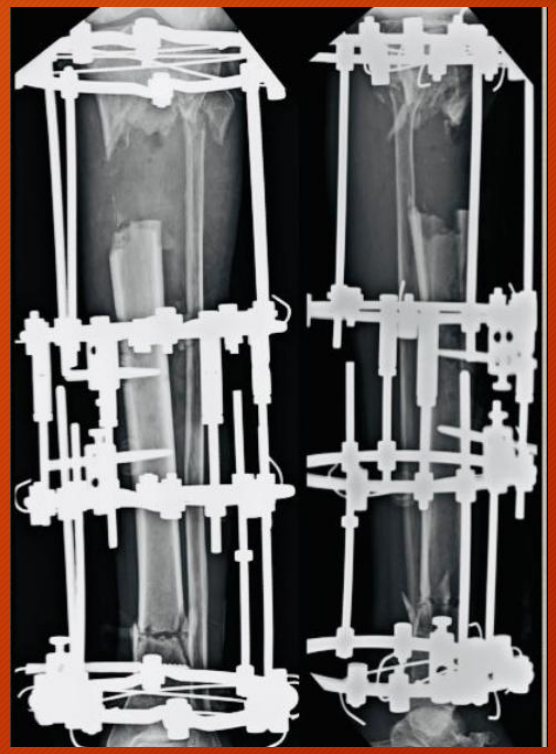
Infected Non-Union: Prevention and Treatment

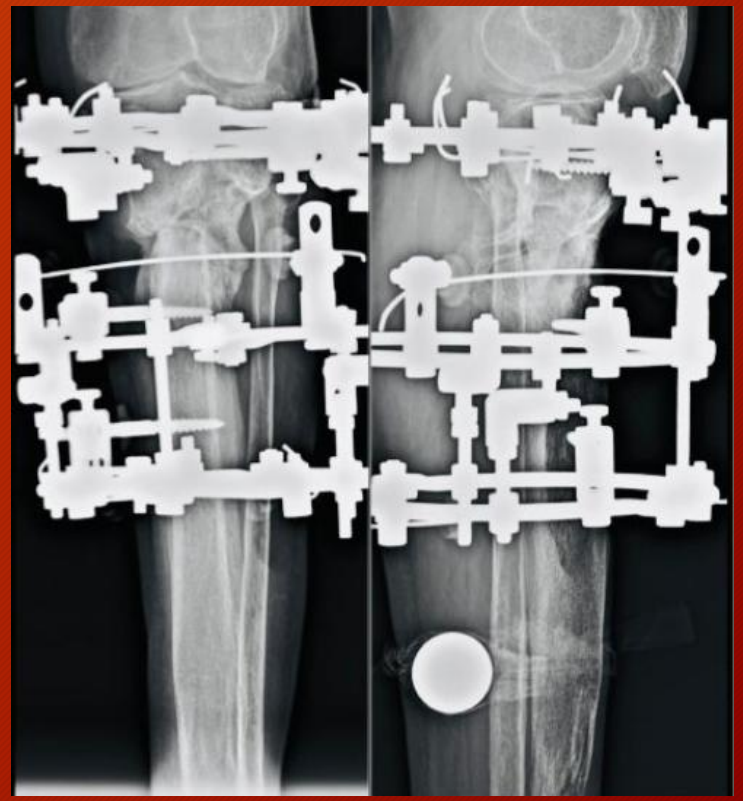
Rajat Agrawal

- Past President ASAMI INDIA
- Fellowship in Limb Lengthening and Deformity correction, Baltimore, USA
- Fellowship in Ilizarov, Kurgan, Russia
- Orthopaedic Surgeon, Agrawal Orthopaedic Hospital and Research Institute, Gorakhpur, INDIA

Management

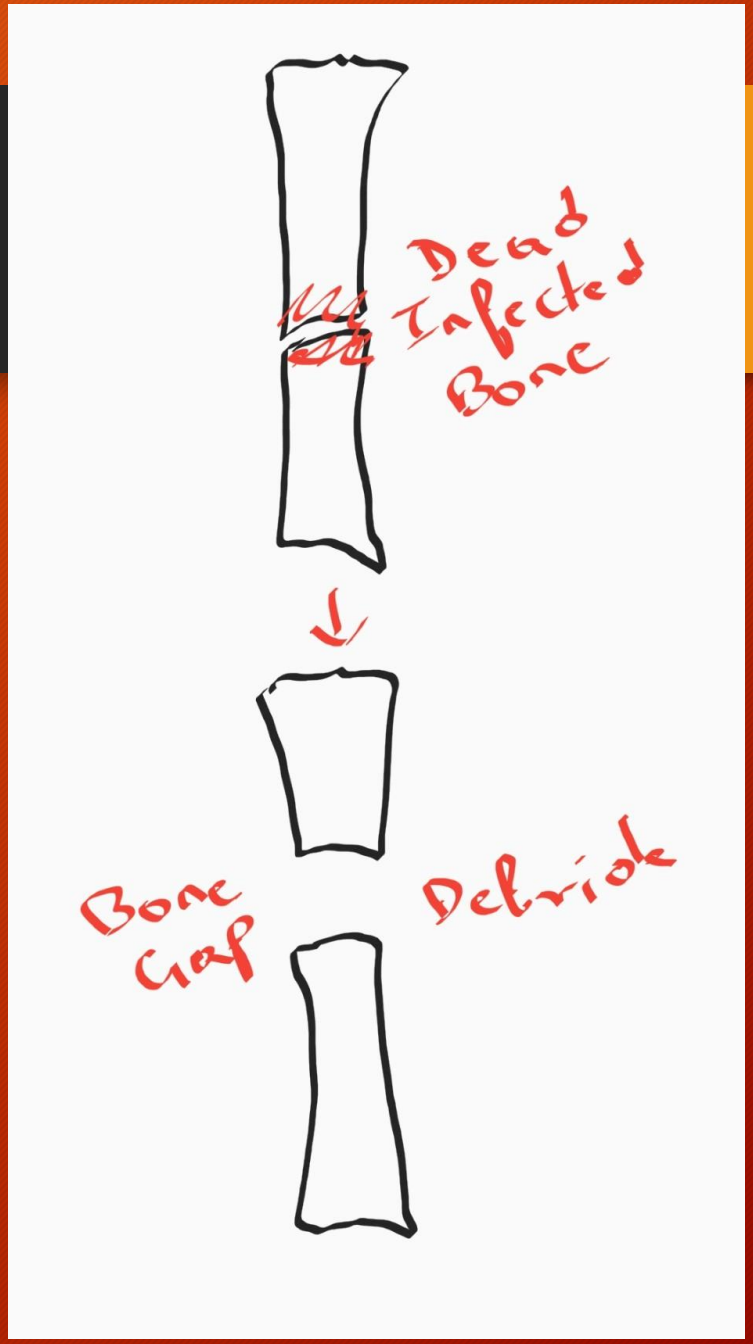
- 3 steps:
  - Debride
  - Fix
  - Unite by bony contact





Step 1: Debridement

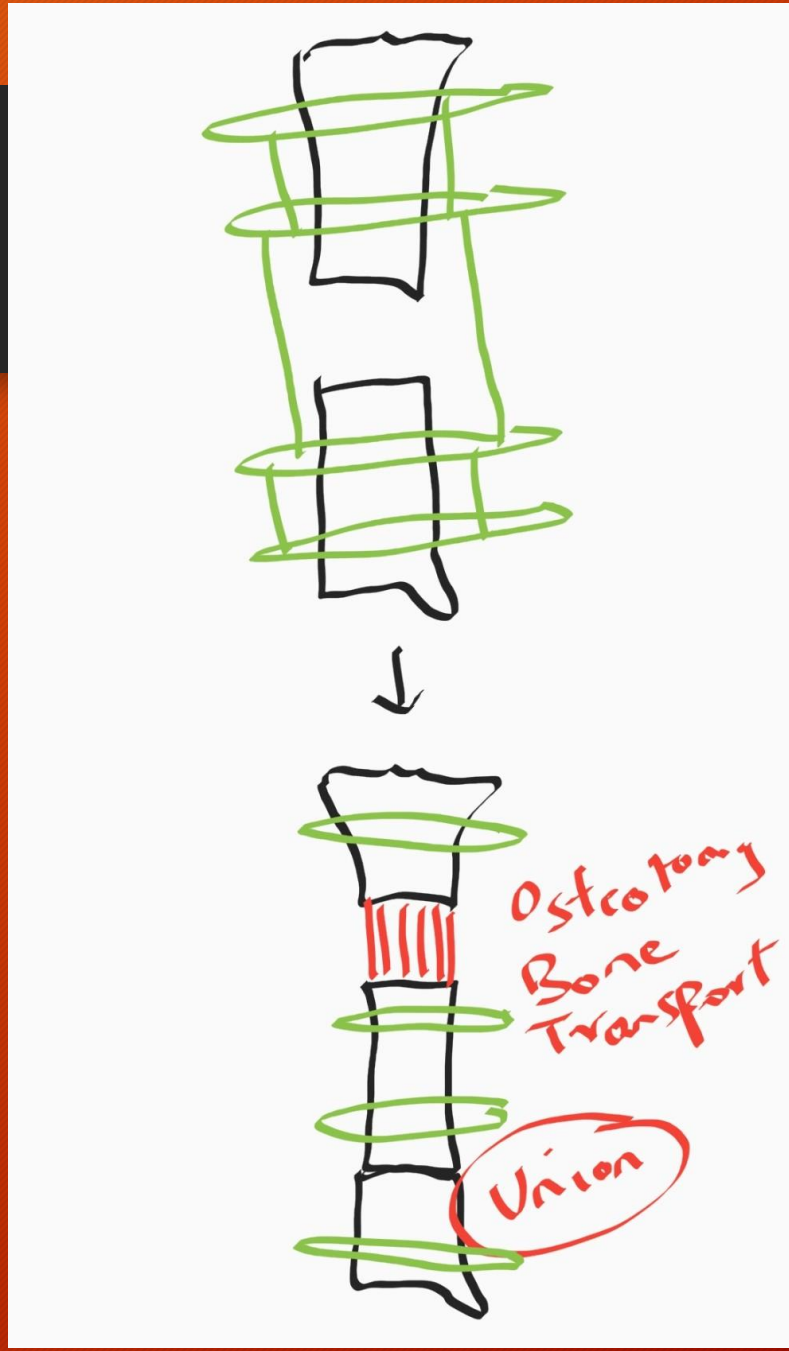
- There is one rule-
  - Remove all dead necrotic bone, irrespective of the amount of bone removed



Debridement

- Don’t be hesitant
- Create as much bone gap as necessary

- Don’t worry
- Now u can make bone !!



Step 2: Fixation

Fixator-

- Uniplanar (LRS)
- Multiplanar (Ilizarov,TSF, SUV, Hexapod)

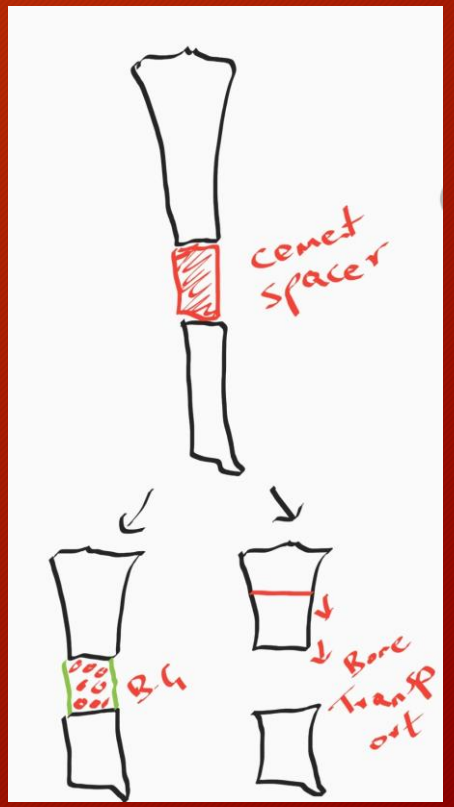
Uniplanar fixators

- Surgeon’s choice
- Uniplanar vs Mutiplanar

Multiplanar devices

Fixation

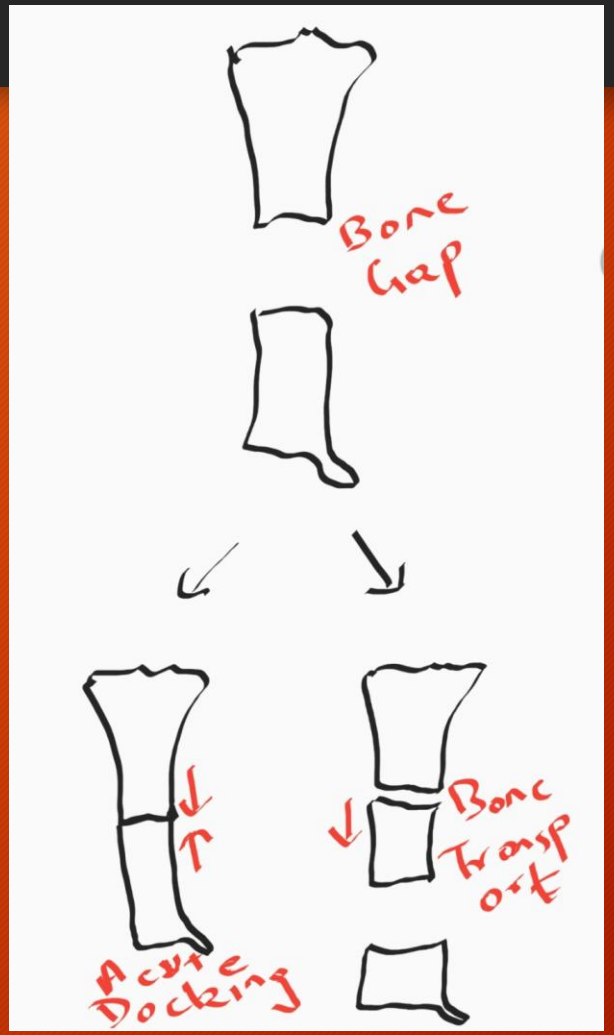
- Very severe infection-
  - Put antibiotic cement in stage 1-
    - Cement antibiotic nail- in acute docking
    - Cement spacer- in bone gap
  - Fixator in stage 2

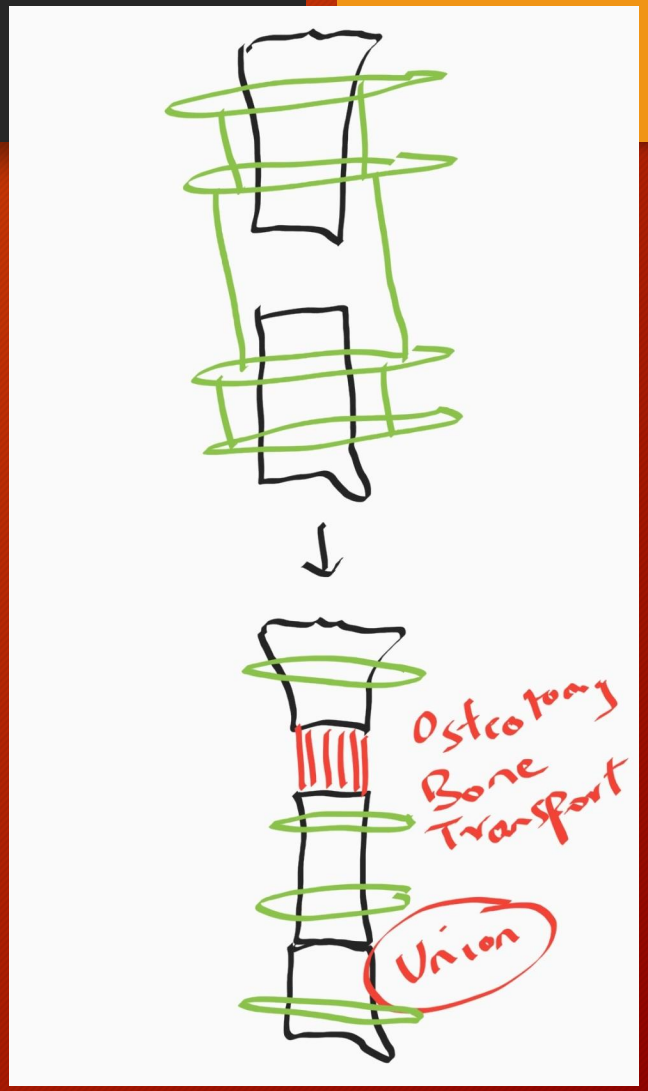


Step 3:Bone contact

2 options-

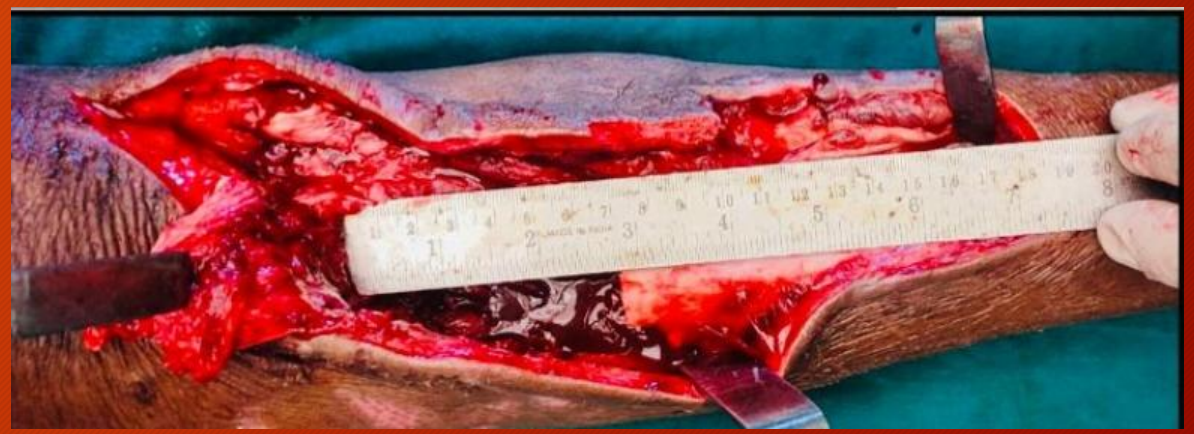
- Acute docking- upto 4-5 cm gap
- Bone transport- more than 5 cm gap



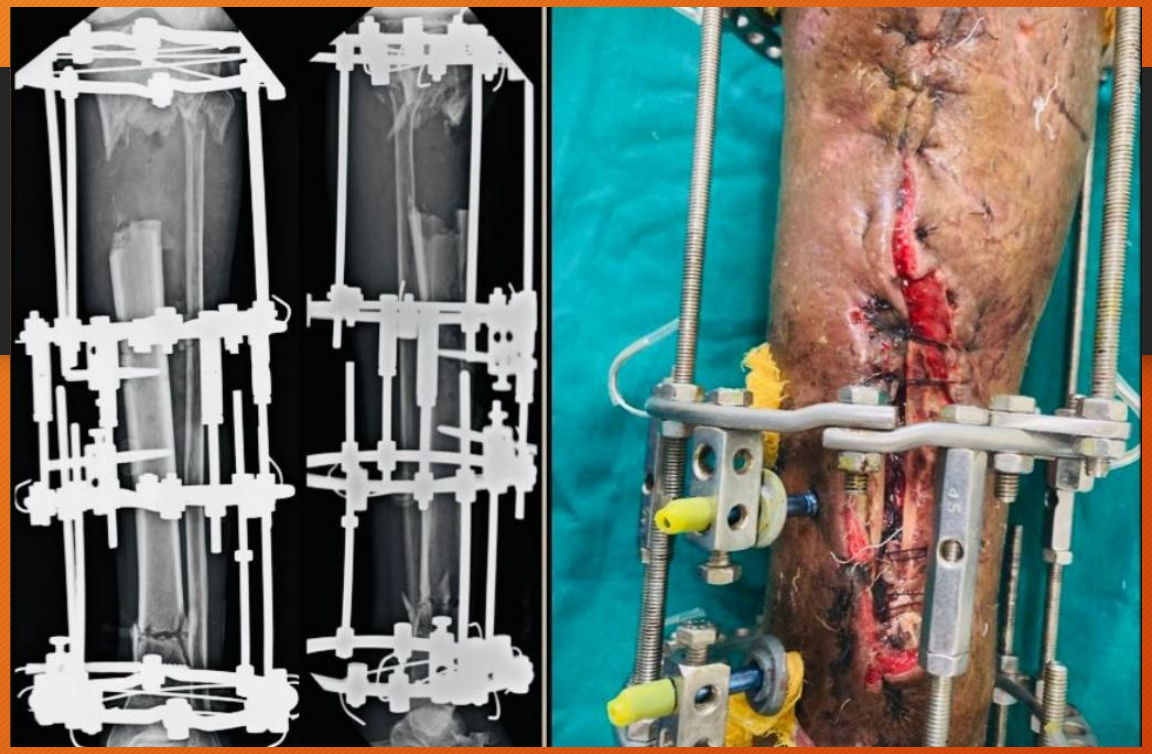


Case Examples

54/M

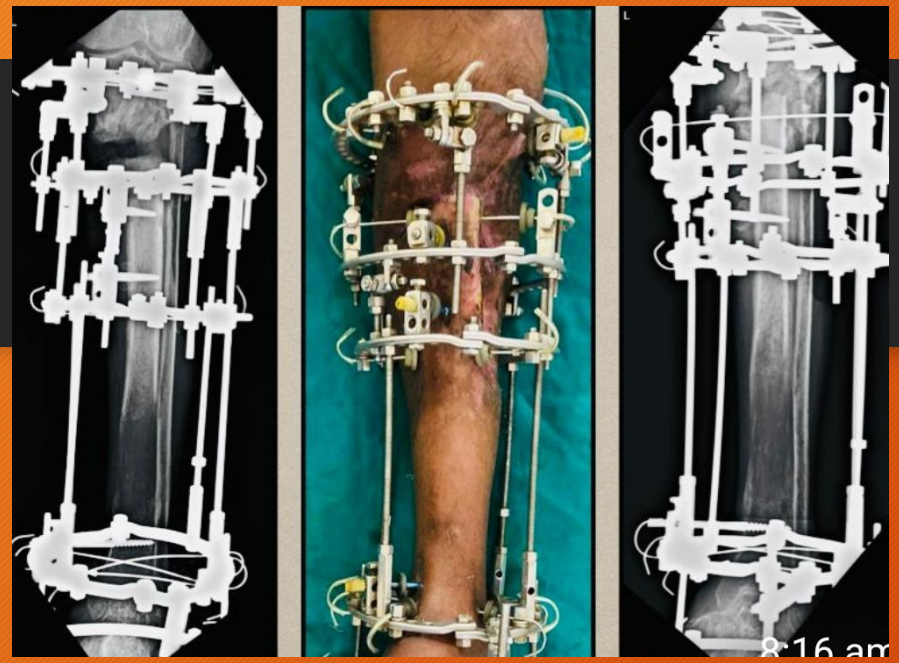


6 cm bone gap

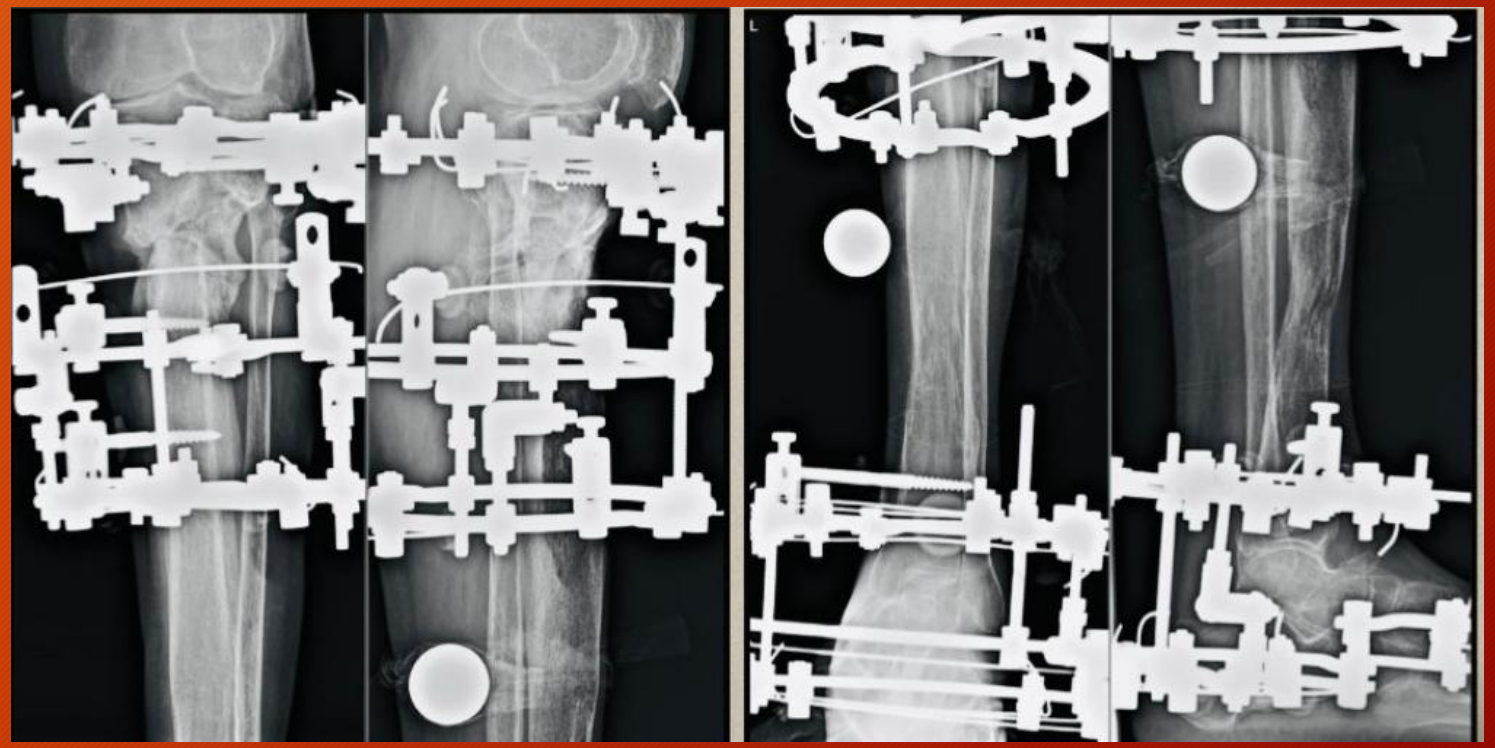


Postop- 6mm gap with distal corticotomy

Further 4cm resection of exposed bone



Docking



Clinical testing at 9months

Final result at 9months

Before

25/M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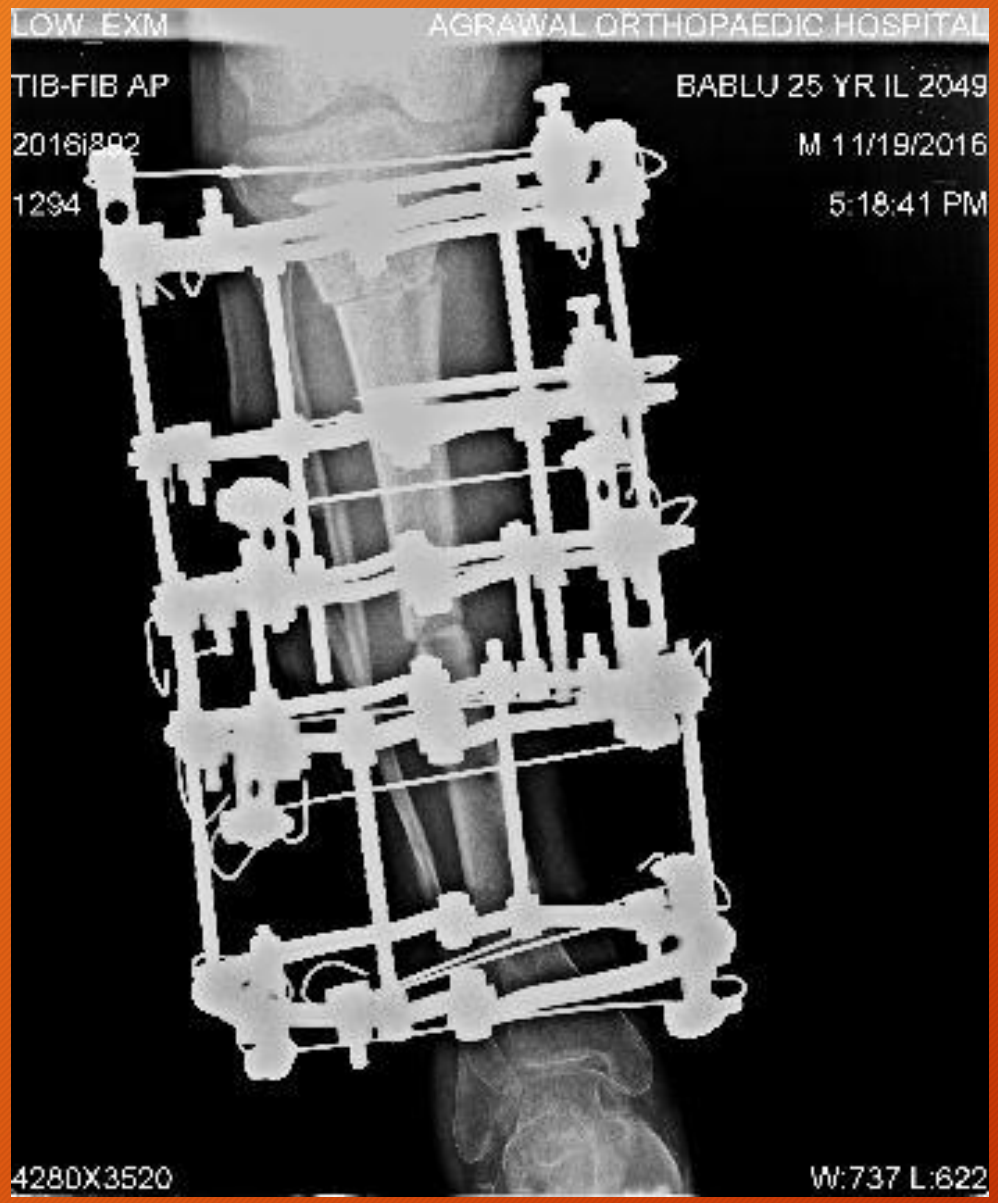
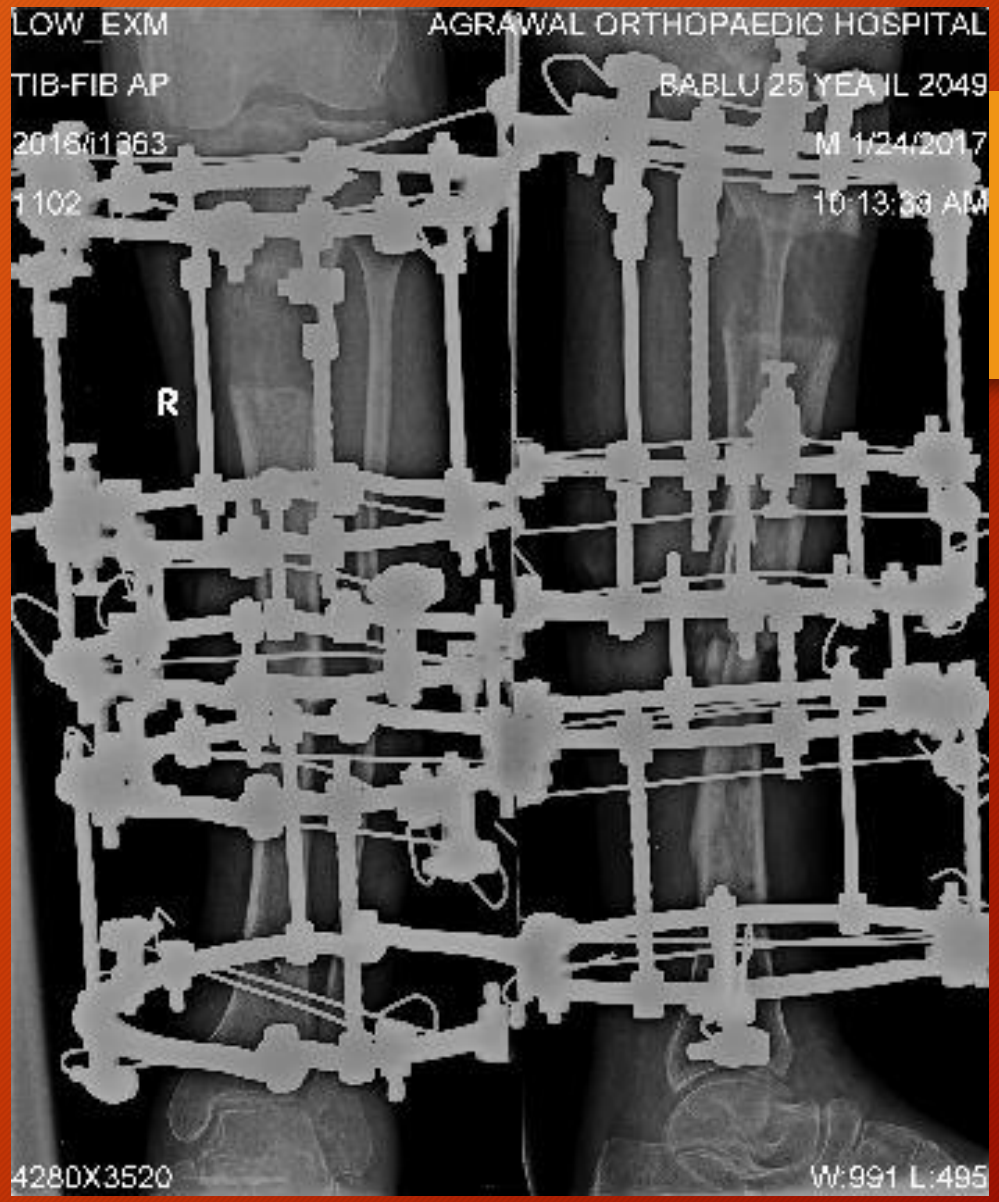




Post operative X-Ray –Nail removal, debridement, Corticotomy and tibia transportation

Final Xray

Before

32/M

Pre

Post

Final

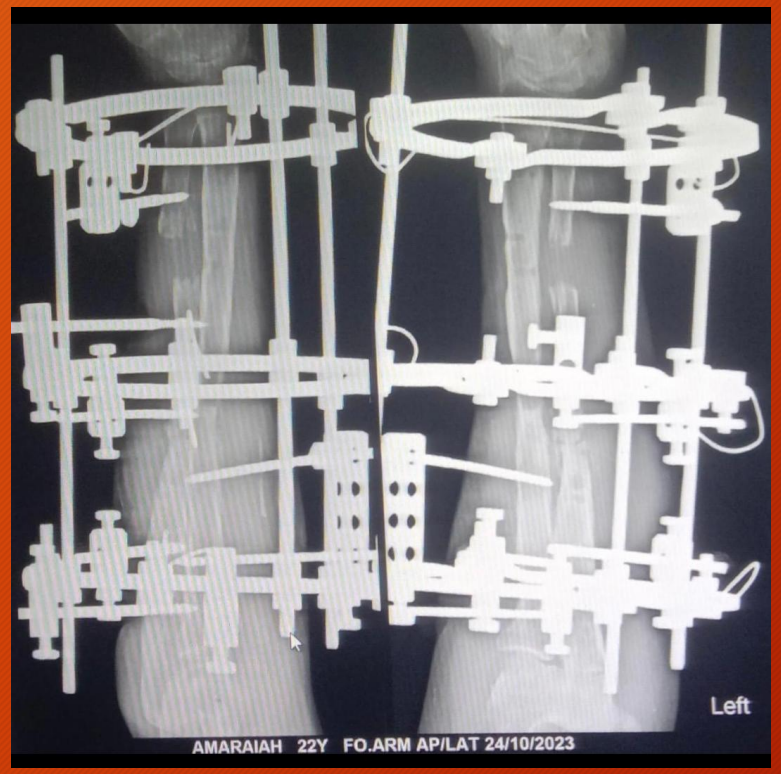
52/M

Pre

Post

Final

Before



Post-operative

After

Severe bone defect

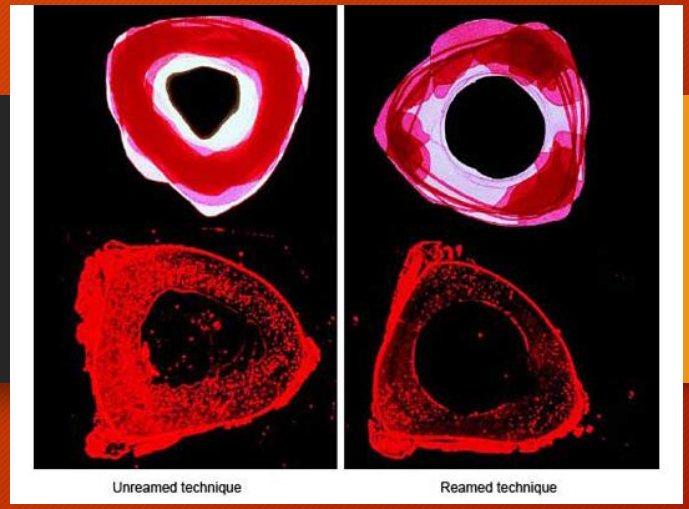
Tibialization of Fibula

Final X-Ray

Prevention

- Why this happened ?
- Most common cause: compound fracture-
  - Primary Nailing/Plating
  - Early plating/nailing after initial ex fix
  - High chance of infected nonunion

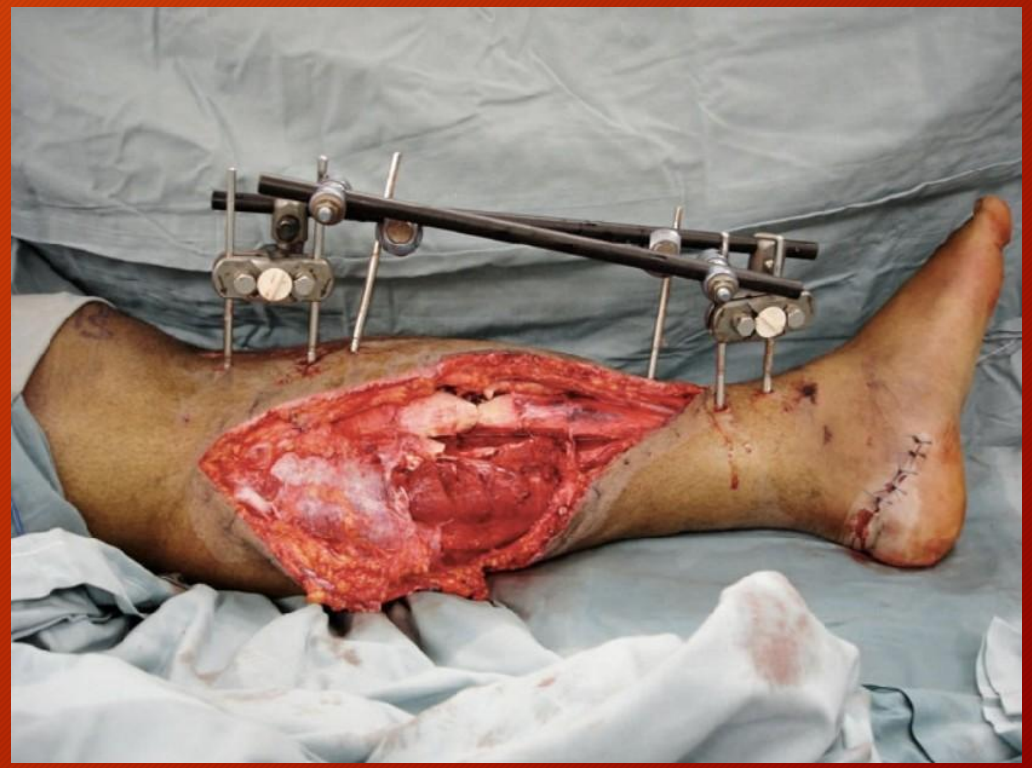
Primary Nailing/Plating



- Always a chance of spread of infection
- Damage to endosteal blood supply

Temporary External Fixator and Secondary Nailing/Plating

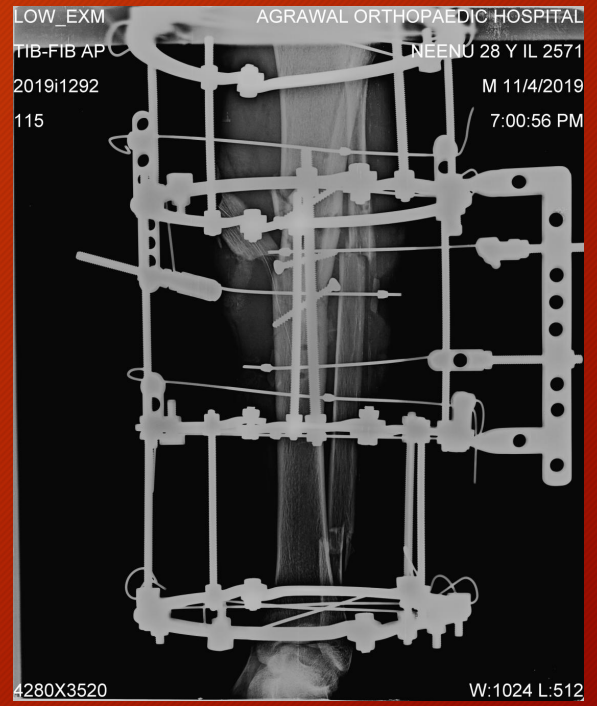
- Multiple surgeries
- Always a chance of complication- Infection, Nonunion



Ilizarov

- Ilizarov as an option comes last in the list
- WHY ?

- Reserved as salvage procedure when all other treatment options fail
- Why not do it in first place?



Ilizarov

- But still most of the young surgeons are hesitant
- Not much interest unlike Replacement or Arthroscopy surgeries

- We are a small society !

Problem with Ilizarov

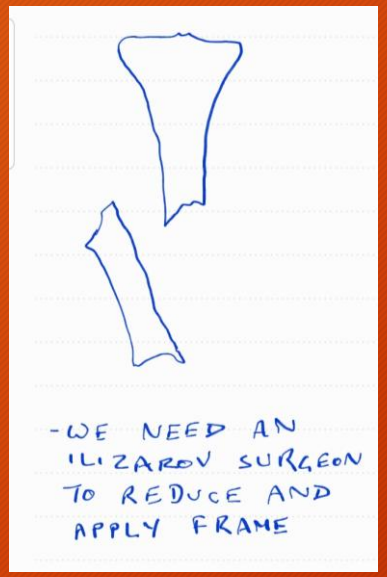
- Reduction:
  - Percutanoeus indirect reduction technique
  - We all are comfortable with open reduction and internal fixation
  - Percutaneous reduction of displaced fractures is difficult

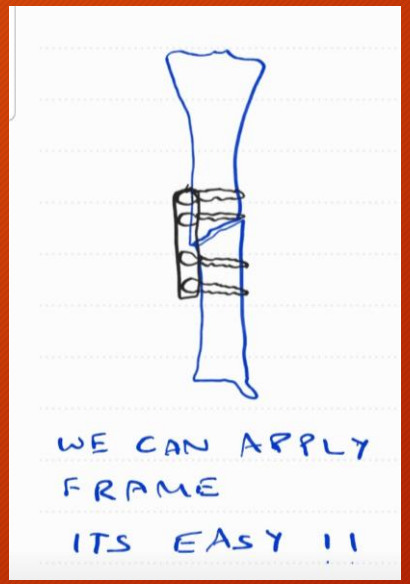
Problem with Ilizarov

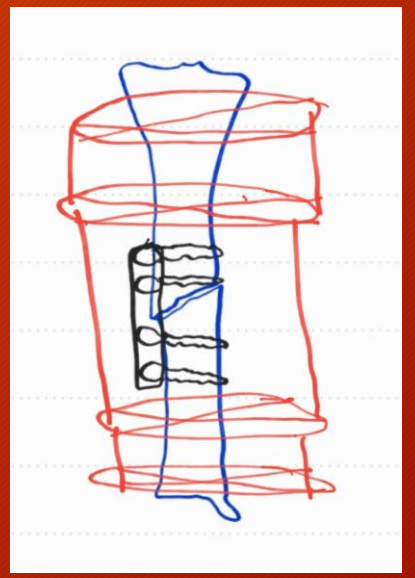
- Frame application:
  - In various Ilizarov workshops, we are taught to apply frame on a normal bone
  - Its difficult to apply frame in displaced fracture

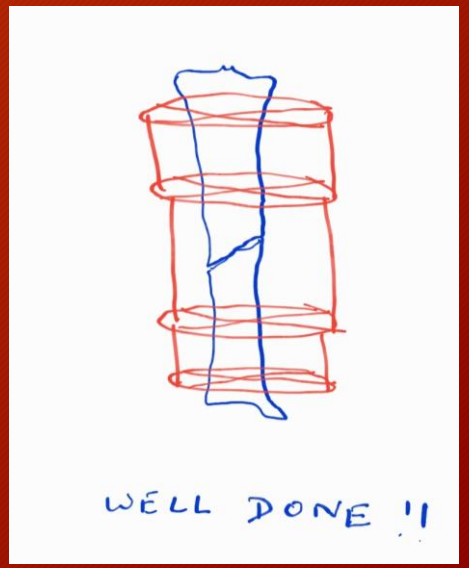
How to solve the problem

- Why don’t we do open reduction and internal fixation only
- Make it as a normal bone
- Then apply Ilizarov like on a normal bone
- Then remove the plate



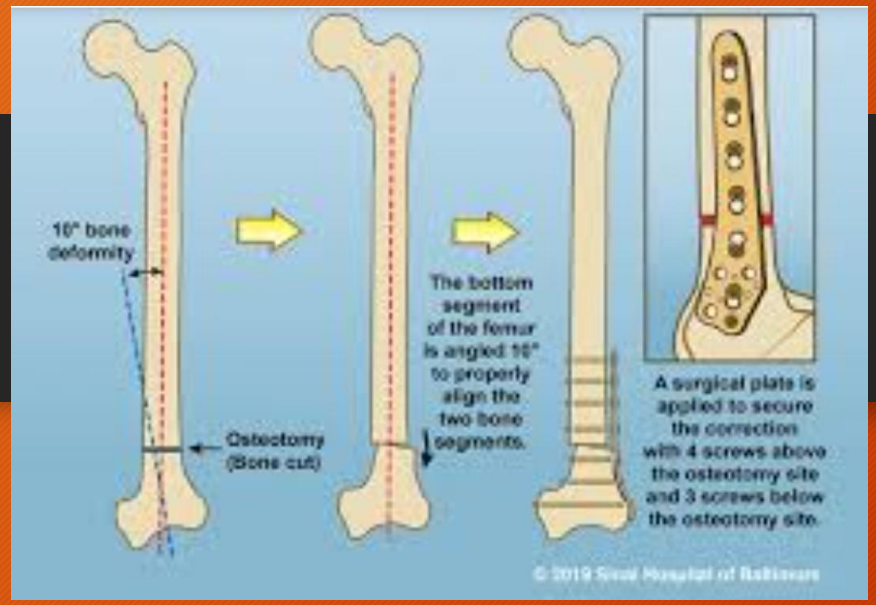




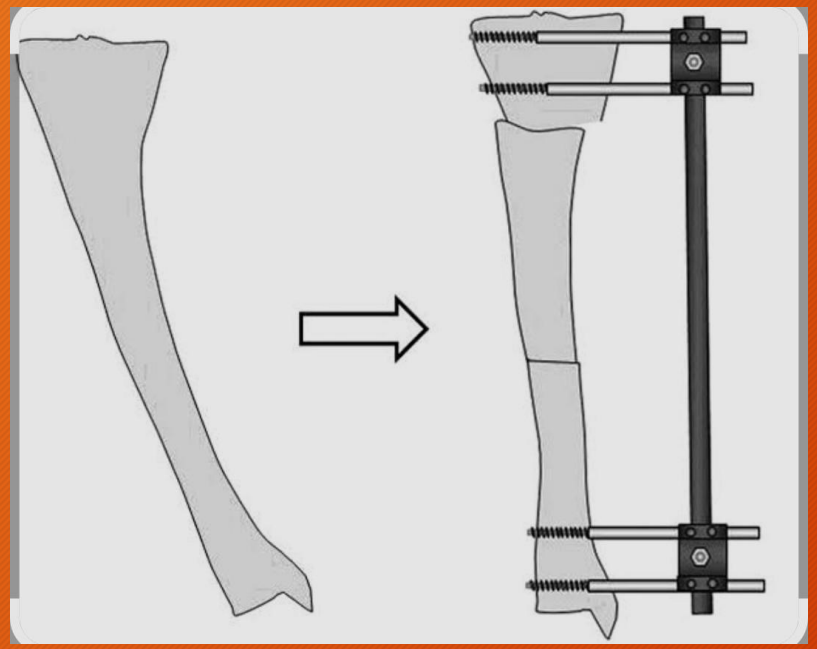


Temporary plating (Plating assisted Fixator)

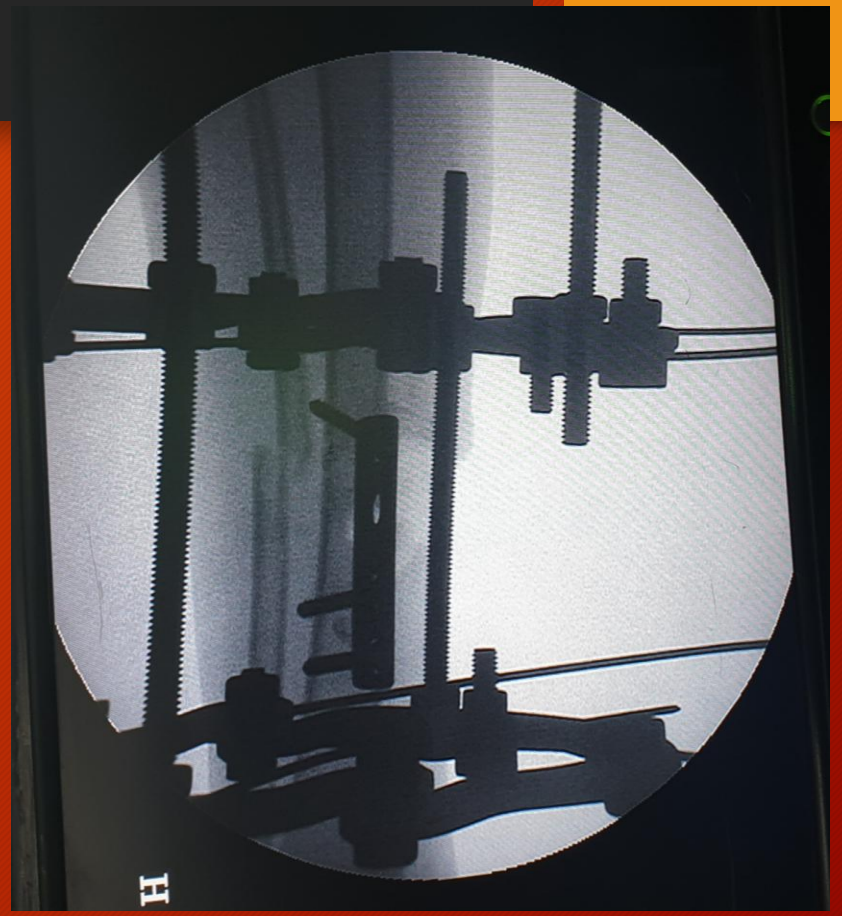
- Technically easy
- Better reduction
- Decrease rate of malunion and non-union



Fixator assisted Plating



Fixator assisted Nailing

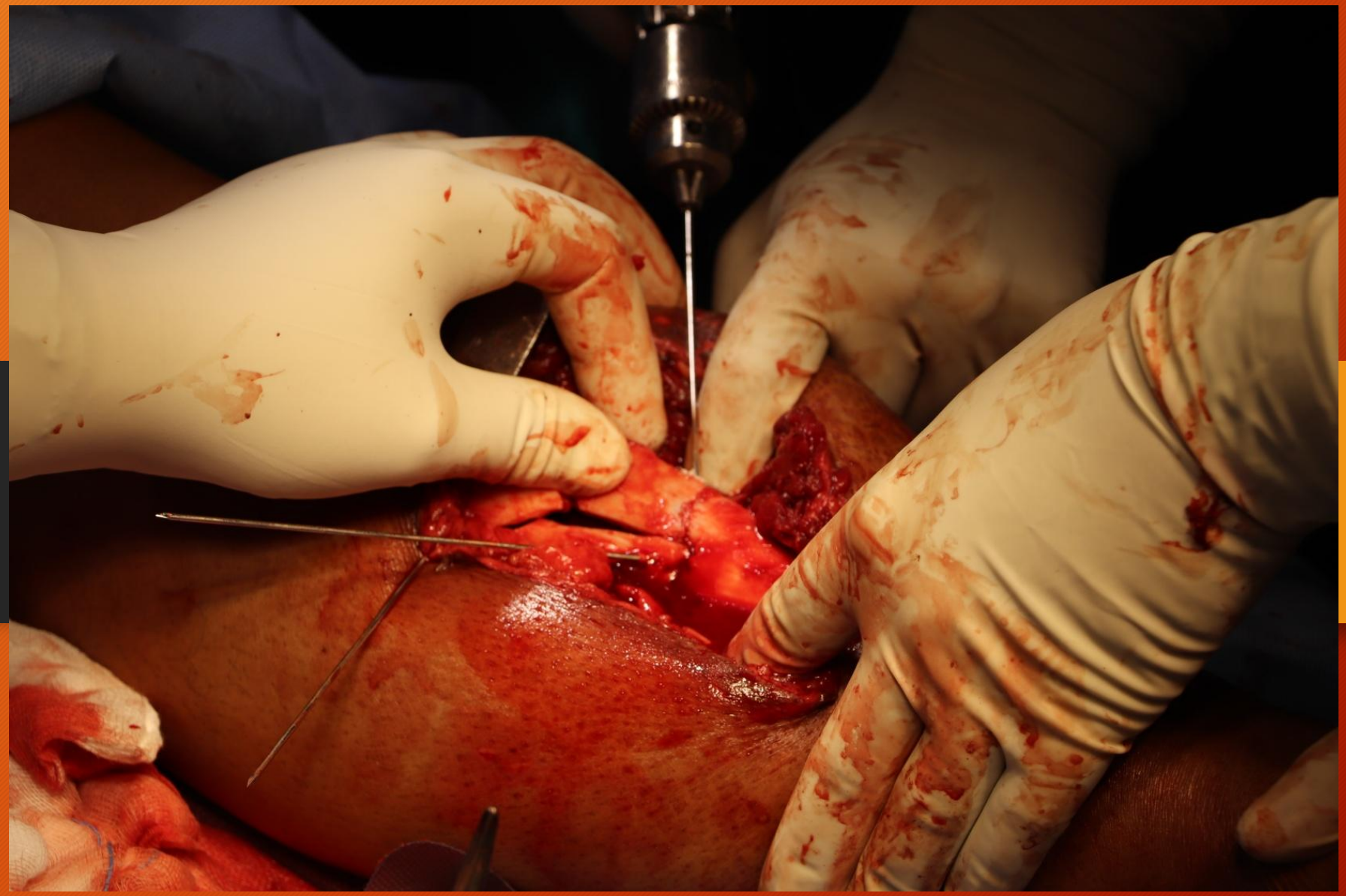


Plating assisted Fixator

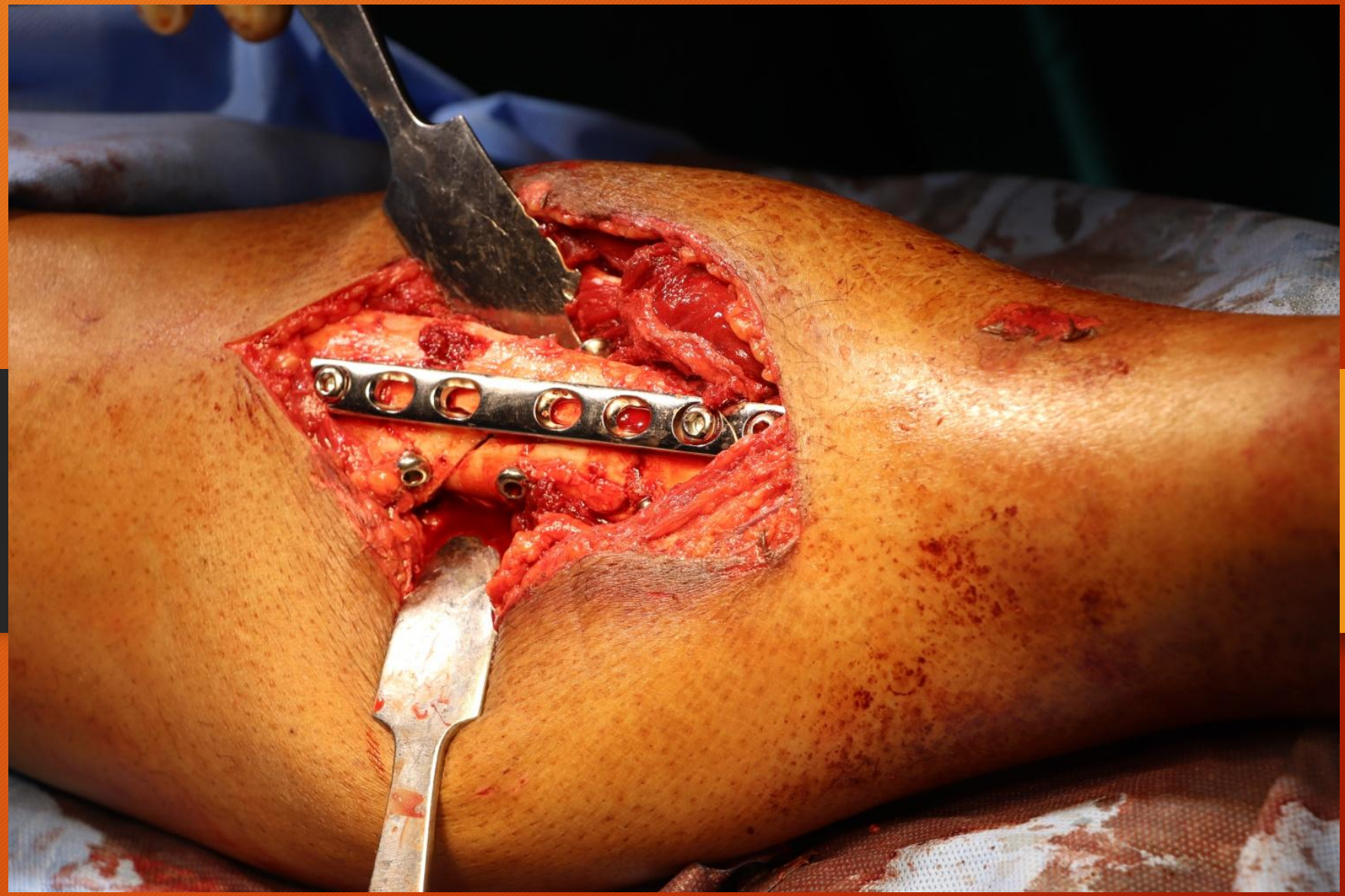
28yrs/M

Intra Op Findings

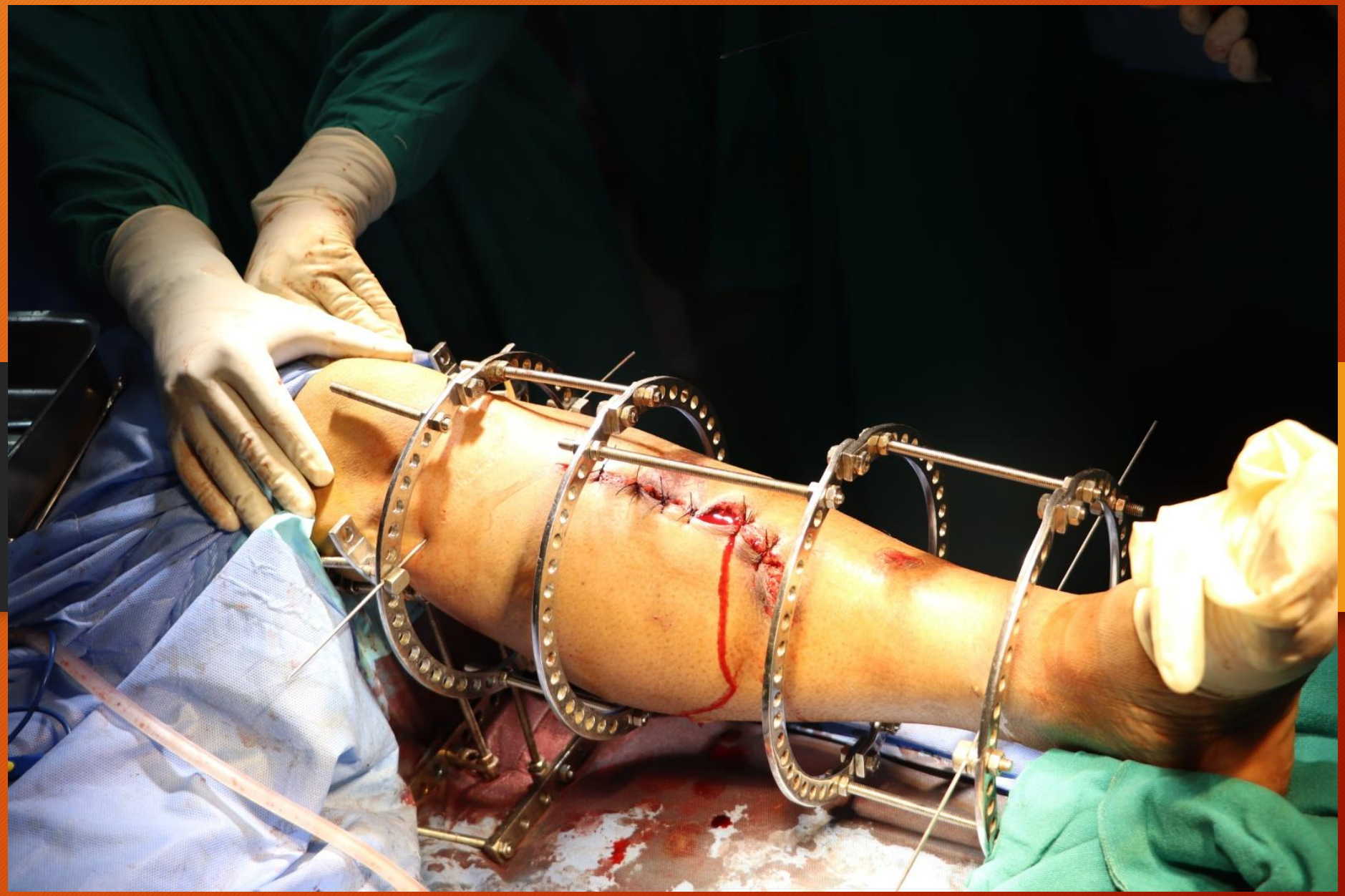
Multiple bony fragments with muscles attachment



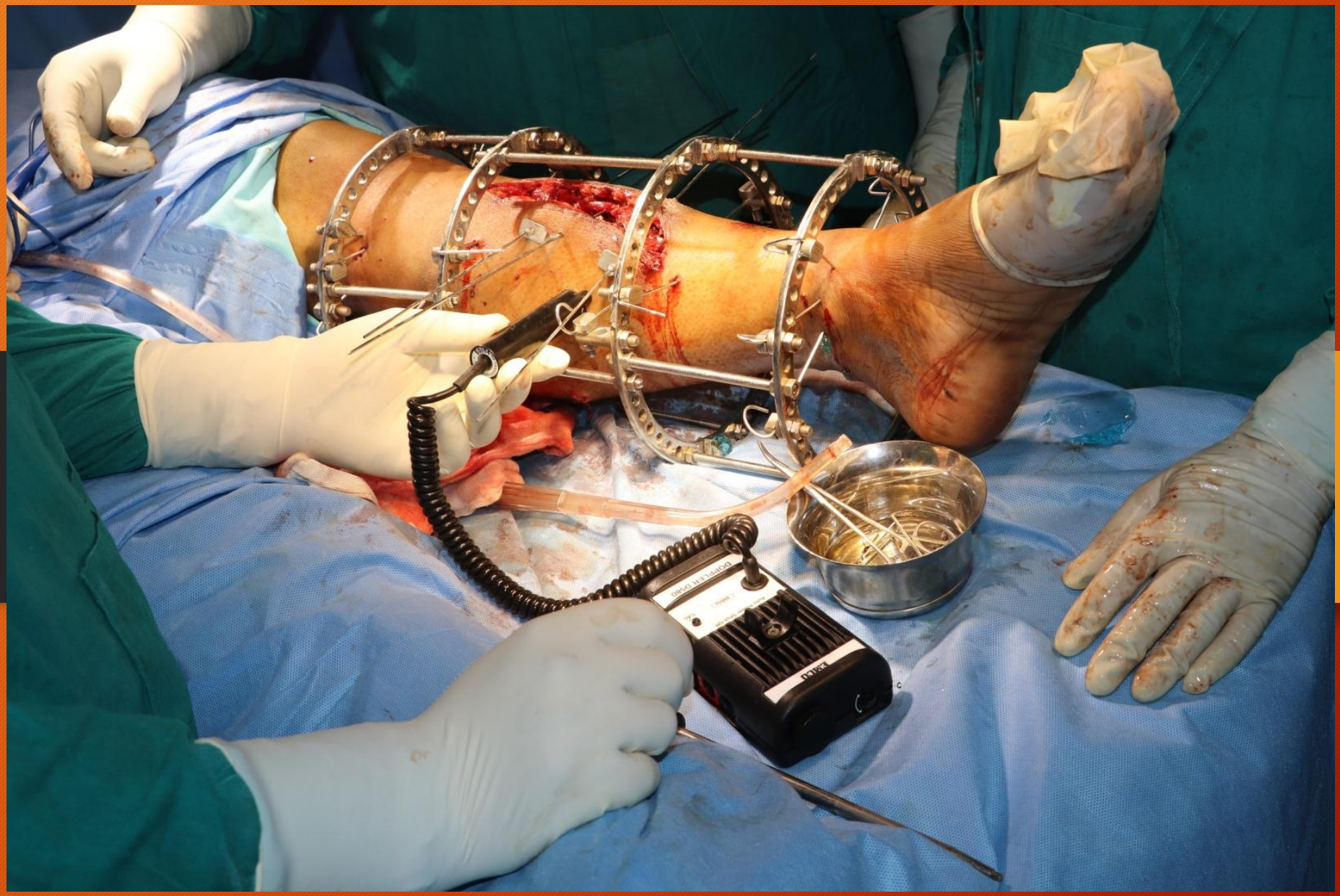
All fragments fixed with K-wire



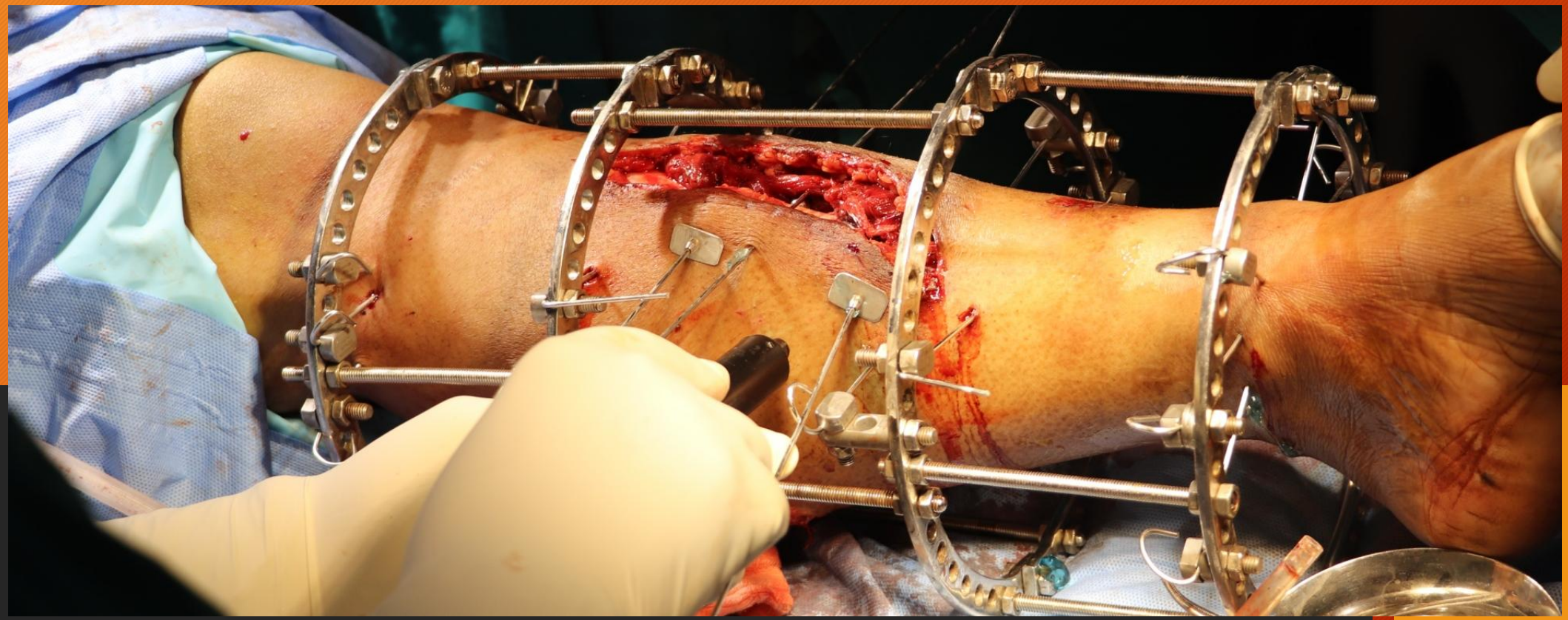
Fragments fixed with lag screw and temporarily reduction plate



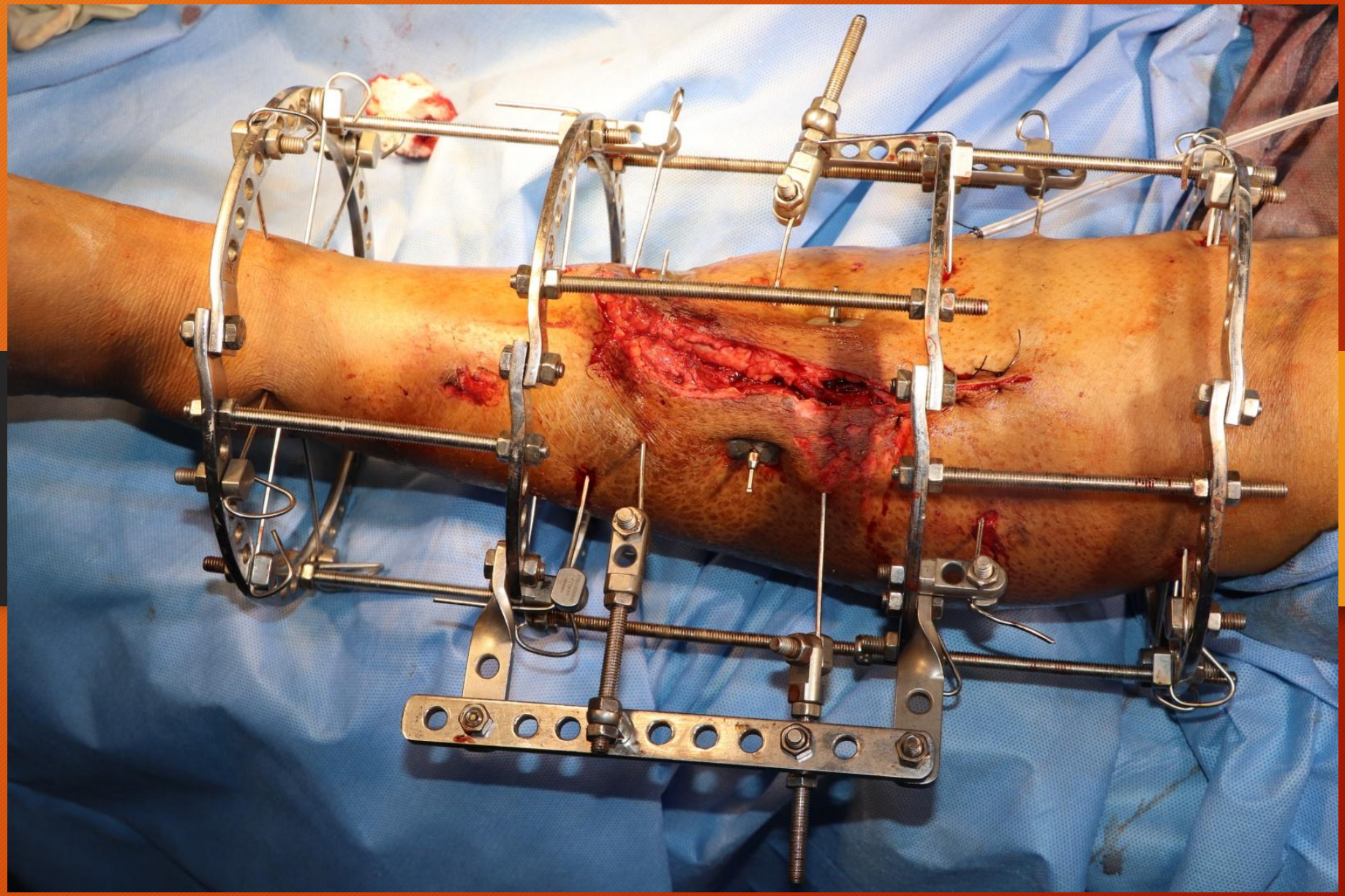
Temporarily skin approximation and Ilizarov frame application



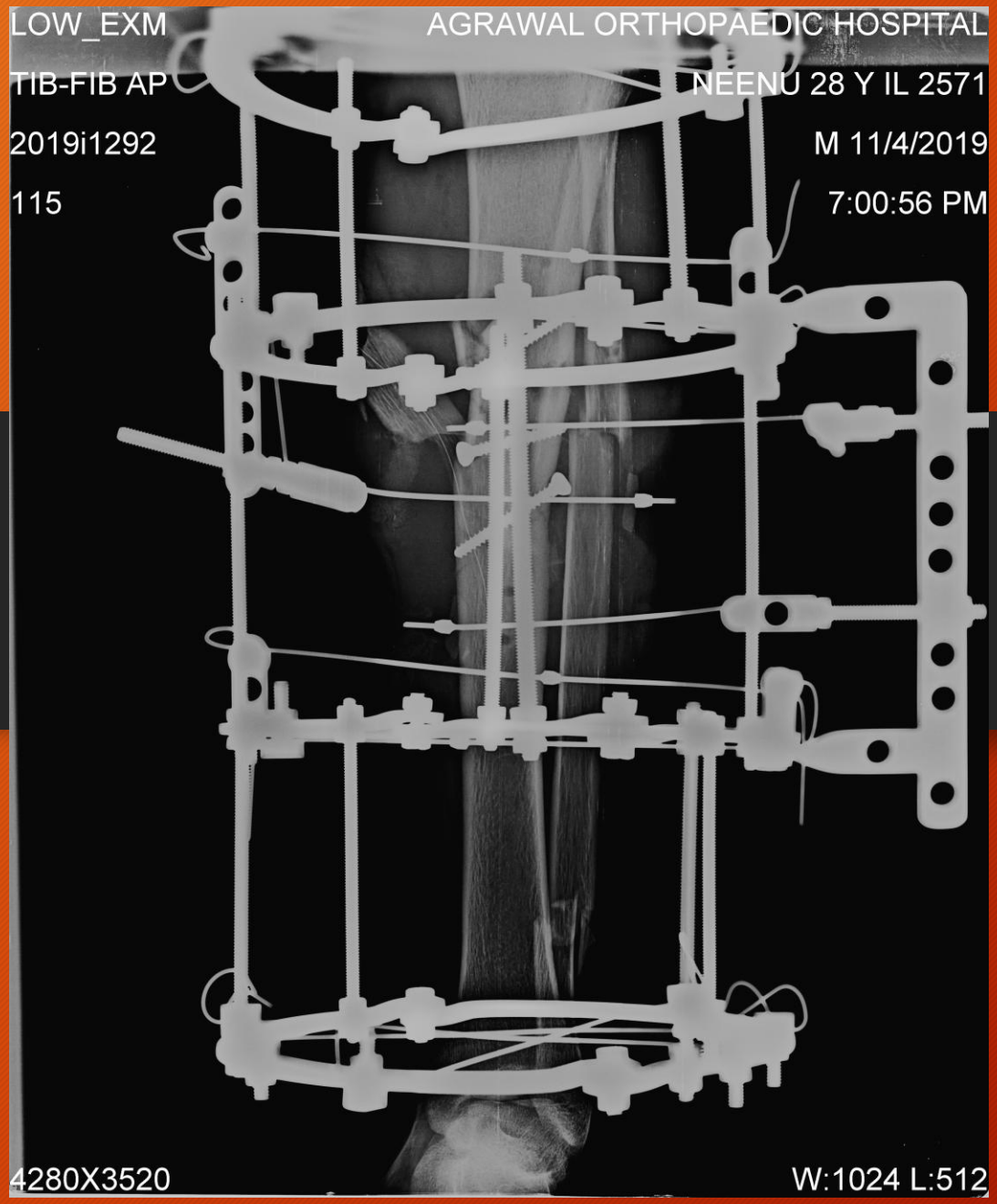
After frame application vascularity confirmed with Doppler machine



Soft tissue traction for gradual and controlled skin approximation to avoid necrosis



Final Ilizarov Assembly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Postop Xray


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Final

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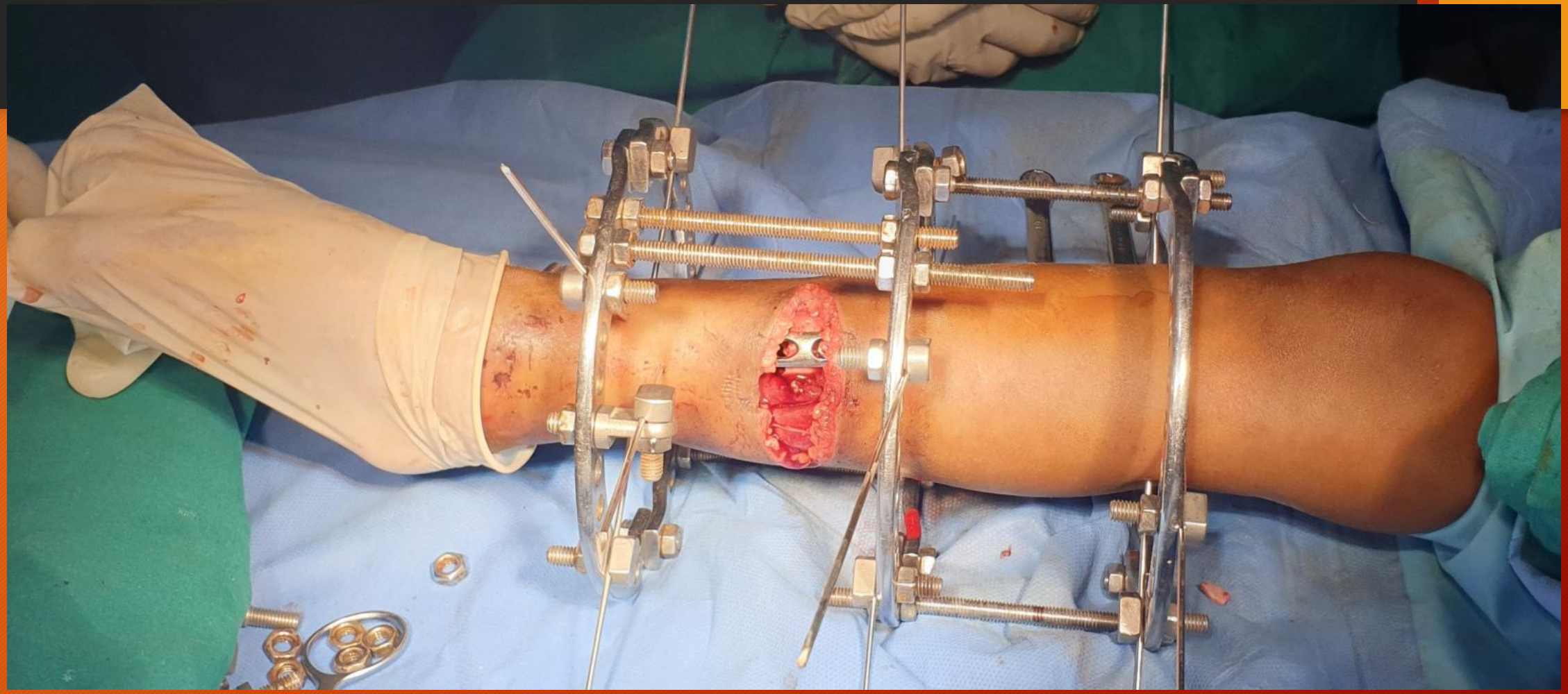
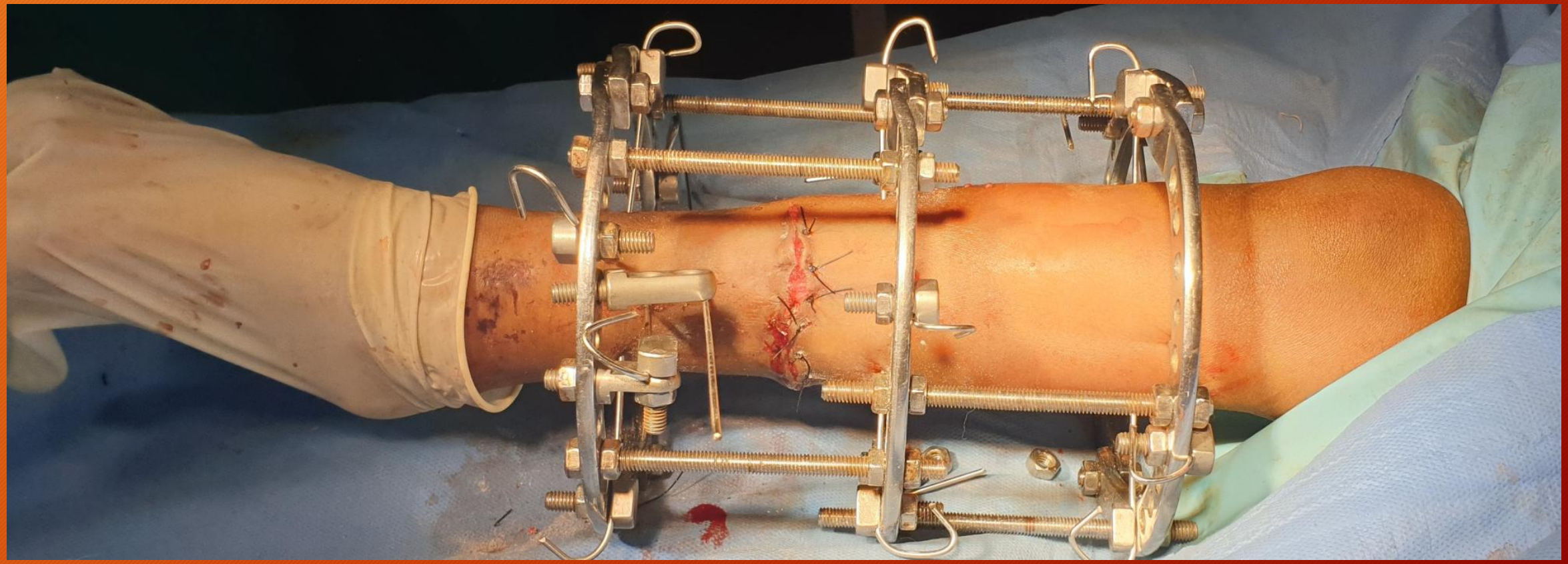
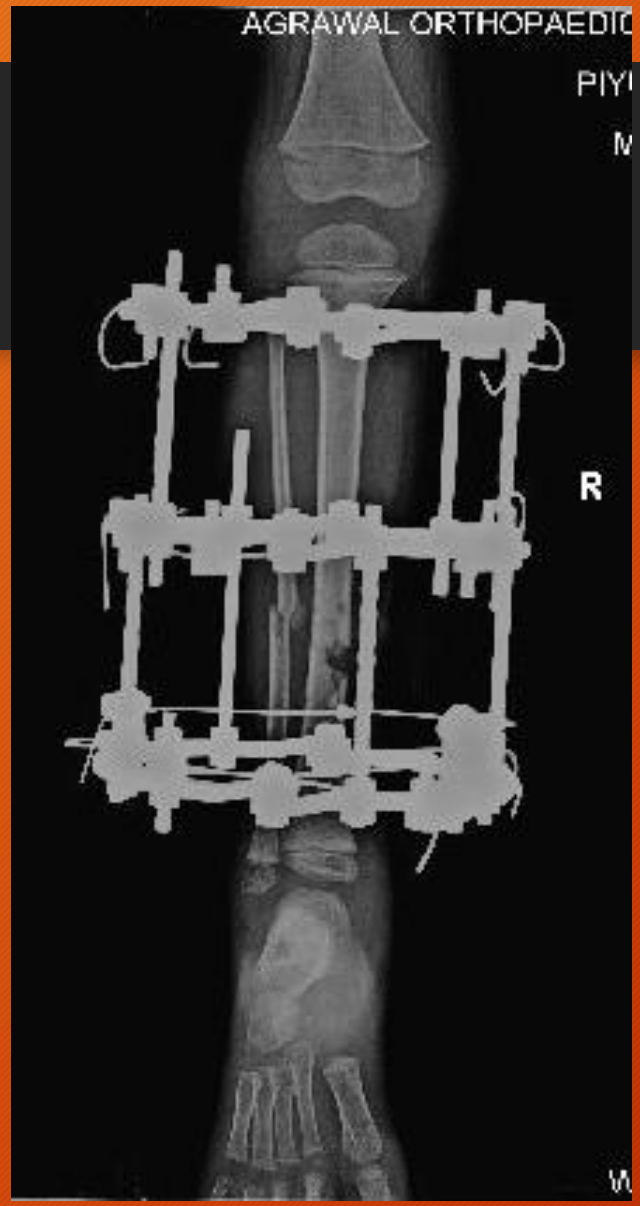


Intraop C-Arm shot

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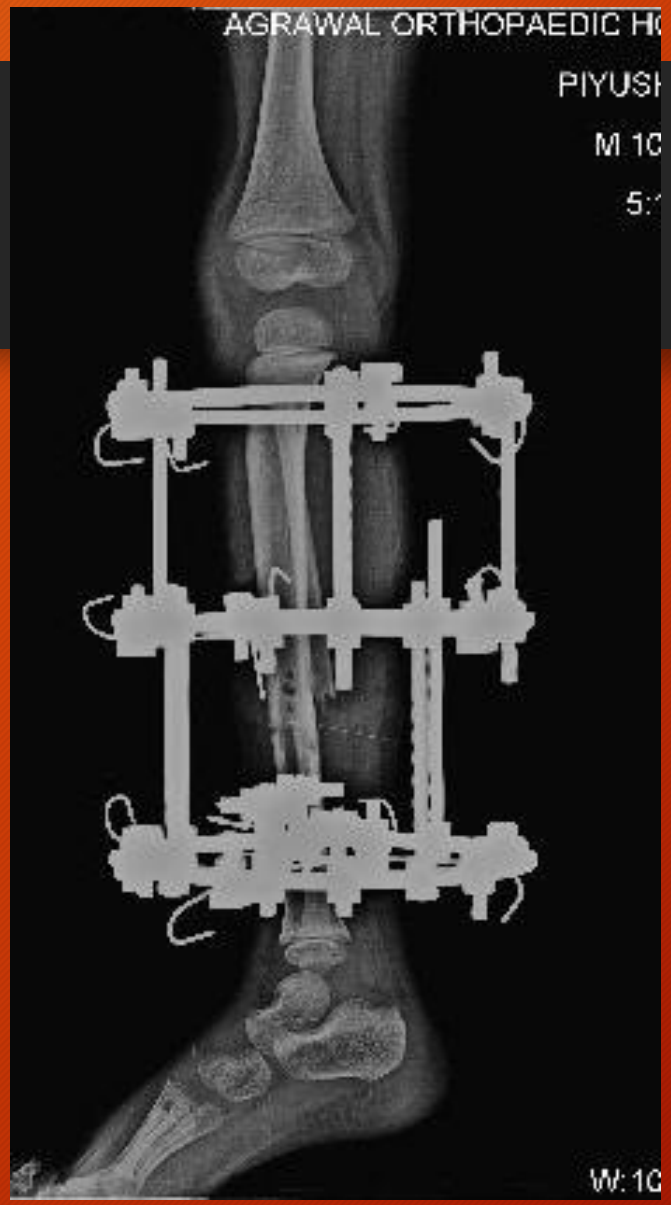
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Postop Xray


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Final

Review of literature

- Many articles on Ilizarov as primary treatment for open fratures


World J Emerg Med, Vol 7, No 3, 2016 221

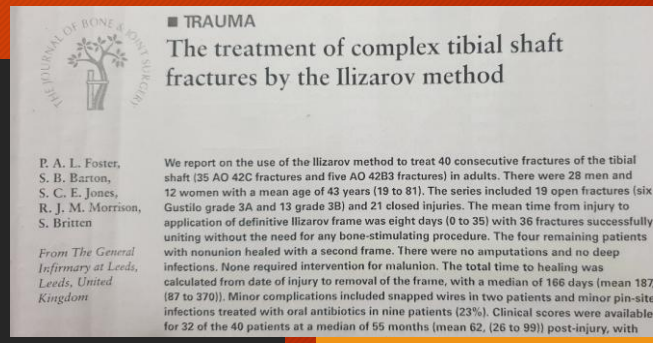
Original Article

Outcome of application of primary versus secondary Illizarov's fixator in open tibial shaft fractures

Anil Joshi[1,2], Saurabh Singh[3], Sudeep Jain[4], Narender Rohilla[5], Vivek Trikha[6], Chandra Yadav[6]

[1] Medical College, V.C.S.G. Government Medical Sciences and Research Institute, Srinagar, Pauri Garhwal, India
[2] H.N.B. Base & Teaching Hospital, P.O.-Srikot, Srinagar, Srinagar Garhwal, Uttarakhand 246174, India
[3] Department of Orthopaedics, IMS BHU, Varanasi, India, Varanasi, Uttar Pradesh 221005, India
[4] Fortis Flt Lt Rajan Dhall Hospital, Ringgold Standard Institution, Safdarjung Enclave, New Delhi, Delhi 110070, India
[5] Fortis Hospital, Shalimar Bagh Ringgold Standard Institution, Safdarjung Enclave, New Delhi, Delhi 110033, India
[6] Department of Orthopaedics, All India Institute of Medical Sciences Ringgold Standard Institution, New Delhi, Delhi 110029, India

Corresponding Author: Anil Joshi, Email: aniljoshi11@gmail.com


THE JOURNAL OF BONE & JOINT SURGERY

■ TRAUMA

The treatment of complex tibial shaft fractures by the Ilizarov method

P. A. L. Foster, S. B. Barton, S. C. E. Jones, R. J. M. Morrison, S. Britten

From The General Infirmary at Leeds, Leeds, United Kingdom

We report on the use of the Ilizarov method to treat 40 consecutive fractures of the tibial shaft (35 AO 42C fractures and five AO 42B3 fractures) in adults. There were 28 men and 12 women with a mean age of 43 years (19 to 81). The series included 19 open fractures (six Gustilo grade 3A and 13 grade 3B) and 21 closed injuries. The mean time from injury to application of definitive Ilizarov frame was eight days (0 to 35) with 36 fractures successfully uniting without the need for any bone-stimulating procedure. The four remaining patients with nonunion healed with a second frame. There were no amputations and no deep infections. None required intervention for malunion. The total time to healing was calculated from date of injury to removal of the frame, with a median of 166 days (mean 187 (87 to 370)). Minor complications included snapped wires in two patients and minor pin-site infections treated with oral antibiotics in nine patients (23%). Clinical scores were available for 32 of the 40 patients at a median of 55 months (mean 62, (26 to 99)) post-injury, with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Chinese Journal of Traumatology

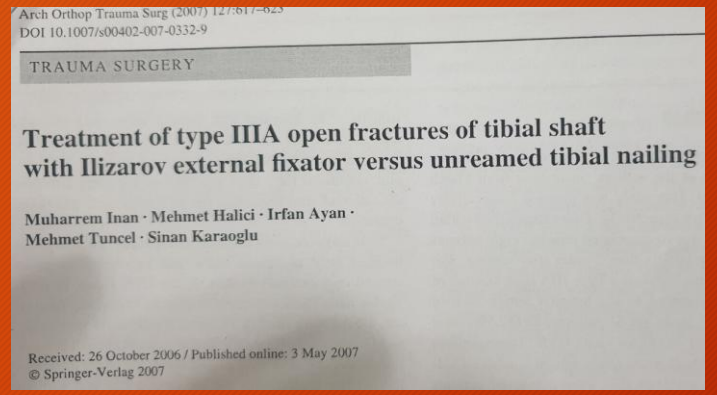
journal homepage: http://www.elsevier.com/locate/CJTEE

Original article

Comparative study of the results of compound tibial shaft fractures treated by Ilizarov ring fixators and limb reconstruction system fixators

Chandra Prakash Pal*, Harish Kumar, Deepak Kumar, K.S. Dinkar, Vivek Mittal, Naveen Kumar Singh

Department of Orthopaedics, S. N. Medical College, Agra, Uttar Pradesh 282002, India

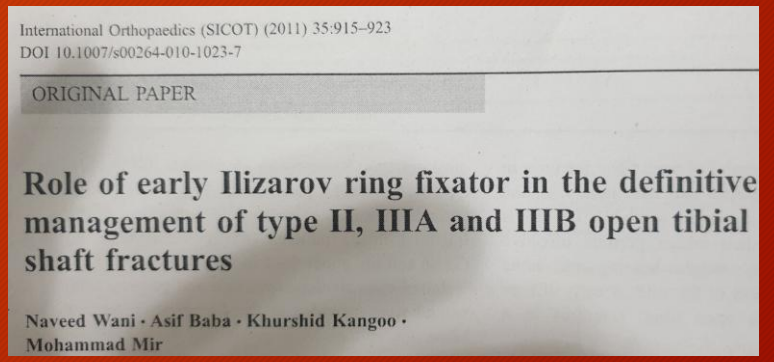

Arch Orthop Trauma Surg (2007) 127:617–623
DOI 10.1007/s00402-007-0332-9

TRAUMA SURGERY

Treatment of type IIIA open fractures of tibial shaft with Ilizarov external fixator versus unreamed tibial nailing

Muharrem Inan · Mehmet Halici · Irfan Ayan · Mehmet Tuncel · Sinan Karaoglu

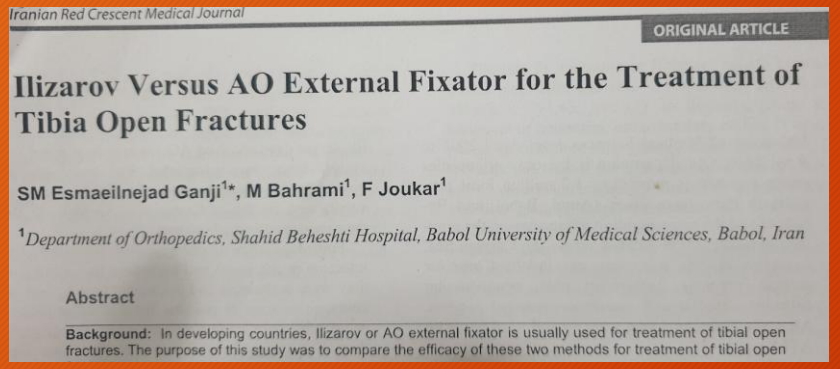
Received: 26 October 2006 / Published online: 3 May 2007
© Springer-Verlag 2007


International Orthopaedics (SICOT) (2011) 35:915–923
DOI 10.1007/s00264-010-1023-7

ORIGINAL PAPER

Role of early Ilizarov ring fixator in the definitive management of type II, IIIA and IIIB open tibial shaft fractures

Naveed Wani · Asif Baba · Khurshid Kangoo · Mohammad Mir


Iranian Red Crescent Medical Journal

ORIGINAL ARTICLE

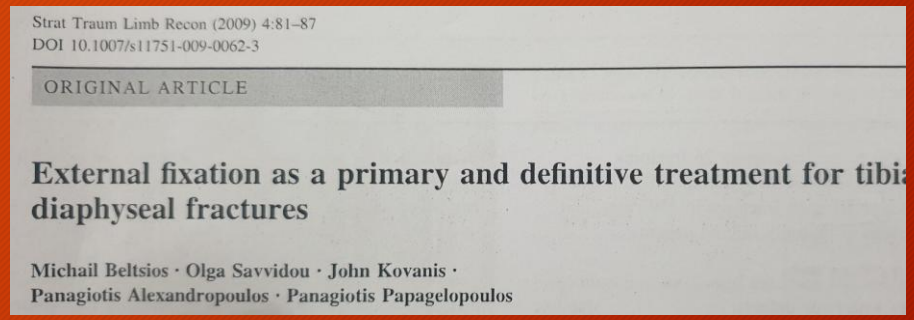
Ilizarov Versus AO External Fixator for the Treatment of Tibia Open Fractures

SM Esmaeilnejad Ganji[1]*, M Bahrami[1], F Joukar[1]

[1]Department of Orthopedics, Shahid Beheshti Hospital, Babol University of Medical Sciences, Babol, Iran

Abstract

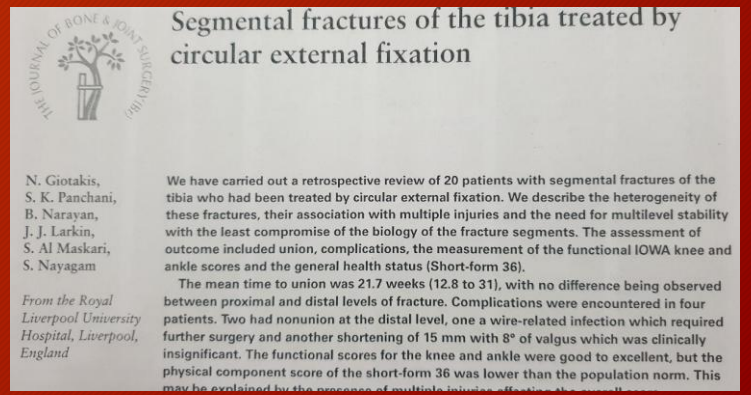
Background: In developing countries, Ilizarov or AO external fixator is usually used for treatment of tibial open fractures. The purpose of this study was to compare the efficacy of these two methods for treatment of tibial open


Strat Traum Limb Recon (2009) 4:81–87
DOI 10.1007/s11751-009-0062-3

ORIGINAL ARTICLE

External fixation as a primary and definitive treatment for tibi diaphyseal fractures

Michail Beltsios · Olga Savvidou · John Kovanis · Panagiotis Alexandropoulos · Panagiotis Papagelopoulos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Segmental fractures of the tibia treated by circular external fixation

N. Giotakis, S. K. Panchani, B. Narayan, J. J. Larkin, S. Al Maskari, S. Nayagam

From the Royal Liverpool University Hospital, Liverpool, England

We have carried out a retrospective review of 20 patients with segmental fractures of the tibia who had been treated by circular external fixation. We describe the heterogeneity of these fractures, their association with multiple injuries and the need for multilevel stability with the least compromise of the biology of the fracture segments. The assessment of outcome included union, complications, the measurement of the functional IOWA knee and ankle scores and the general health status (Short-form 36).

The mean time to union was 21.7 weeks (12.8 to 31), with no difference being observed between proximal and distal levels of fracture. Complications were encountered in four patients. Two had nonunion at the distal level, one a wire-related infection which required further surgery and another shortening of 15 mm with 8° of valgus which was clinically insignificant. The functional scores for the knee and ankle were good to excellent, but the physical component score of the short-form 36 was lower than the population norm. This

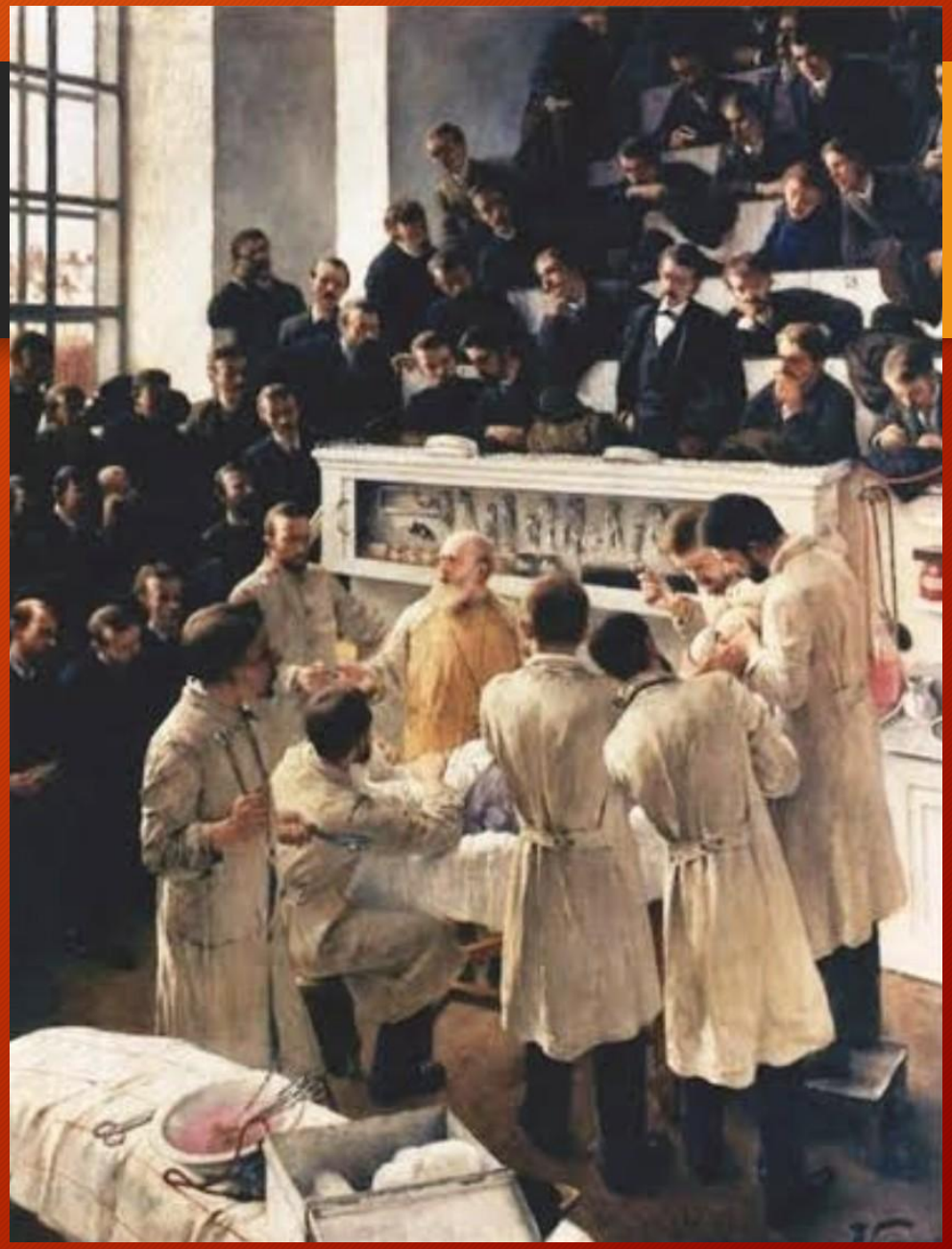
Review of Literature

General recommendation:

- Ilizarov surgeons
- Percutaneous indirect reduction techniques
- Temporary fixator converted to Ilizarov fixator after a mean 8 days

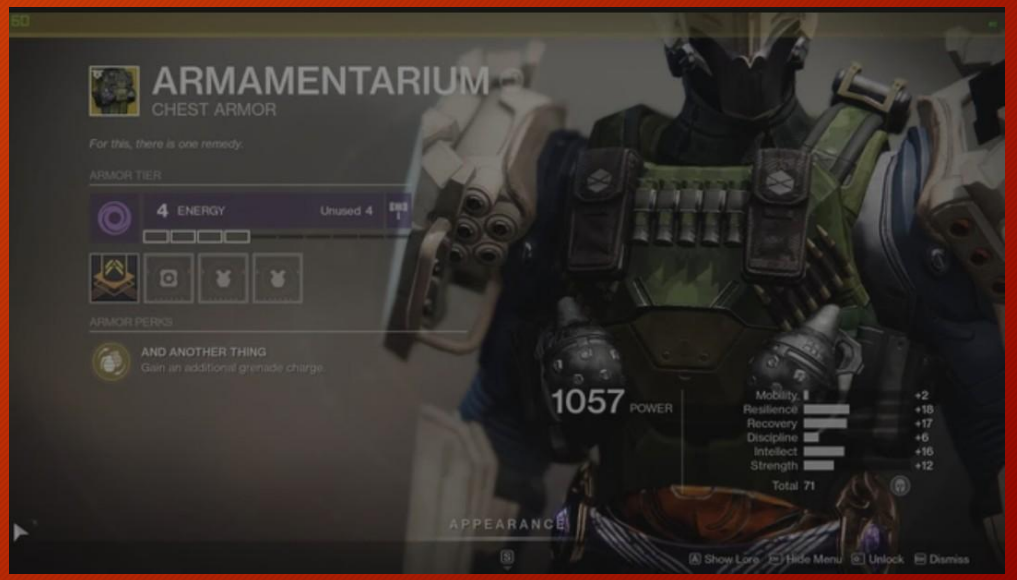
We recommend:

- Young trauma surgeons
- Open reduction and temporary internal fixation
- Immediate Ilizarov application
- 1 surgery- less financial burden to the patient



Recommendation: Ilizarov must be in the curriculum of Orthopaedic residency training

- Our bulk of cases are trauma, and open fractures are a significant part of it
- U don’t need to be an Ilizarov surgeon
- Learn just basic Ilizarov for open fractures
- Apply Ilizarov instead of temporary fixator
- Avoid multiple surgeries
- Be aggressive and do best in your first shot



Take home message

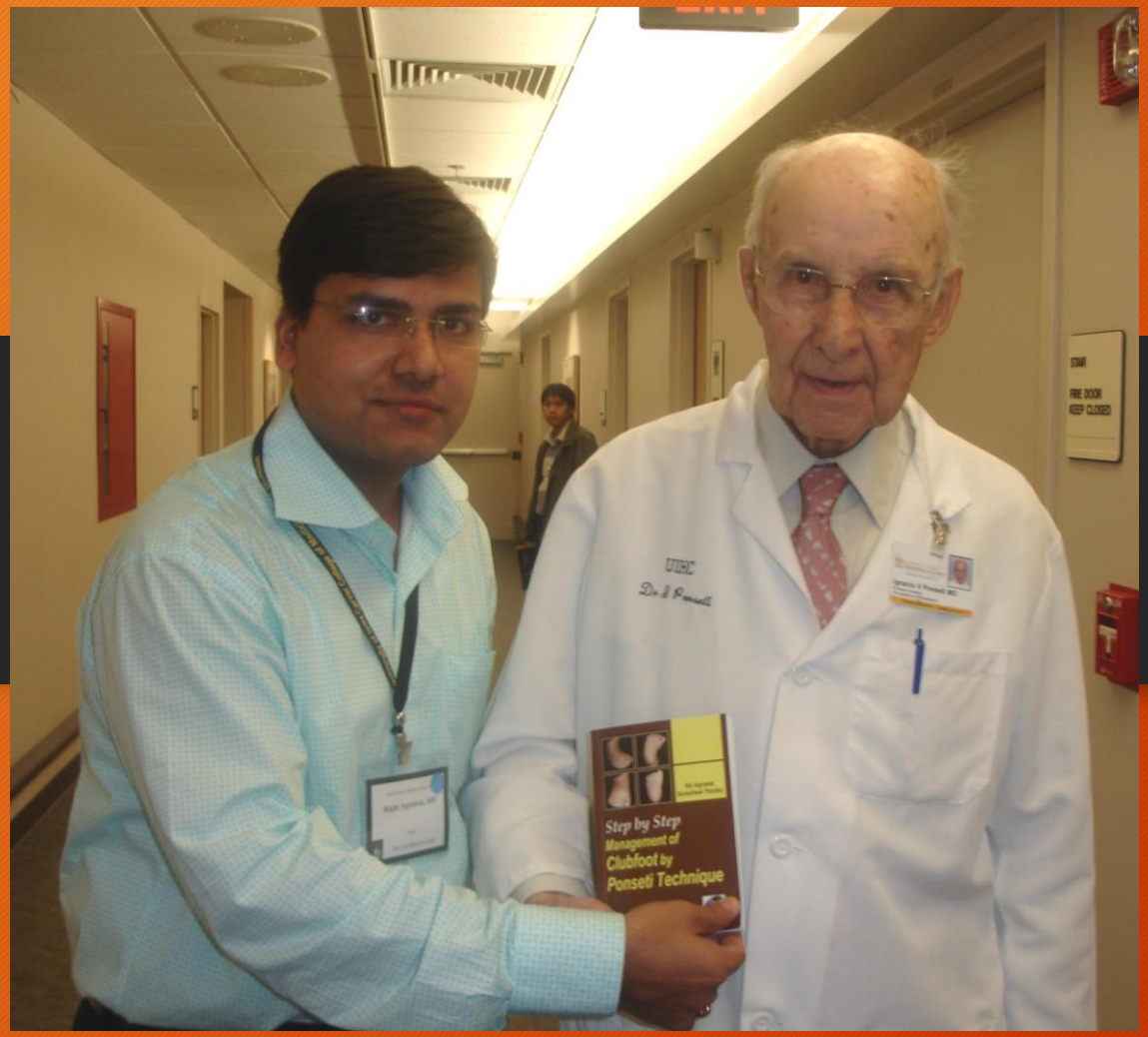
- Don’t wait for the complications to happen
- And expect Ilizarov to do magic
- Do Ilizarov in the first place when things are still simple
- Its better to prevent infected nonunion than to treat it

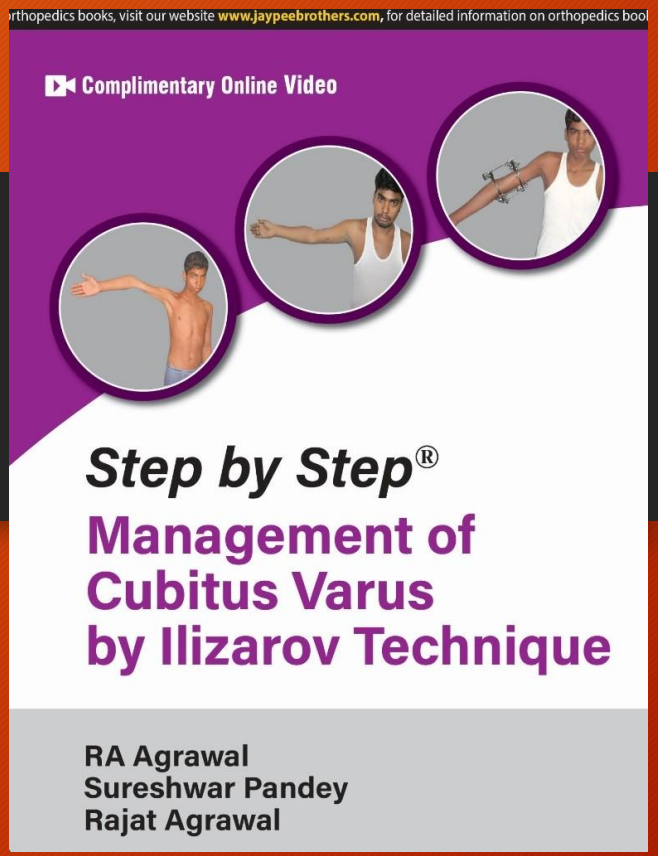
PREVENTIVE ORTHOPEDICS

Future

- Plates made of some inert materials which are not needed to be removed in infection
- Betadine coated plates
- Till then, try Ilizarov

Thank You





Agrawal Orthopaedic Hospital & Research Institute, India
Web: www.aohospital.org

Spine Ilizarov