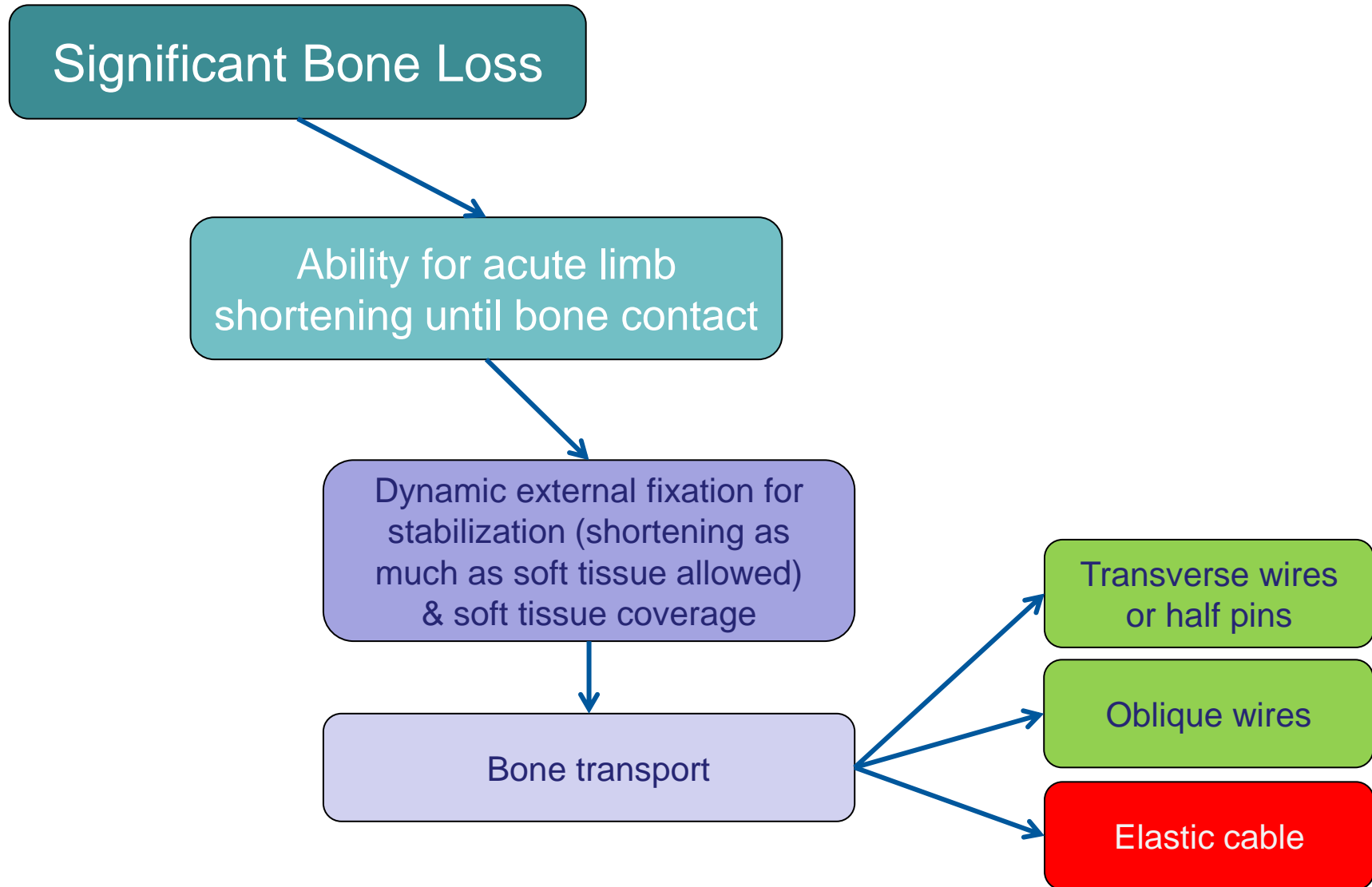


Outcome

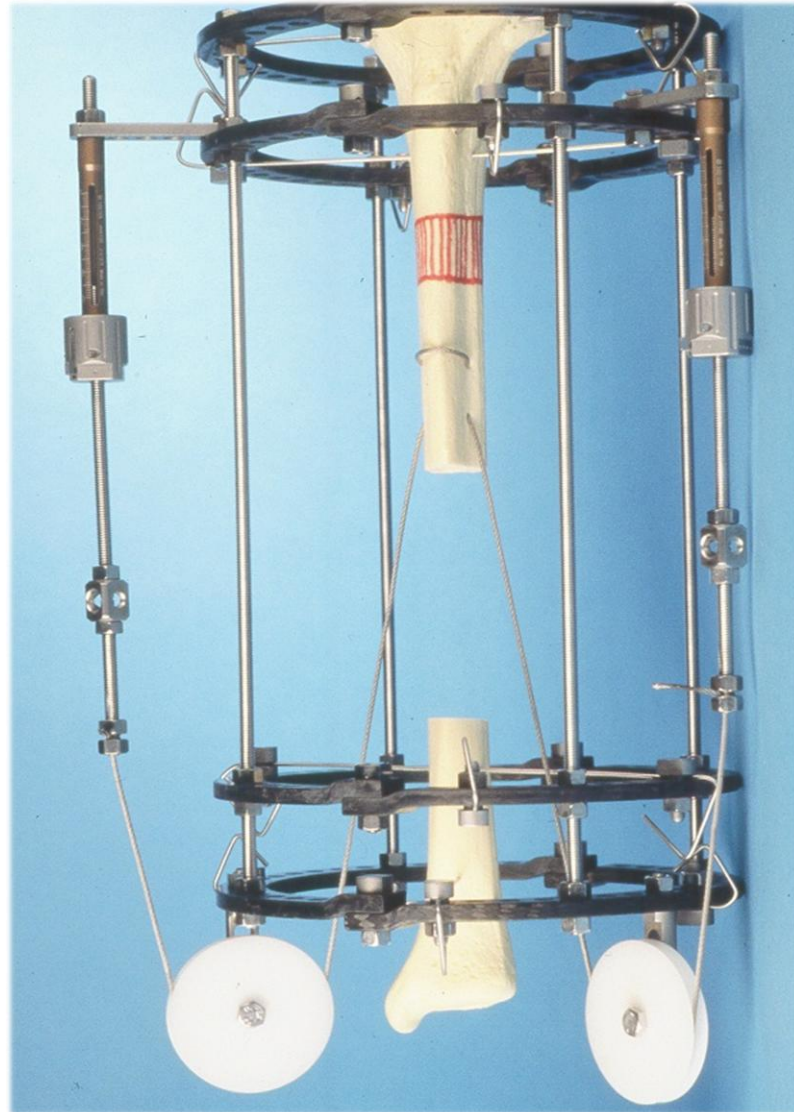
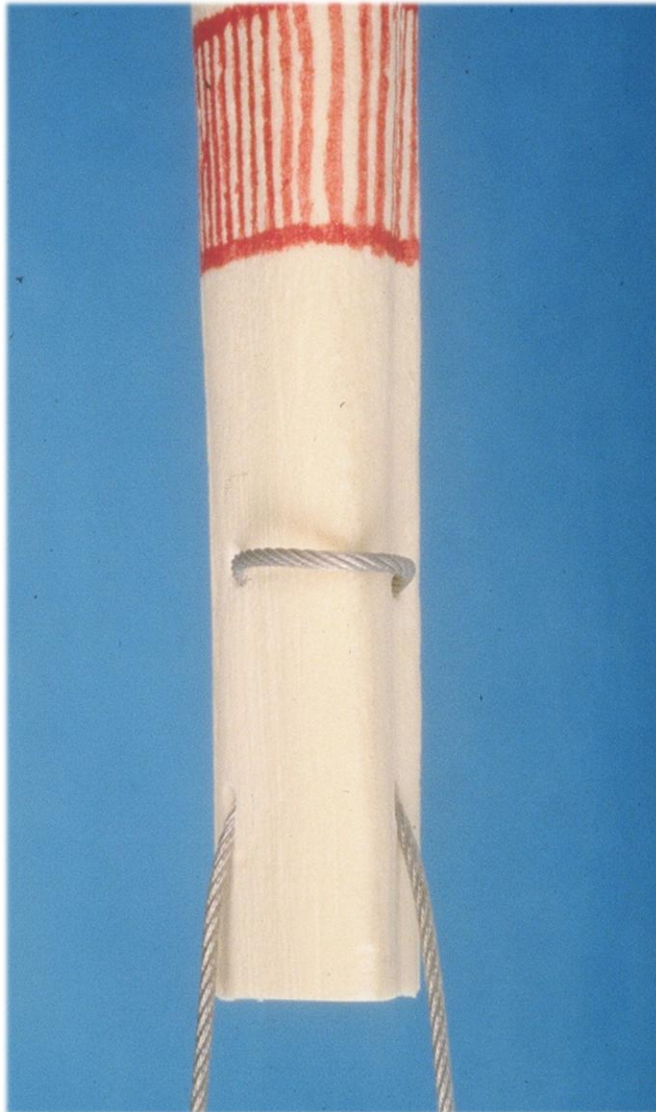


9/20/2012

Bone Transport Techniques



Weber Cable Bone Transport



Patient



- 13-year-old boy
- ATV rollover accident
- Severe open multi-fragmented Grade IIIB distal tibial fracture with bone loss
- Massive soft tissue loss

6/15/2011

Soft Tissue Defect



Soft Tissue Defect



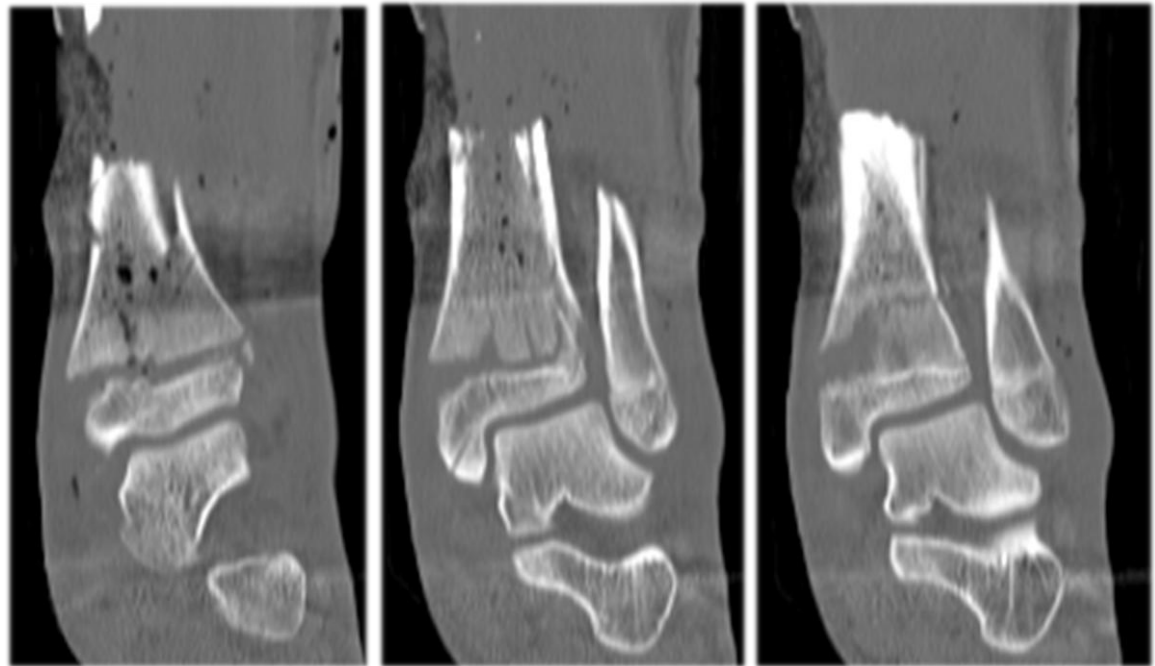
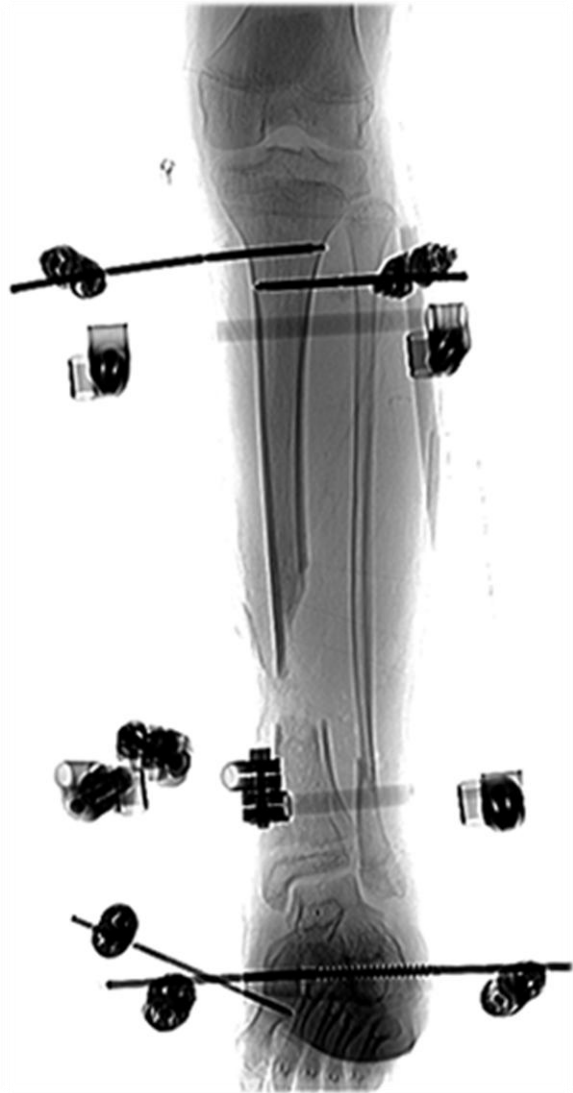
6/15/2011

Bone Loss



6/15/2011

CT Scan



6/15/2011

CT Scan



6/15/2011

Spanning Fixation



Fixation 8 Weeks



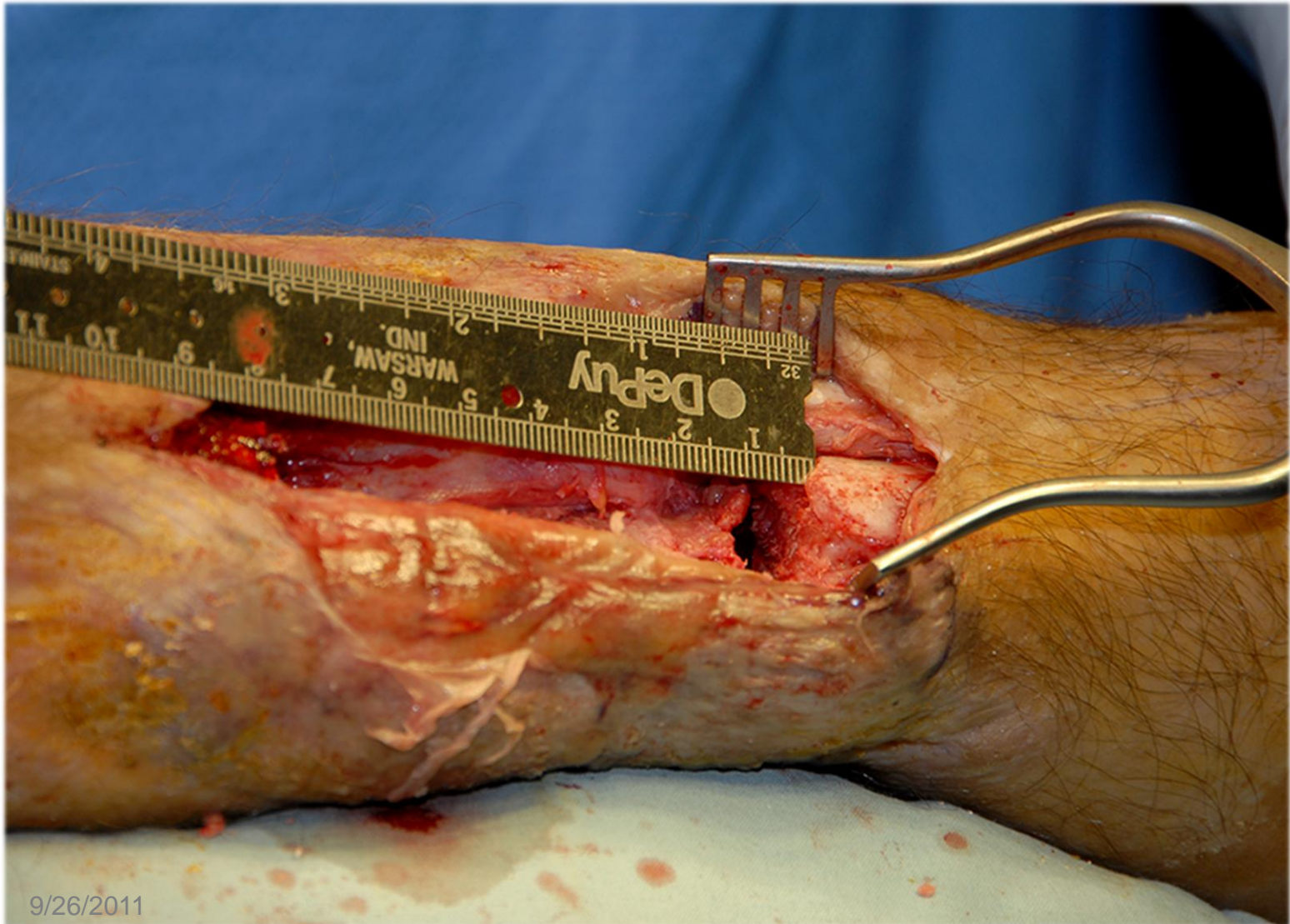
8/26/2011

Treatment Strategy



- Defect debridement
- Circular external fixation
- Proximal tibial osteotomy
- Cable bone transport

Defect Debridement (8 cm)



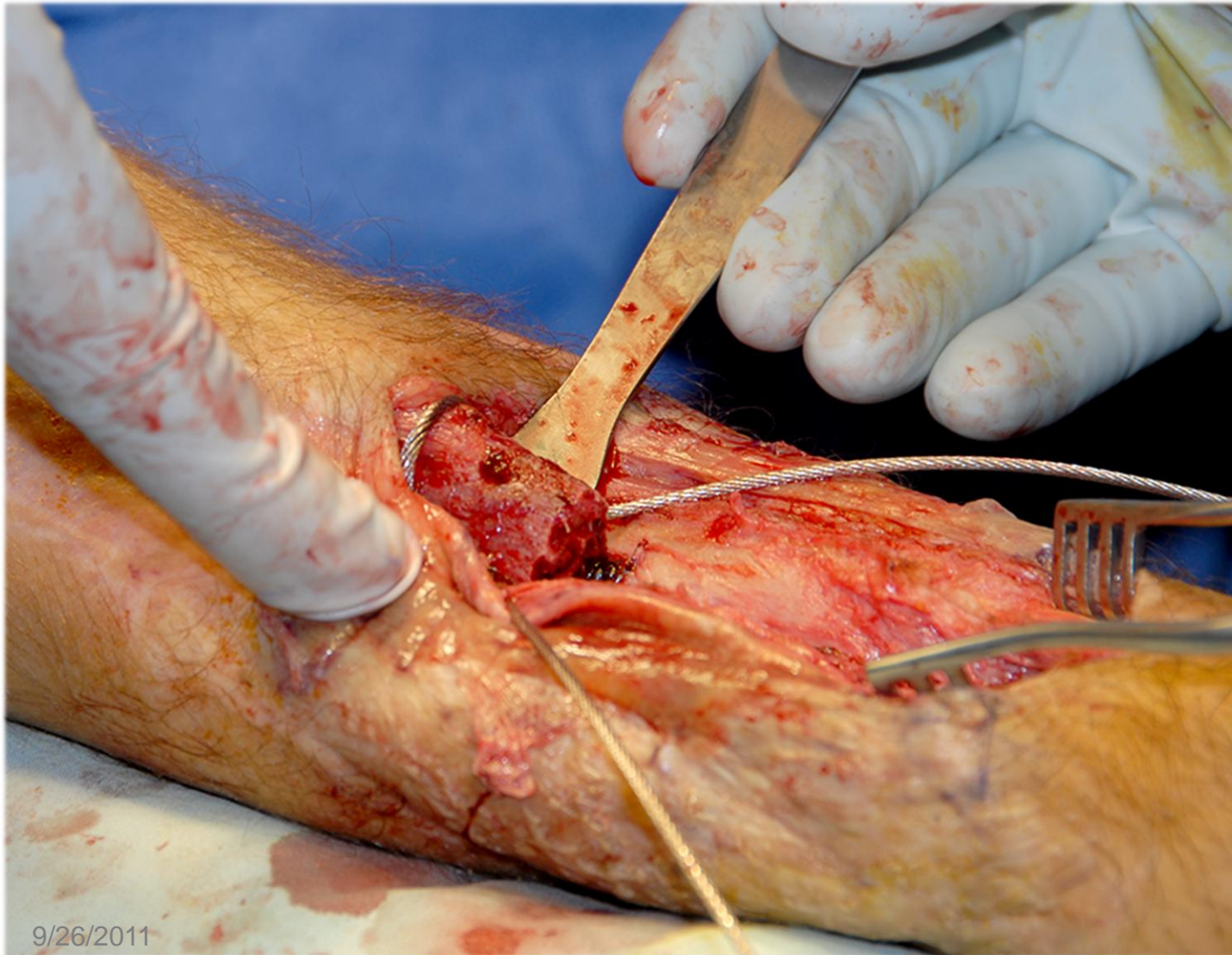
9/26/2011

Transport Segment Preparation



9/26/2011

Cable Insertion



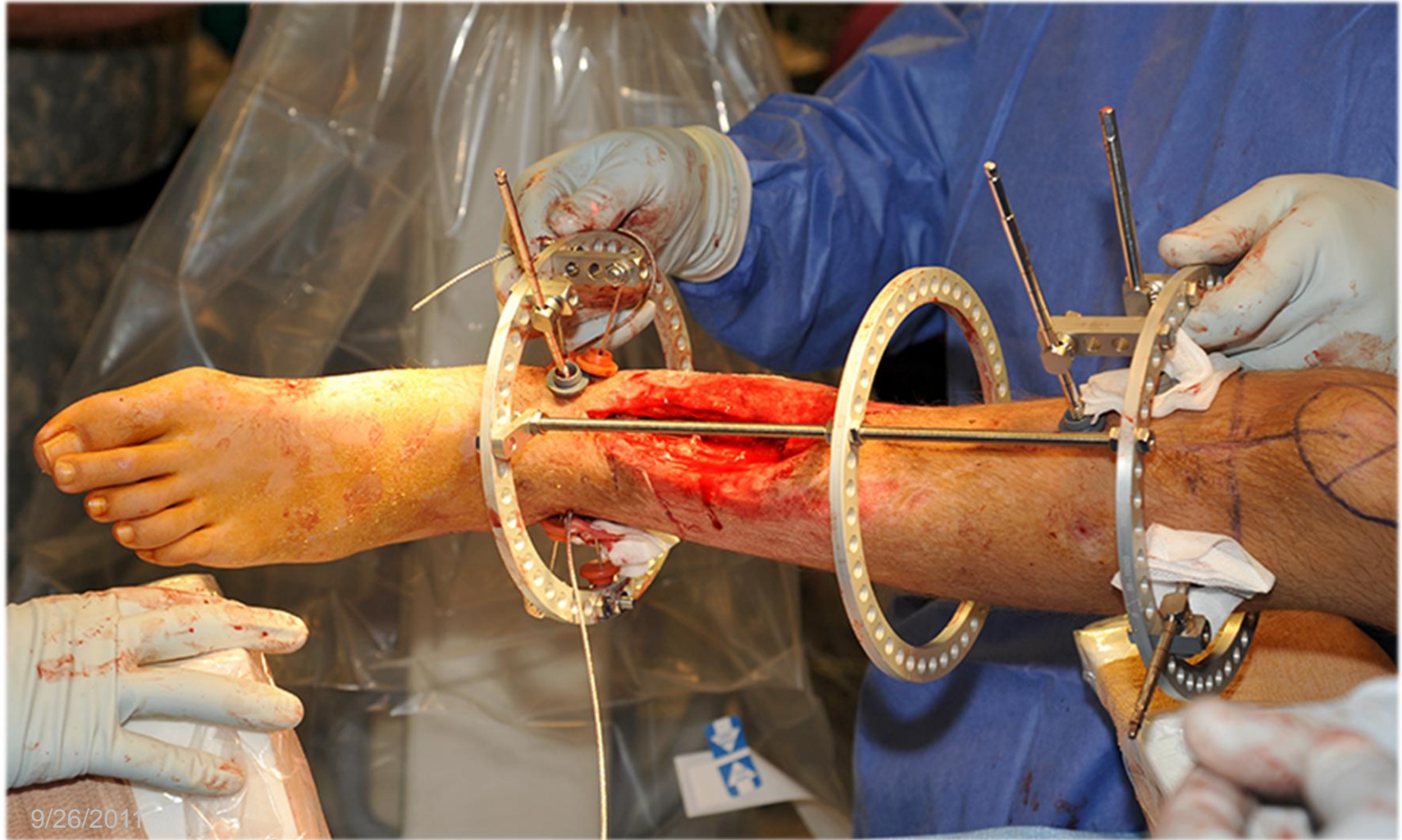
Cable Insertion



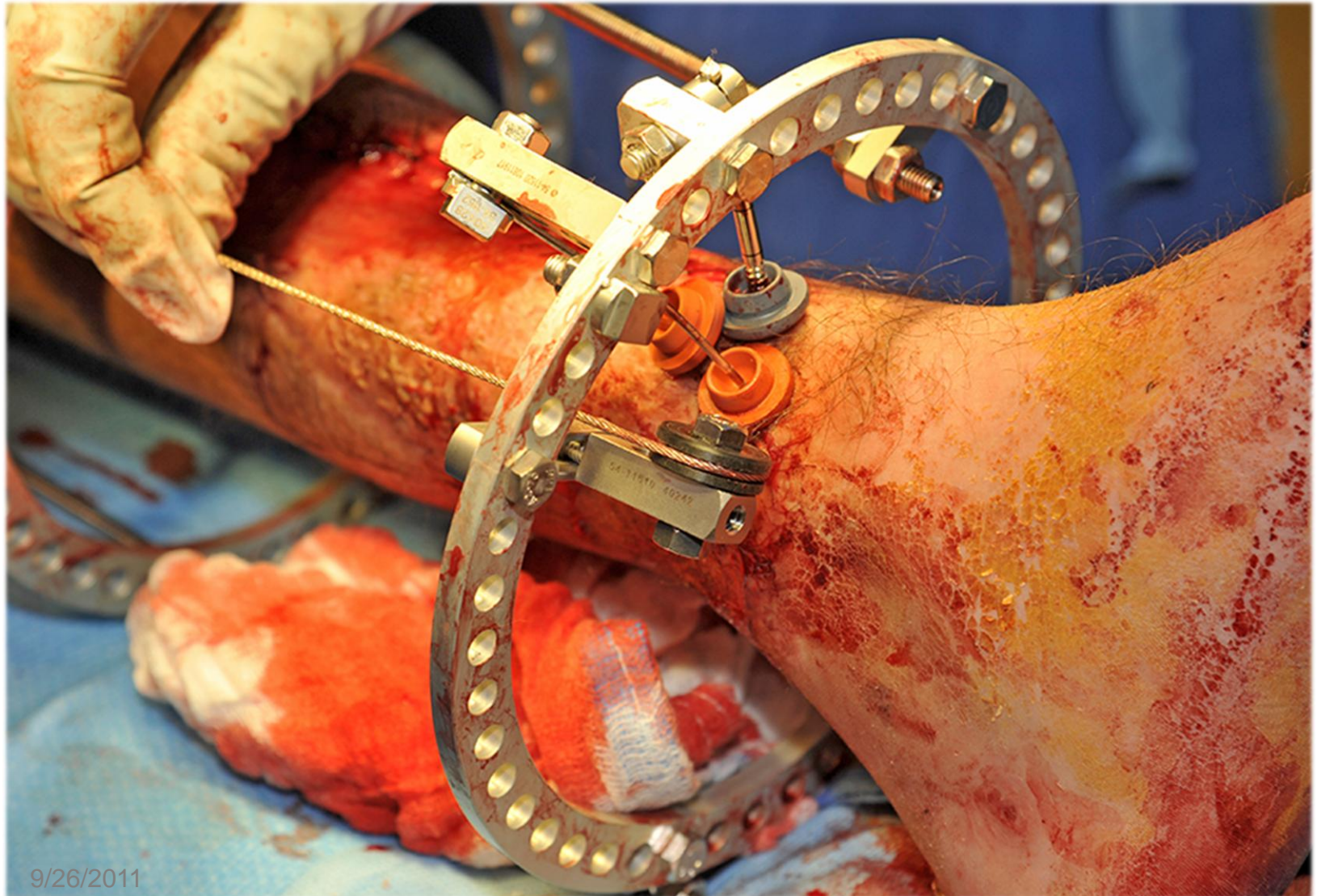
Cable Insertion



Circular External Fixation

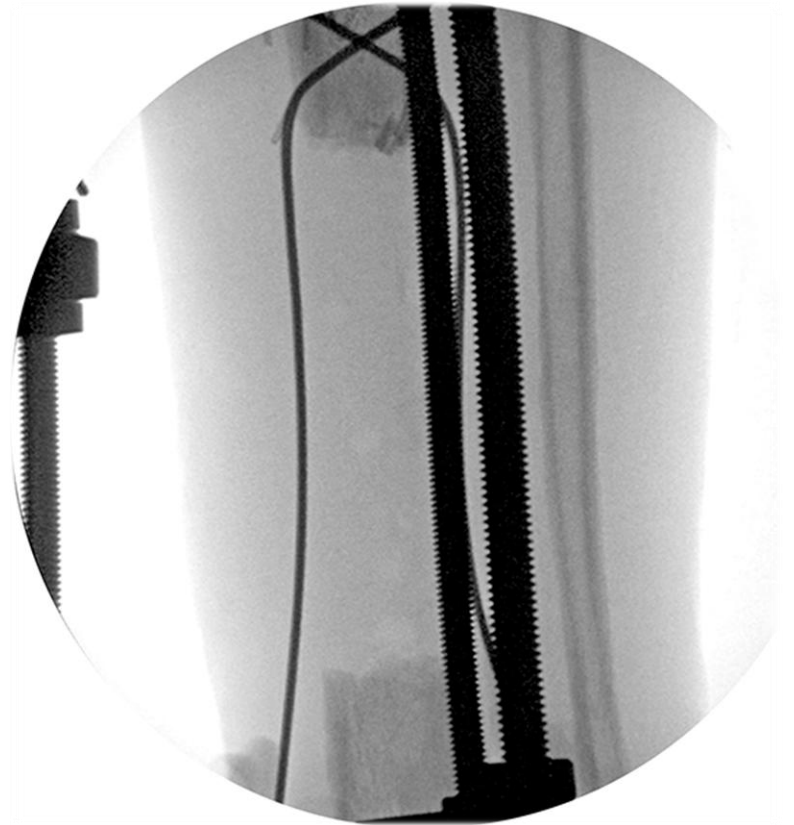


Transport Module Attachment

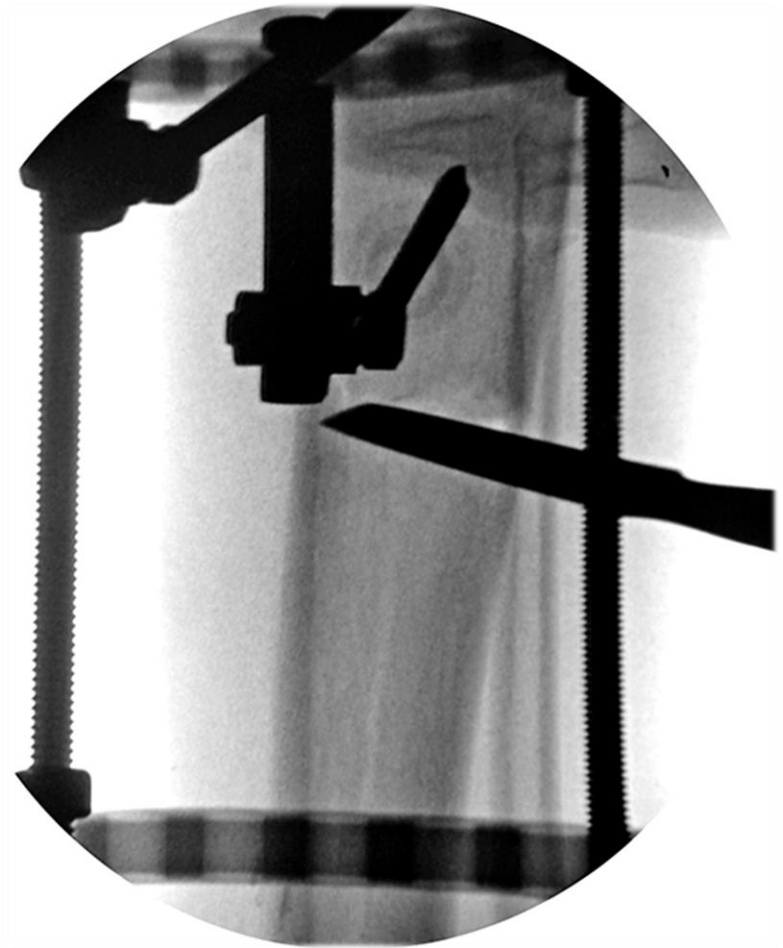
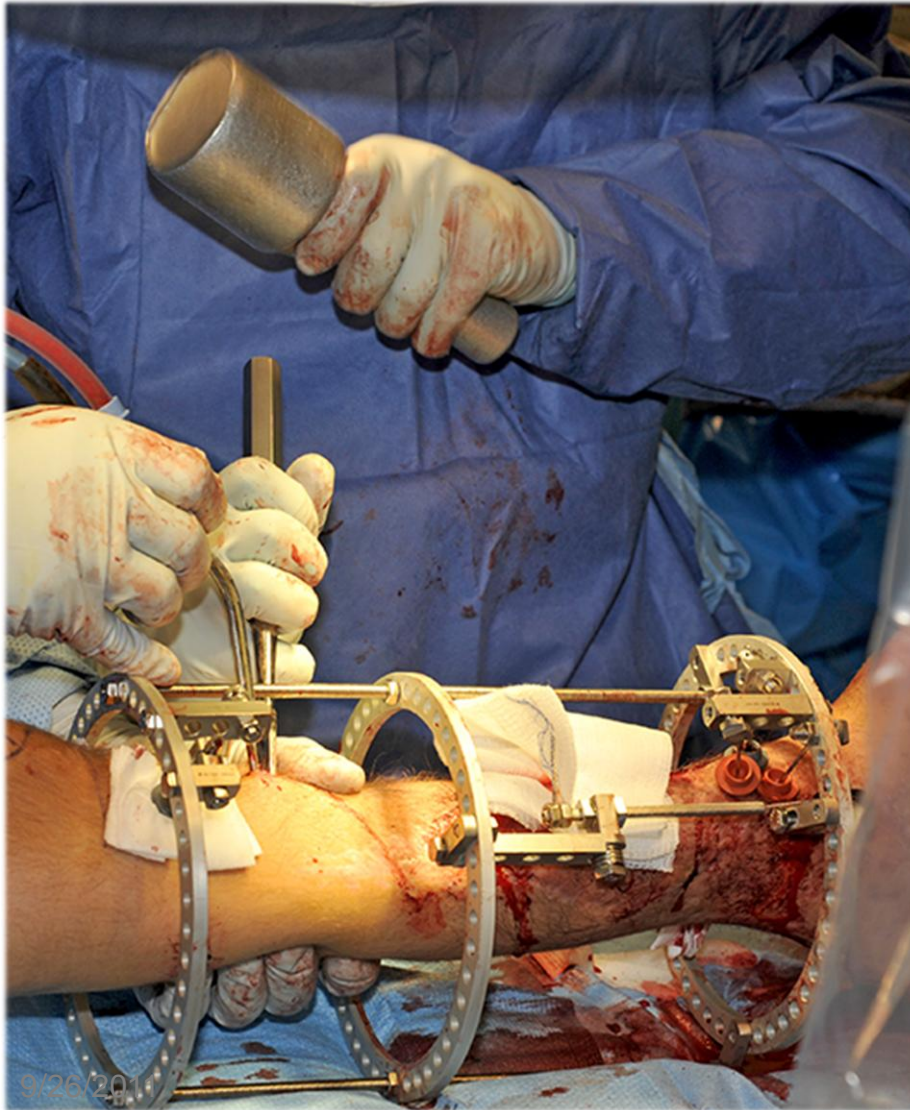


9/26/2011

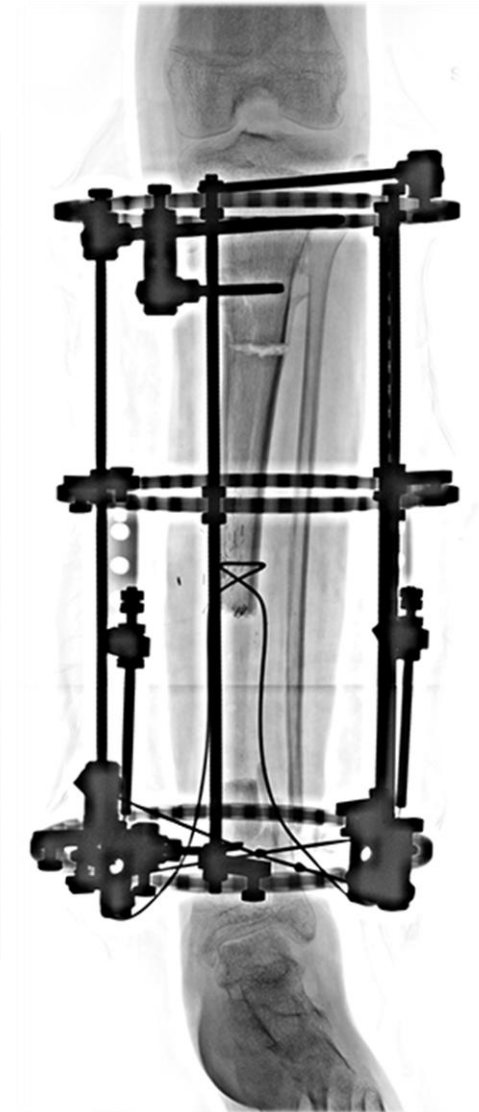
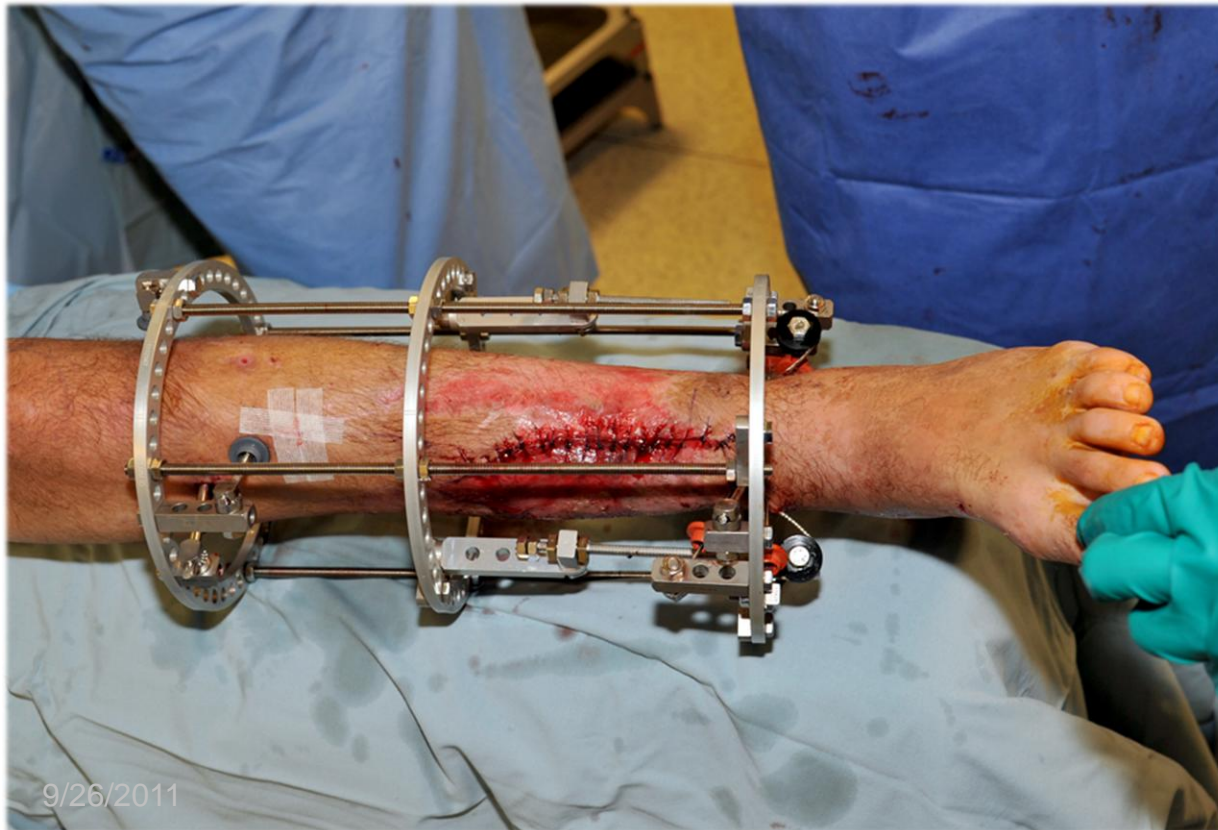
Transport Module Attachment



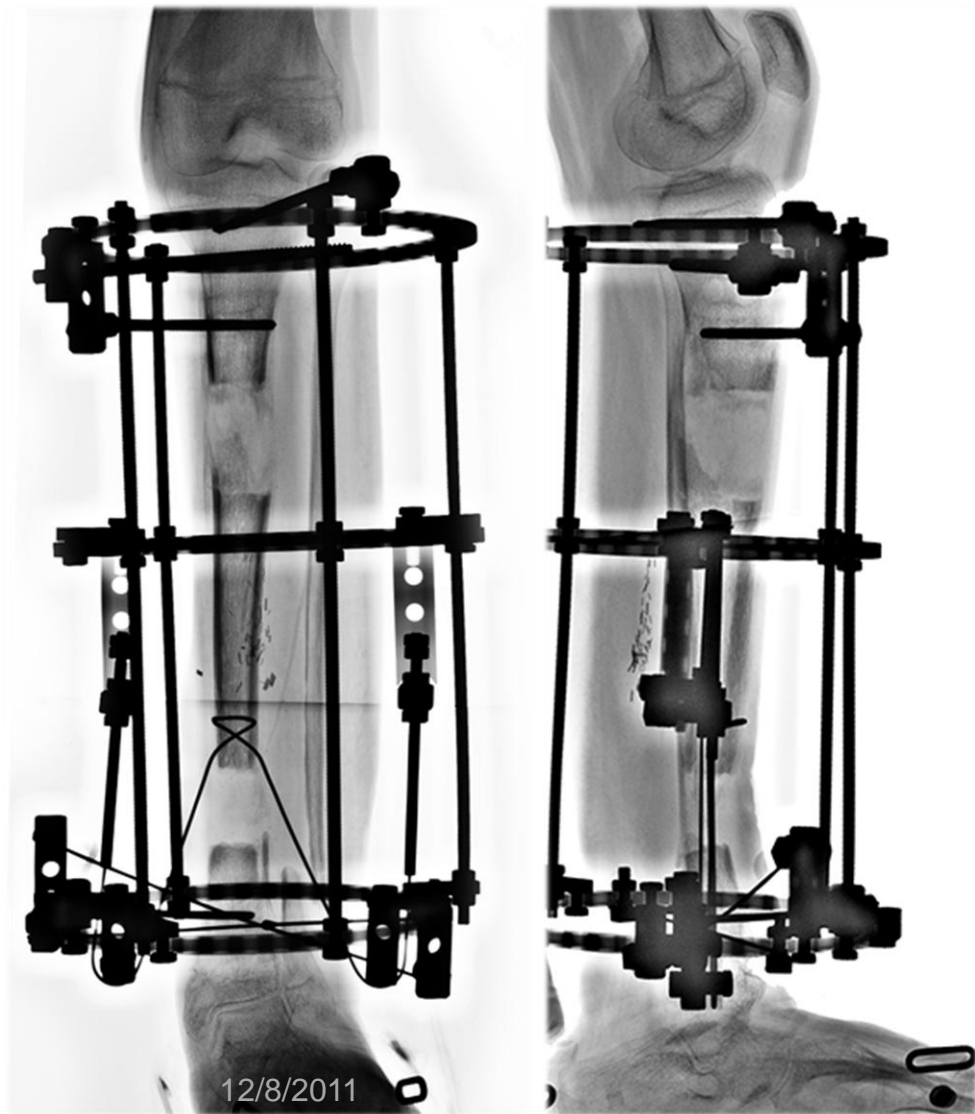
Proximal Tibial Osteotomy



Final Frame Assembly



Cable Bone Transport

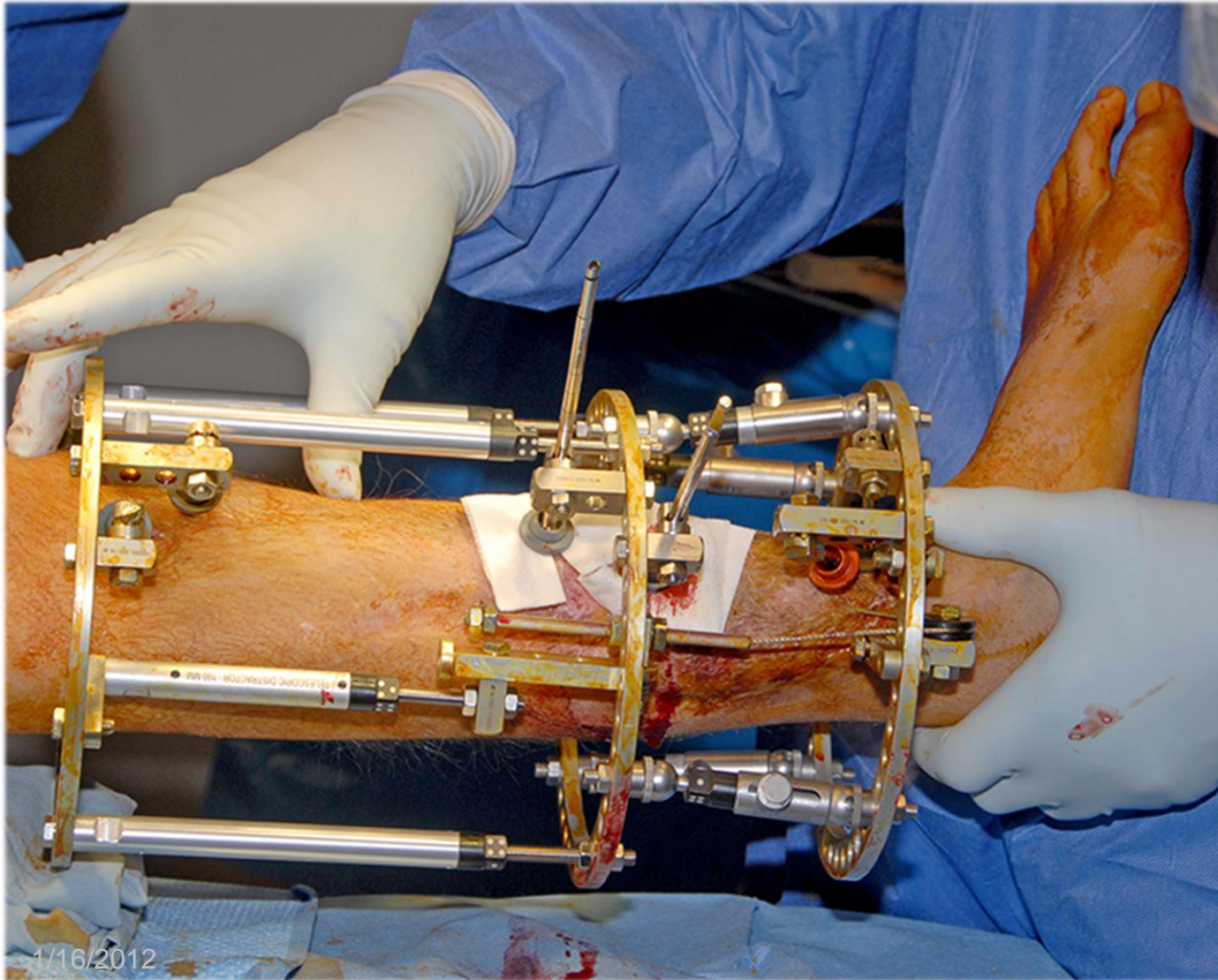


Transport Segment Docking

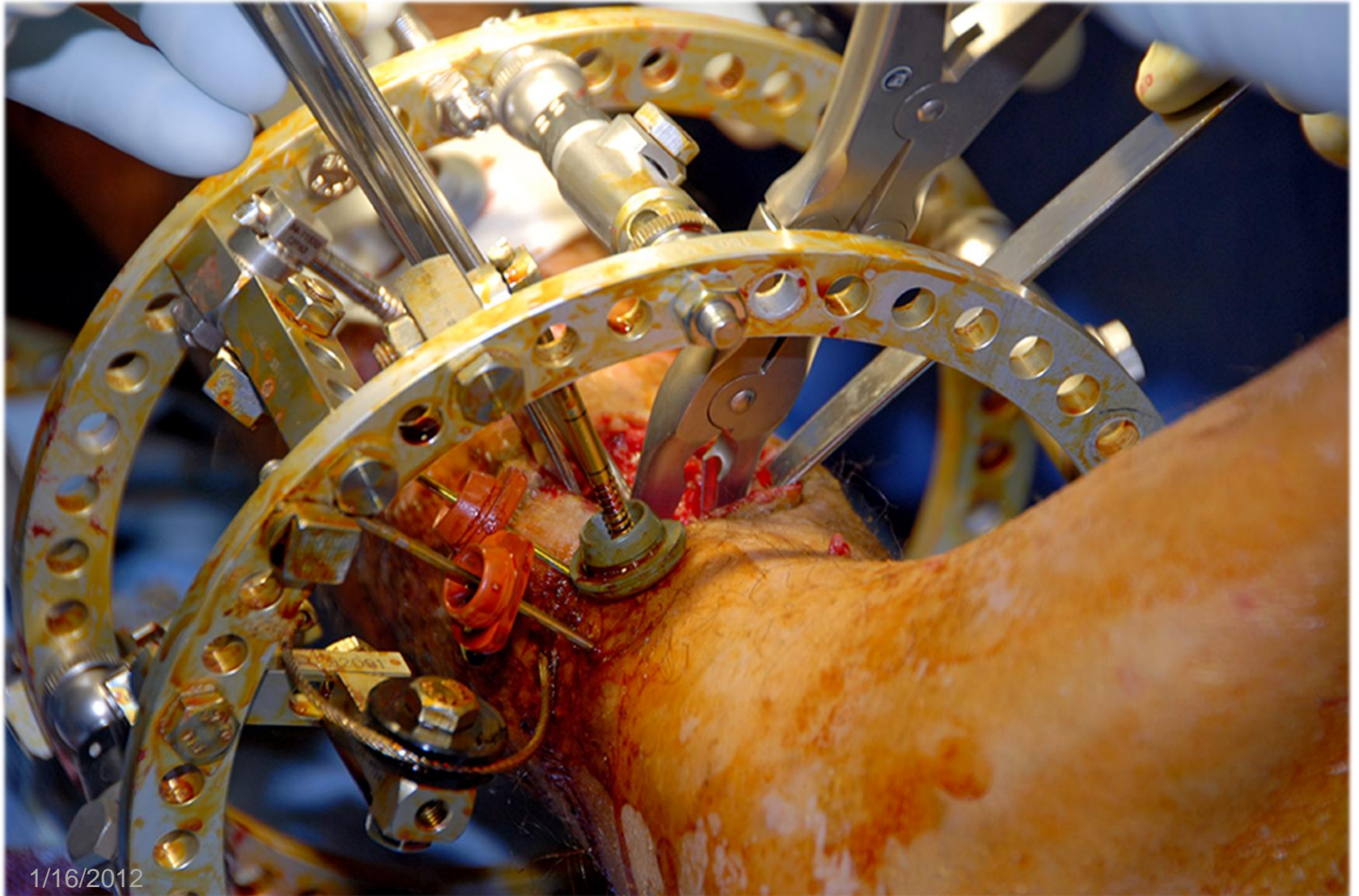


- Cable removal
- HP placement
- Additional bone segment stabilization

Rapid Adjust Struts Attachment

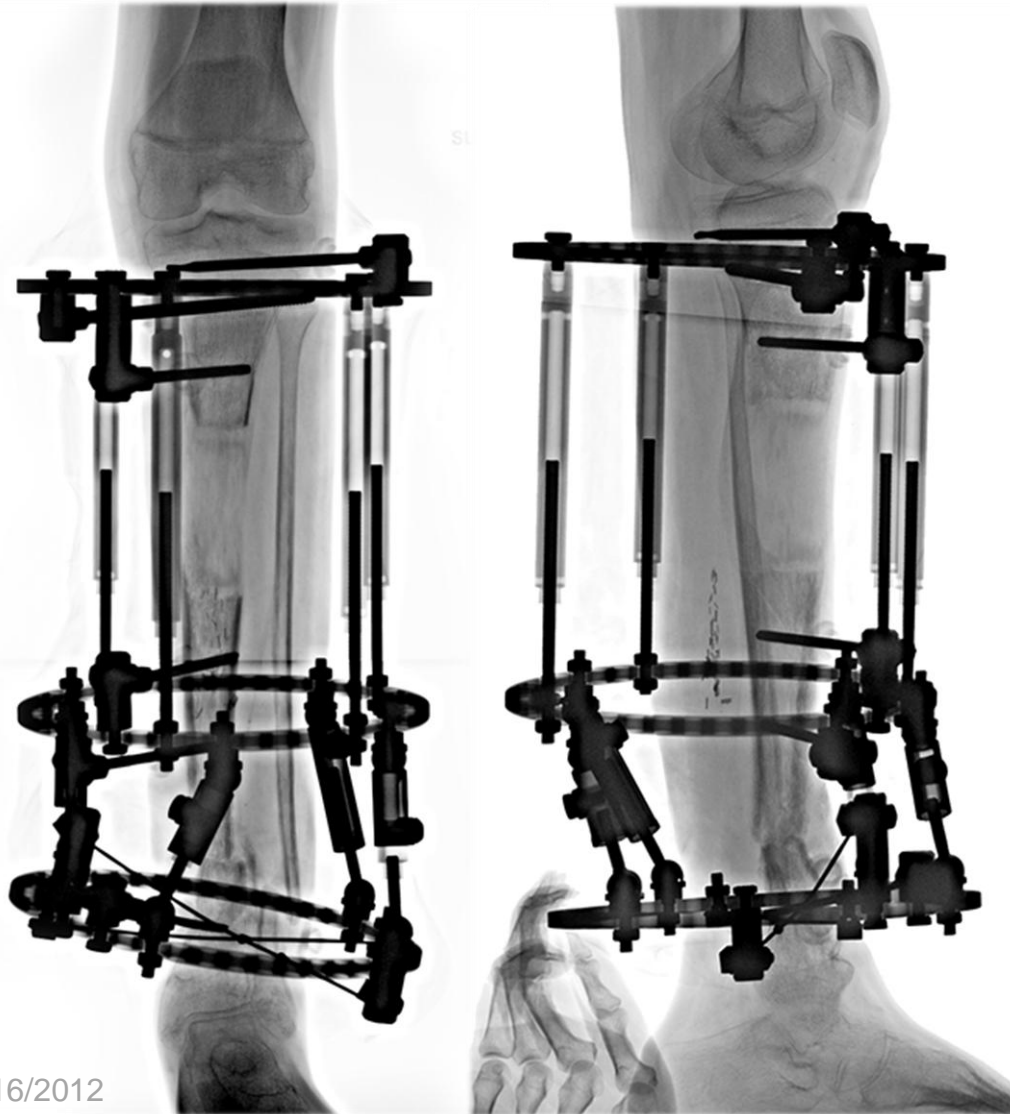


Docking Site Debridement

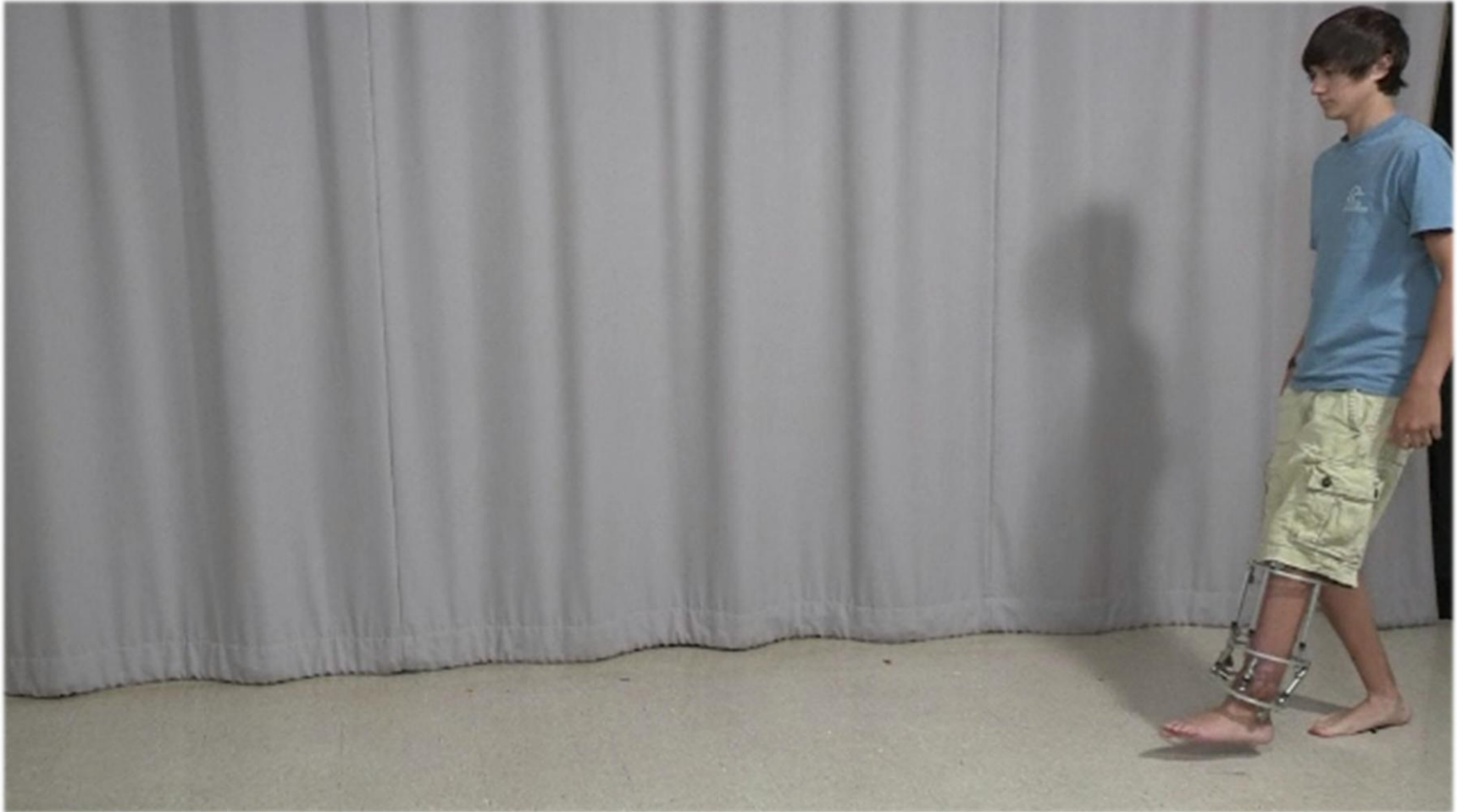


1/16/2012

Docking Site Compression



2 Months After Docking



5/25/2012

Frame Removal



- External fixation: 252 days
- Bone transport: 97 days
- Consolidation after docking: 140 days
- Long-leg cast: 8 weeks

Outcome



Outcome



10/28/2016

Outcome



10/28/2016

Outcome

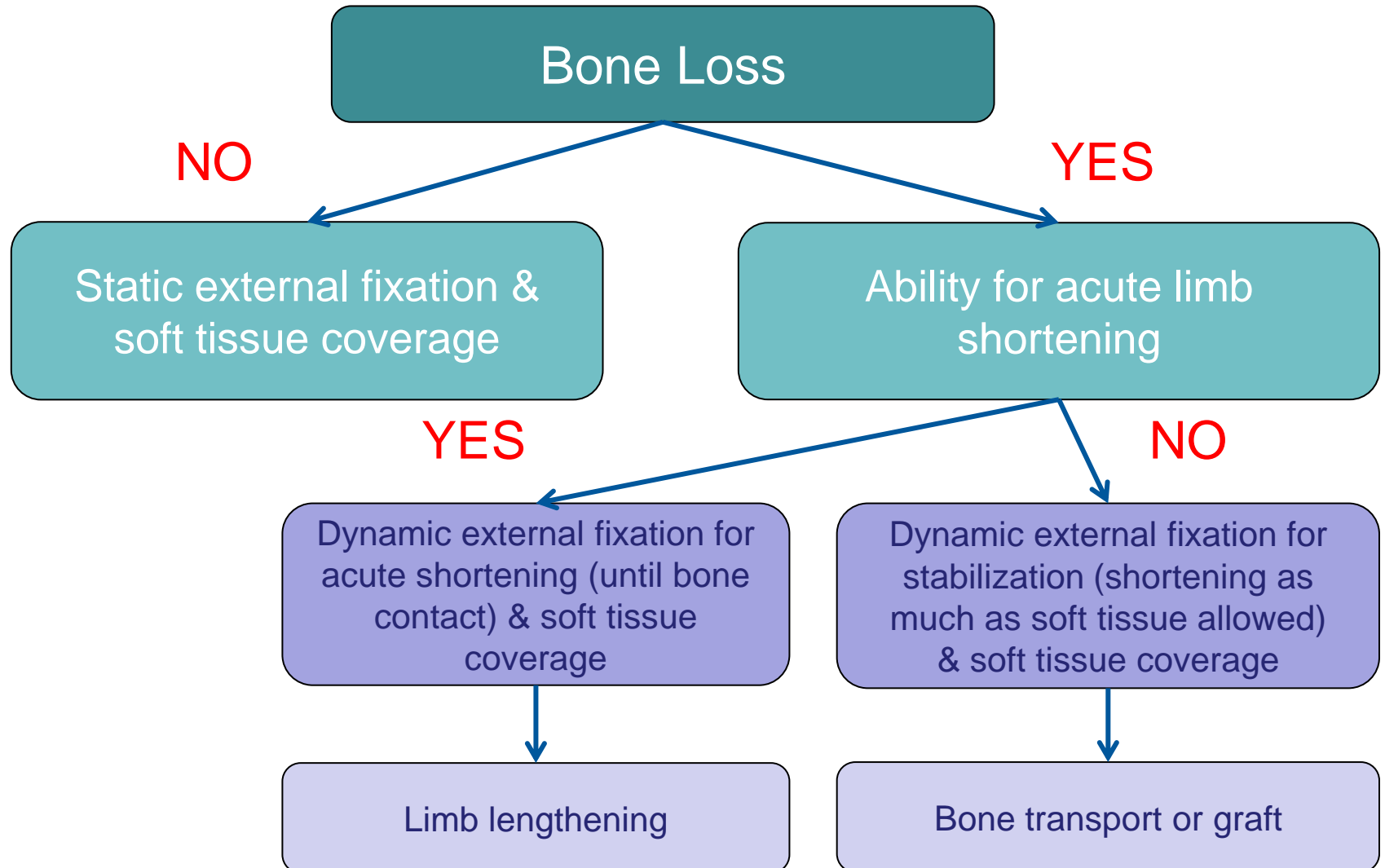


Outcome



10/28/2016

Treatment Algorithm



T E X A S
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FOR CHILDREN

