ISRAELI EXPERIEANCE IN MILITARY TRAUMA

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Galilee Medical Center
Azrieli Faculty of Medicine
Bar Ilan University Affiliated


Lebanon
Damascus
Syria
6 km
Nahariya
Galilee
Medical Center
Safed
Rivka Ziv
Medical Center
Golan
Heights
Tiberias
Poriya
Medical Center
Haifa
Rambam Health
Care Campus
Israel
Jordan


Lebanon
Nahariya
Acre
Haifa
Nazareth
Afula
Syria
Sea of Galilee
Mediterranean
Sea
Netanya
West
Bank
Jordan River
Tel Aviv
Ashdod
Jerusalem
Ashkelon
Bethlehem
Gaza City
Gaza Strip
Dead Sea
Beersheba
Dimona
Jordan
ISRAEL
Egypt
Eilat
Gulf of Aquaba
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WHERE ARE WE?

NAHARIYA

THE RESORT FOR FUN LOVERS

Welcome to the Galilee Medical Center

Galilee Medical Center is University Hospital, affiliated to the Bar Ilan Medical School

One of Two Trauma Units

Coordination with Military and Emergency Services

Importance of Collaboration

Collaboration with military and emergency services is vital for an effective response to conflicts and emergencies.

Galilee Medical Center's Role

Plays a key role in coordinating efforts with military and emergency services to handle trauma cases efficiently.

- Terror attacks from South Lebanon 1982-2000
- Second Lebanon War 2006
- Syria's Civil War from 2013 till Now
- Israel-Hamas War from October,7 -2023
- Hezbollah-Israel Conflict from 2024 till Now

Since 25.02.2013 more than 2000 wounded Syrians were treated in Galilee Medical Center.

Main 2 Types of Military Injury.

1. **Israeli civil victims and Israeli soldiers.**

   - *Early admission to Hospital (**up to 2 hours**).*

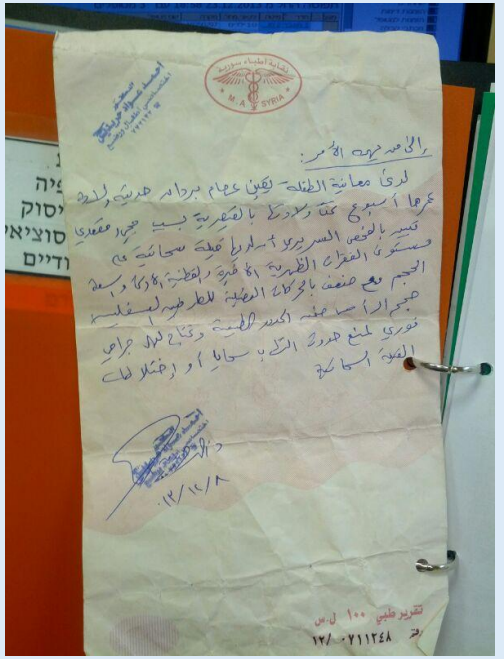
   - *Professional pre-hospital care.*

2. **Civil victims from Syria and Lebanon.**

   - *Very late admission (**days and even weeks**).*

   - *Occasional initial care!*

   - *Almost all cases with severe infections.*



Main institutional care principles.
1. Multidisciplinary approach

- **Initial multidisciplinary approach**

General surgeon (Trauma Surgeon) – coordinator of initial care

Ortopaedic Surgeon

Anesthesiologist

Vascular Surgeon

Neurosurgeon

Hematologist

- **Definitive treatment**

Infectionist

Chest Surgeon

Hand Surgeon

Plastic Surgeon

Pediatric Surgeon

Urologist

Psichiatrist

Main institutional care principles.

2. Damage Control (DC)

- *ATLS*
- *Temporally External Fixation or Early Total Care (according to DC)*

3. Orthopaedic Care

- *Multiple Second Look of wound and Debridements*
- *Definitive treatment as soon as possible*
- *Cooperation with Vascular and Plastic Surgeons*
- *Proper antibiotic treatment*

2 topics are still controversial.

1. Treatment of severe bone and soft tissue loss.

2. When to perform amputation?

Massive bone and soft tissue loss.

ATLS + Damage Contol

⬇

Evaluation of Limb Perfusion

⬇

Evaluation of Neurologic Damage

⬇

Exclusion of Compartment Syndrome

⬇

Imaging

Contaminated / Infected

⬇

Immediate I/V Antibiotics

⬇

Aggressive Debridmant

⬇

Provisional fixation Unilateral

⬇

Wet Dressing

Massive bone and soft tissue loss.

1. Aggressive deridement
2. Second, Third, Forth Look Debridement
3. Conversion to VAC treatment
4. Decision making how to cover the bone, how to close soft tissue defect.

- Acute shortening
- Local Flap
- Cross Leg Flap
- Pedicle Vascularized Flap
- Free Flap
- Skin Grafting

- Classical Bone Transport
- Cable Bone transport
- Insertion of Cement Spacer with antibiotics
- Insertion of Antibiotic Beads
- Implantation of Printed Spacer

Case 2

- Male, 14- year old
- Polytrauma
- Total body CT
- Bone and soft tissue

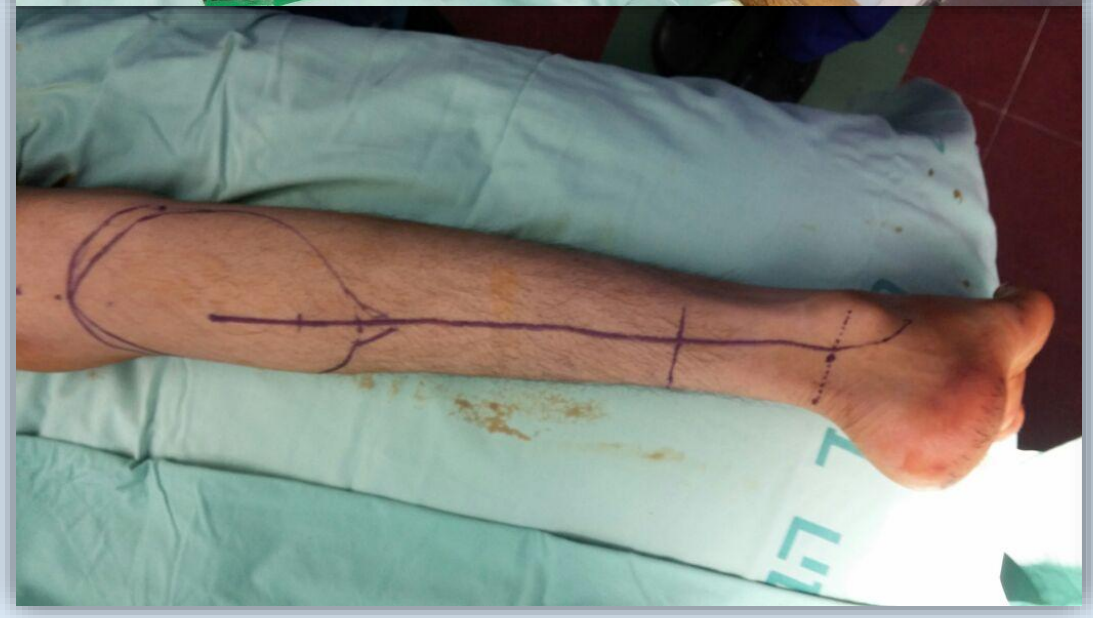
  defect of leg
- CTA

Case 2

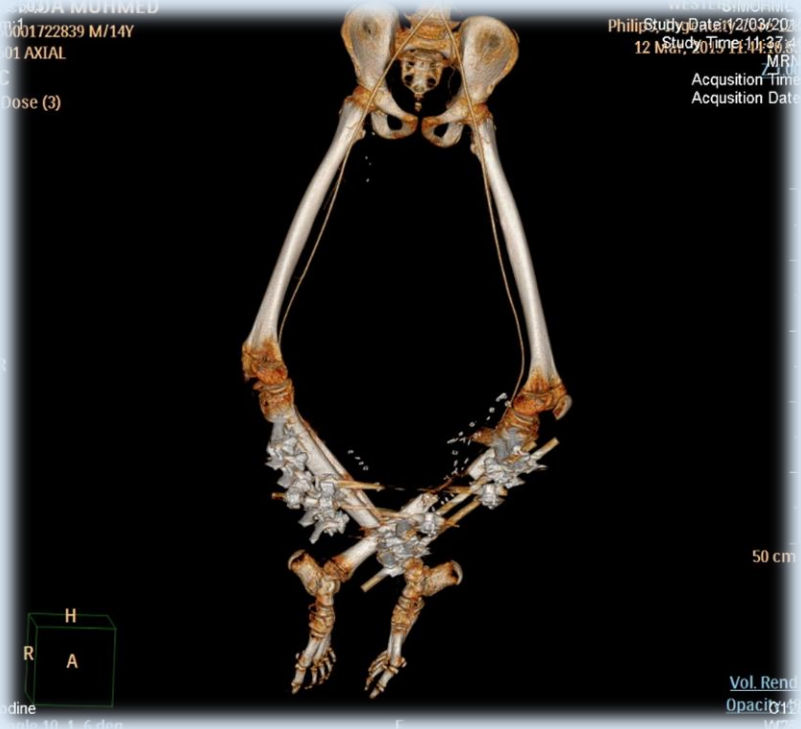
External fixation and vascular repair

Case 2

Case 2

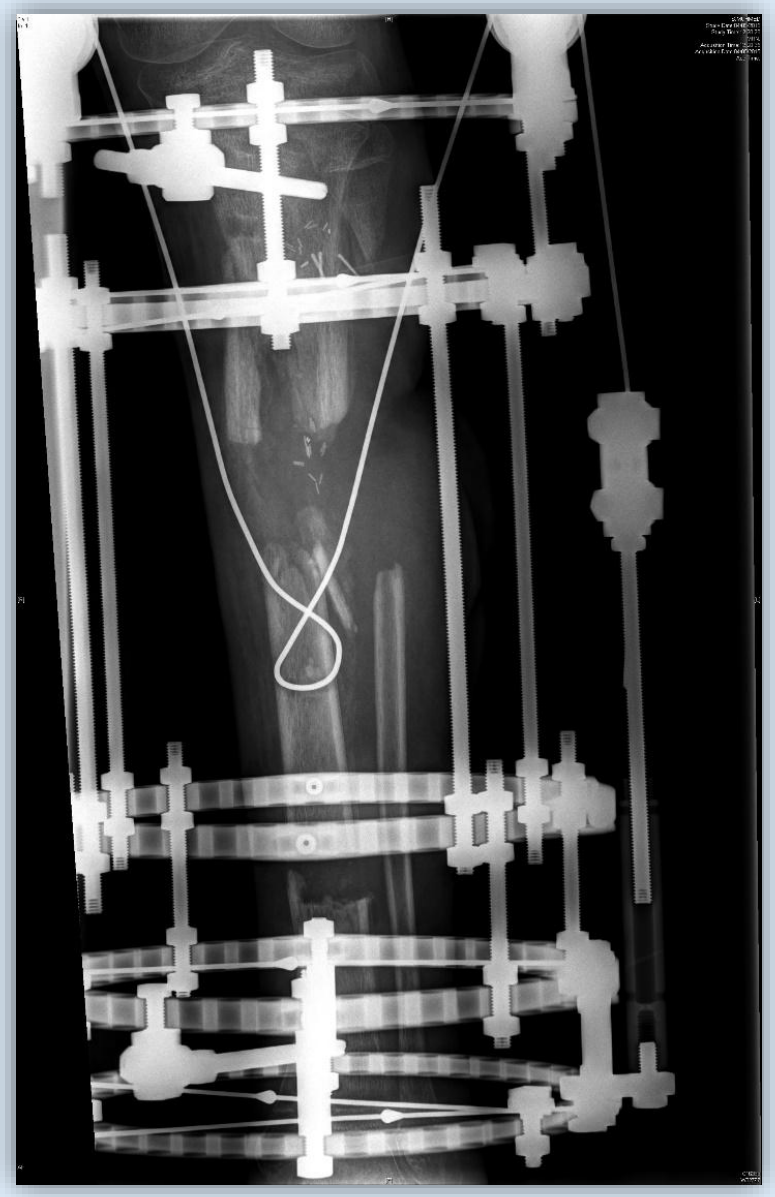


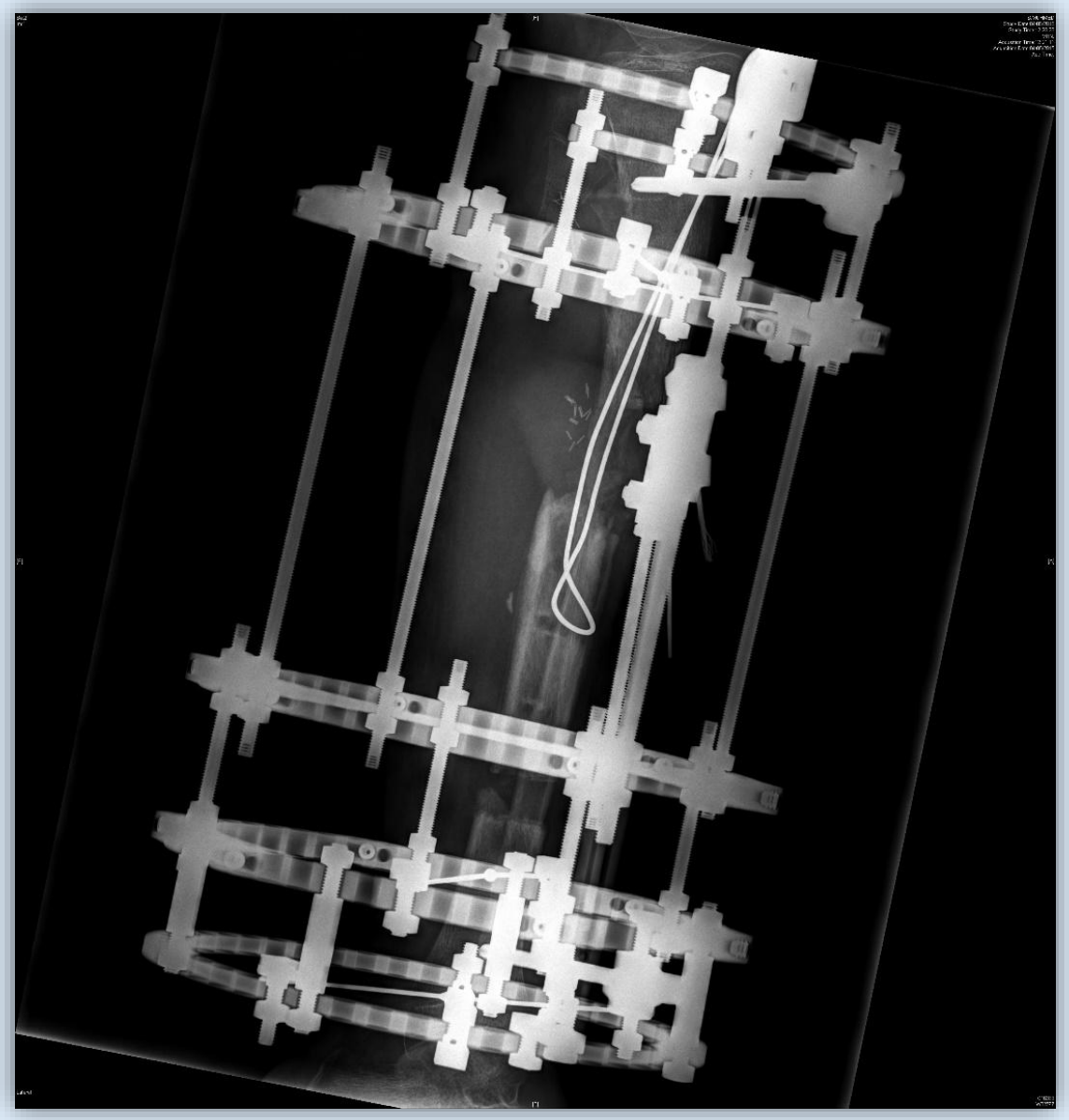
Case 2



95-97% flap survival

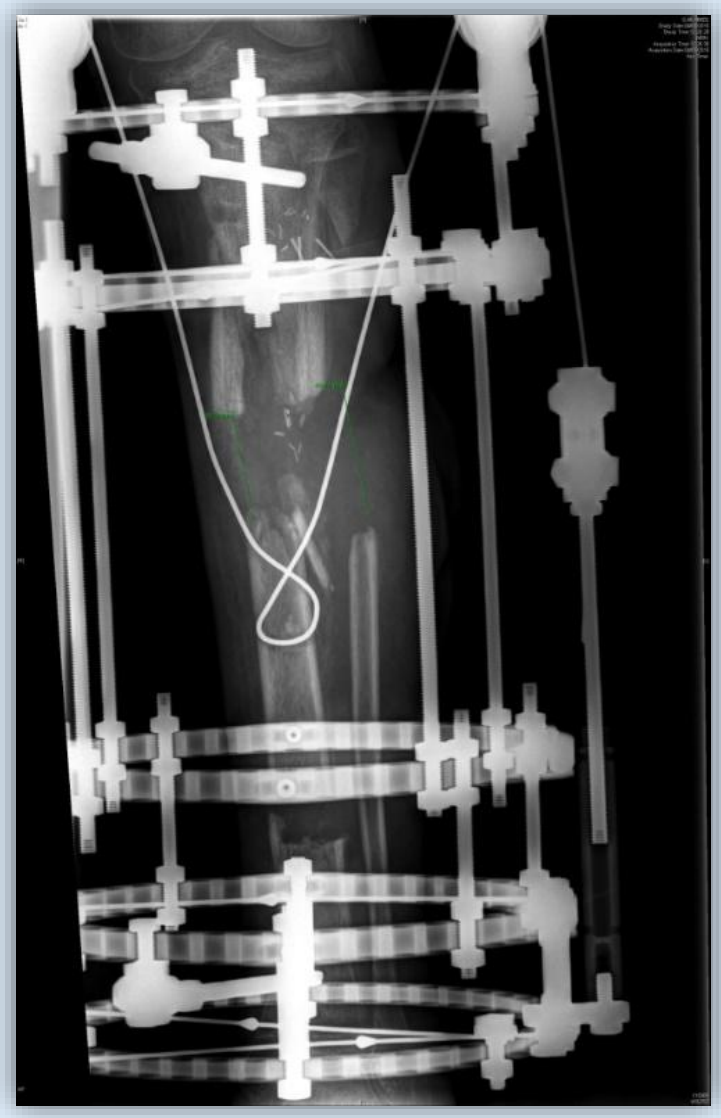
Case 2

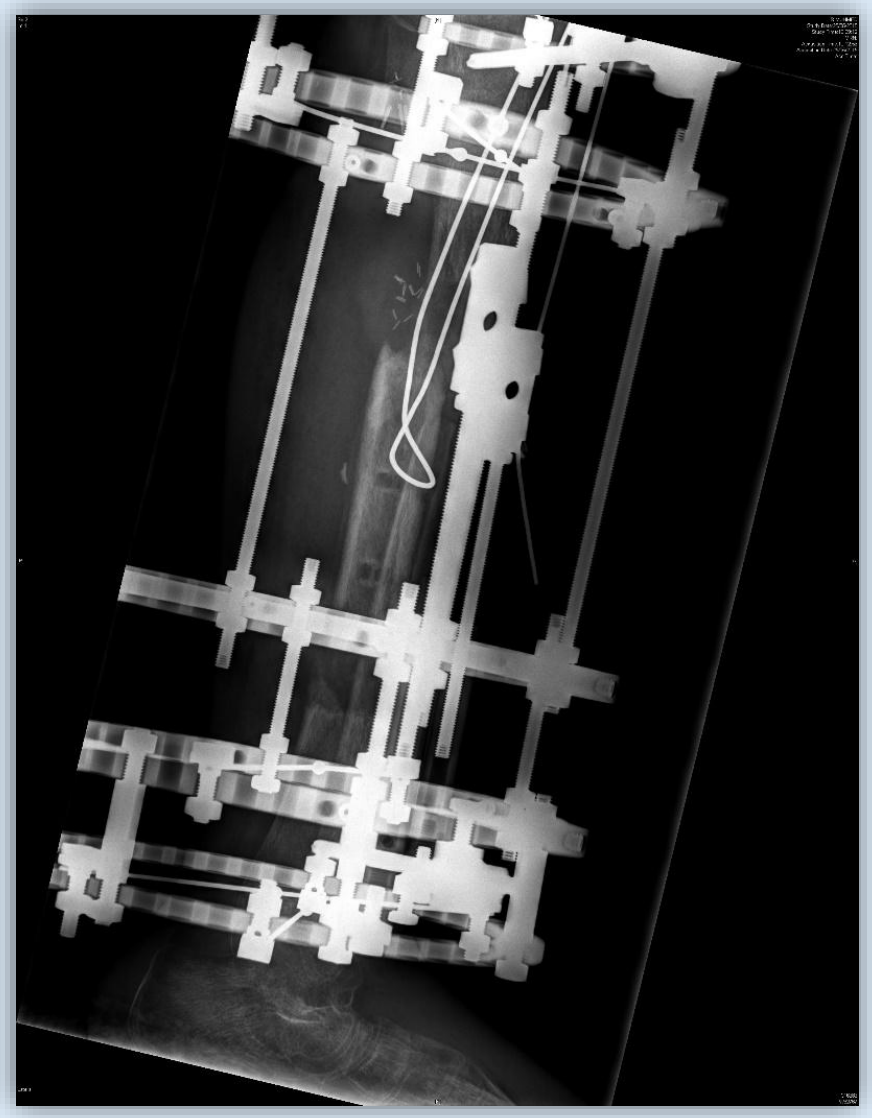




Case 2

Case 2





Case 2

Case 2

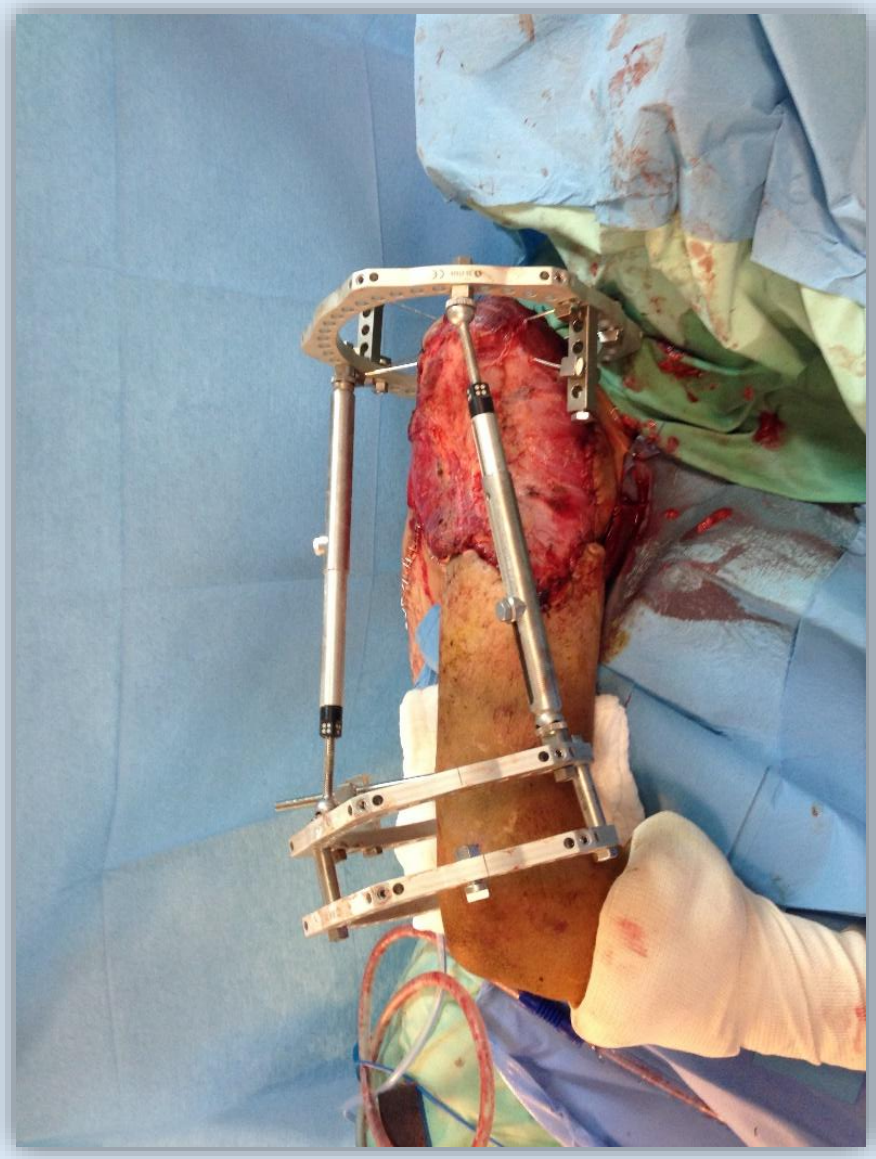
Case 3

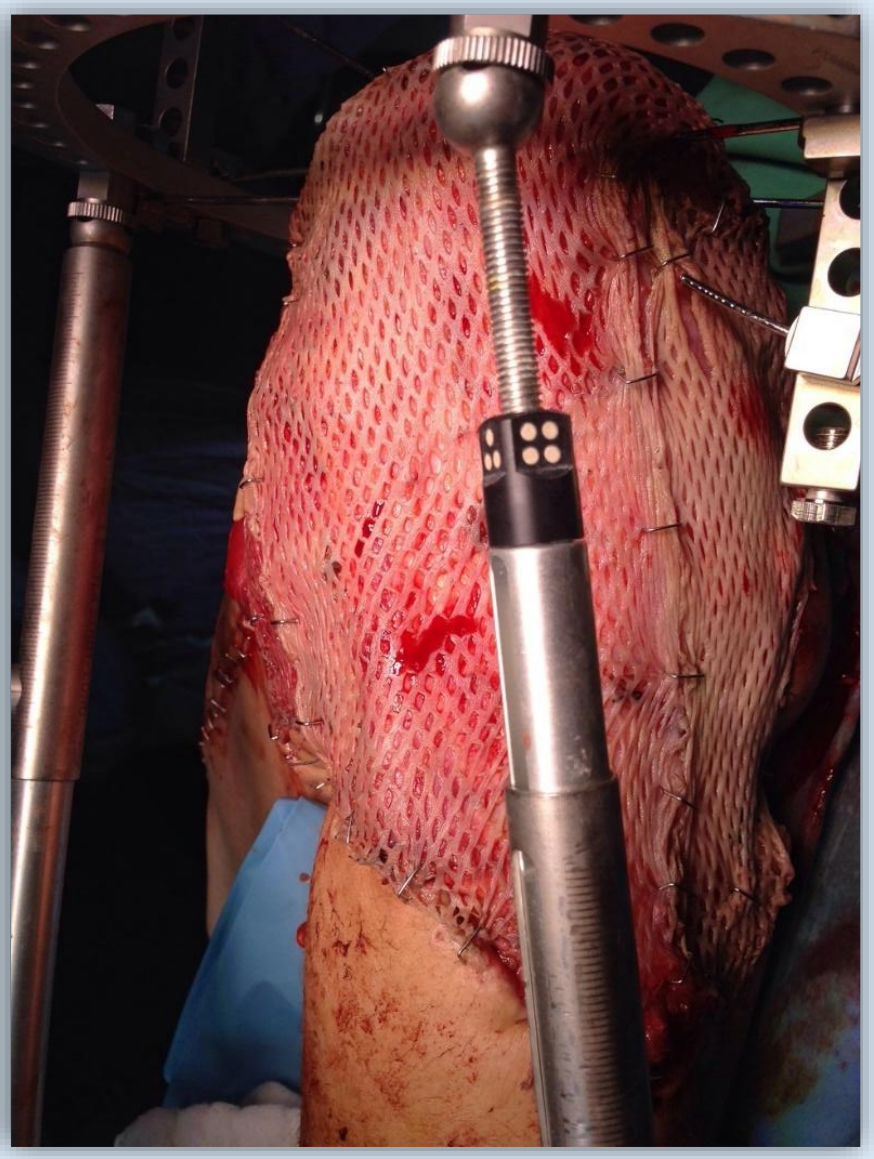
2014.09.28
admission – 1.5
months after injury
and surgery in Syria.

Case 3

Latissimus Dorsi Pedicle Flap

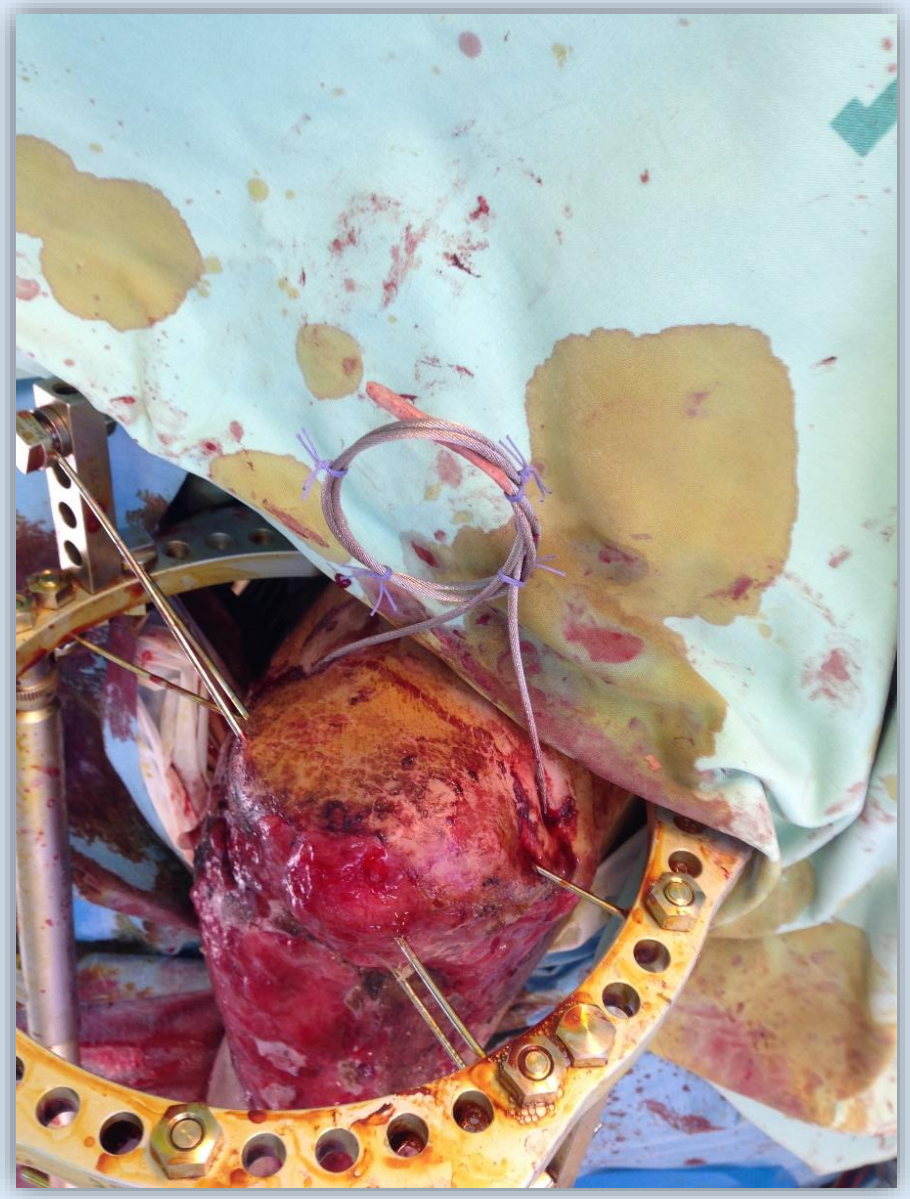
Case 3





Ilizarov TLT Temporary Fixation and Skin Grafting

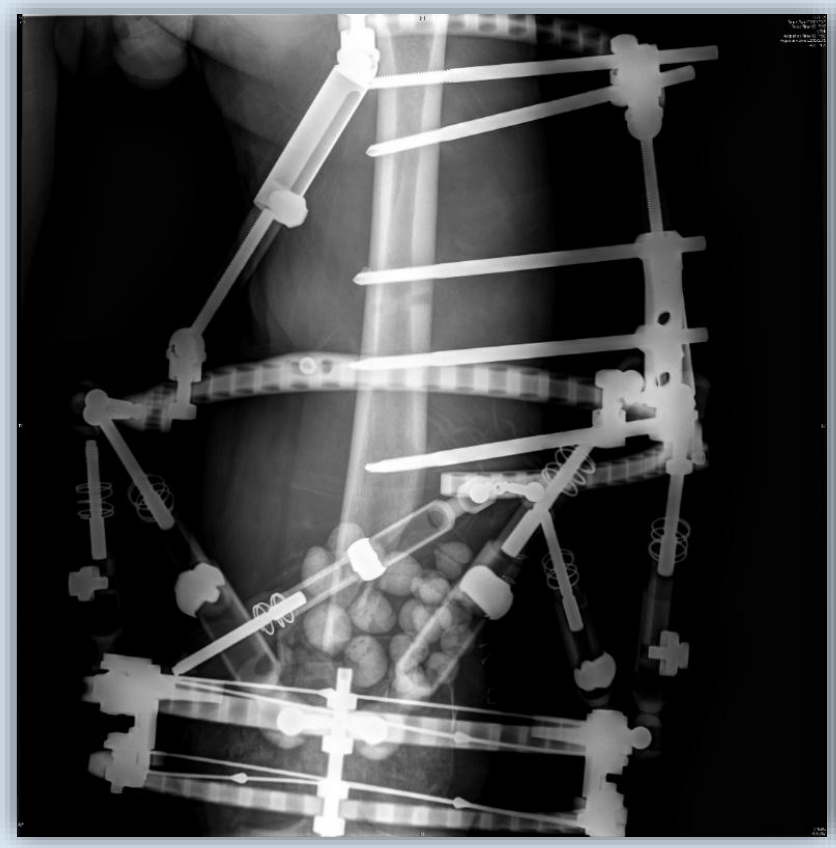
Case 3



Osteotomy for Bone Transport.
Cable Passing for Bone Trasport (2 mm).
Pulling Blocks Assembly.

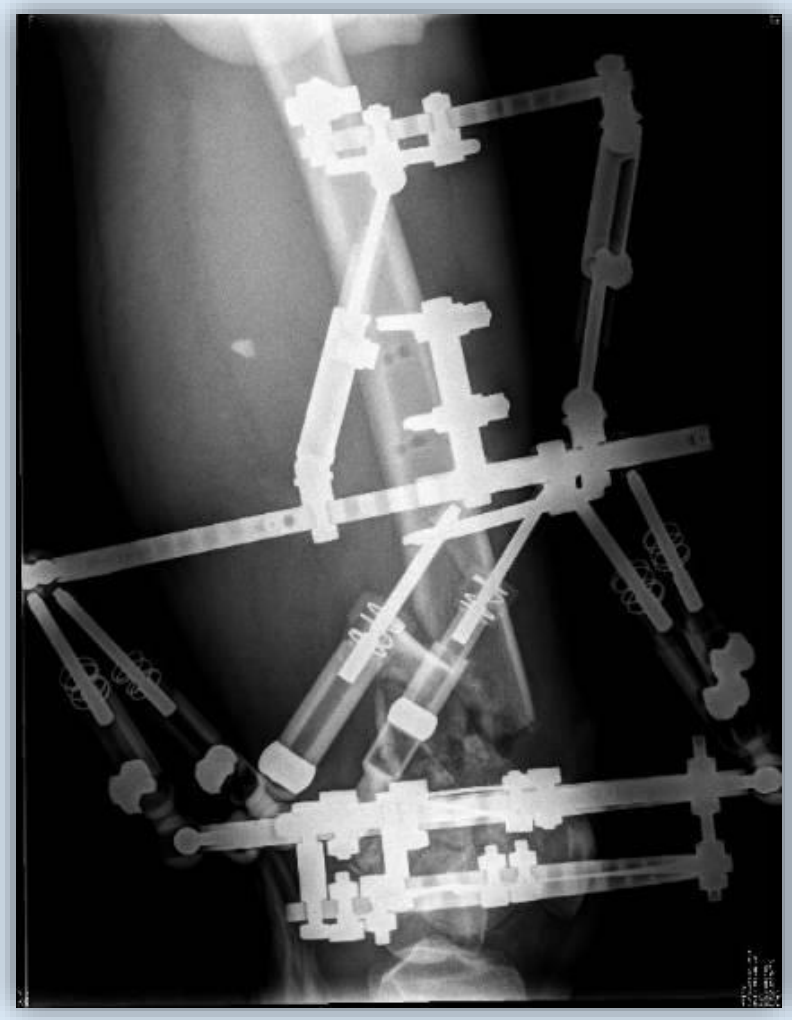
After completion of regenerate growth – Shoulder Arthrodesis.

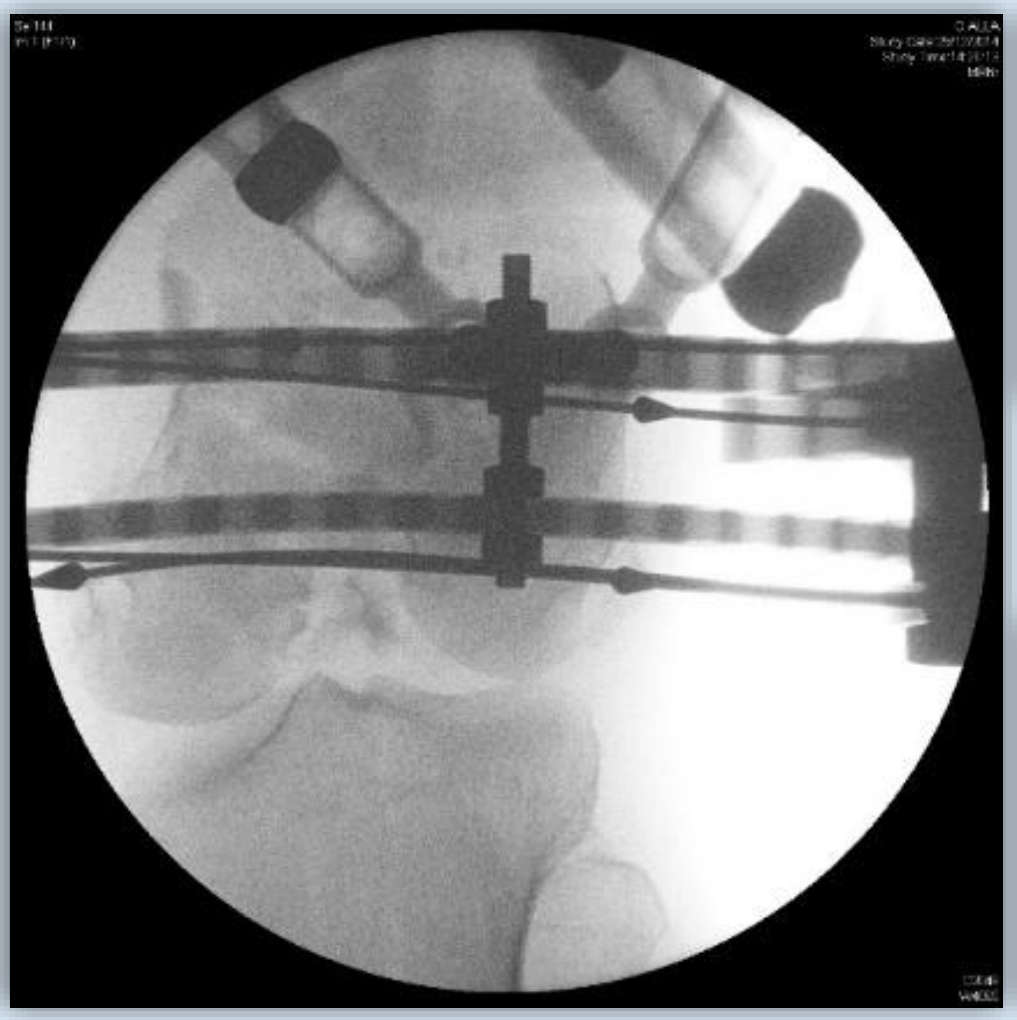
Case 4

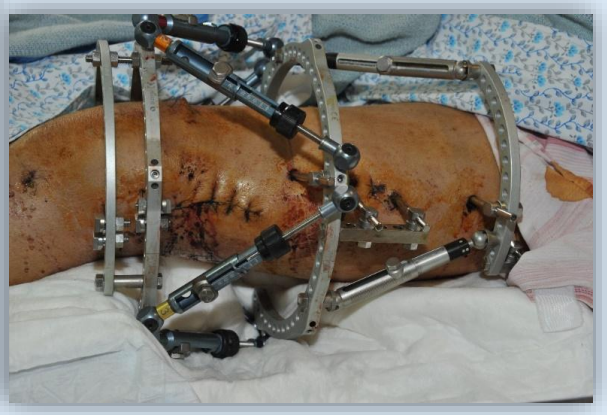


28 yr. old male patient from Syria, wounded by tank missile , first surgery in Syria (unilateral external fixation and debridement), later Ilizarov External Fixation and insertion of Antibiotic Beads.

Case 4

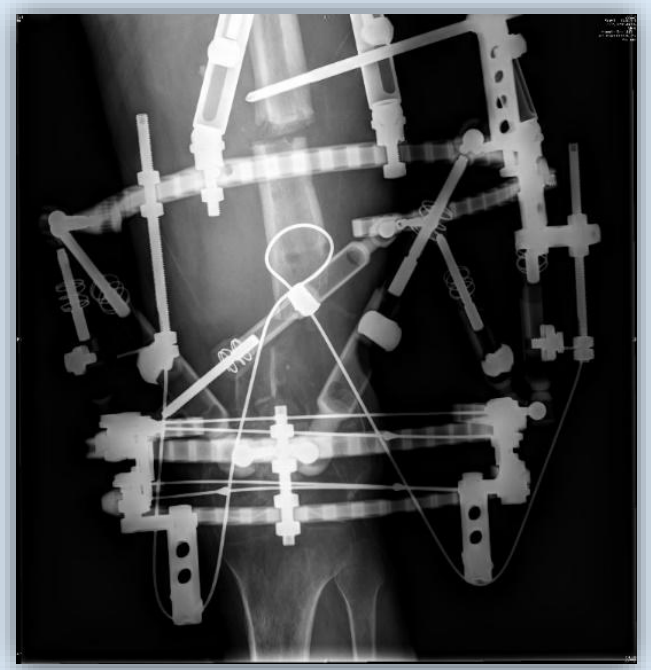


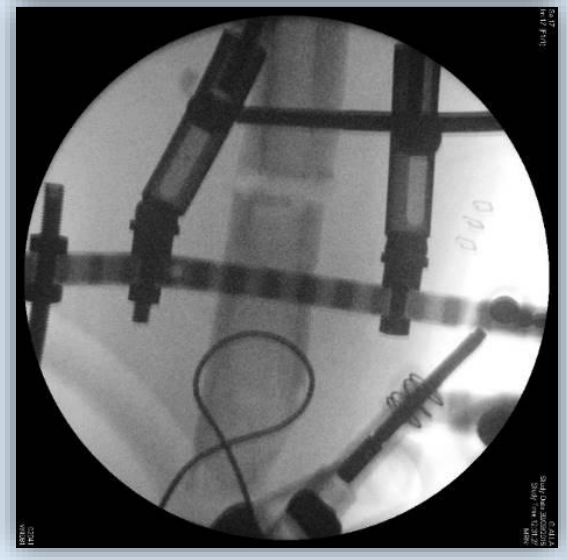


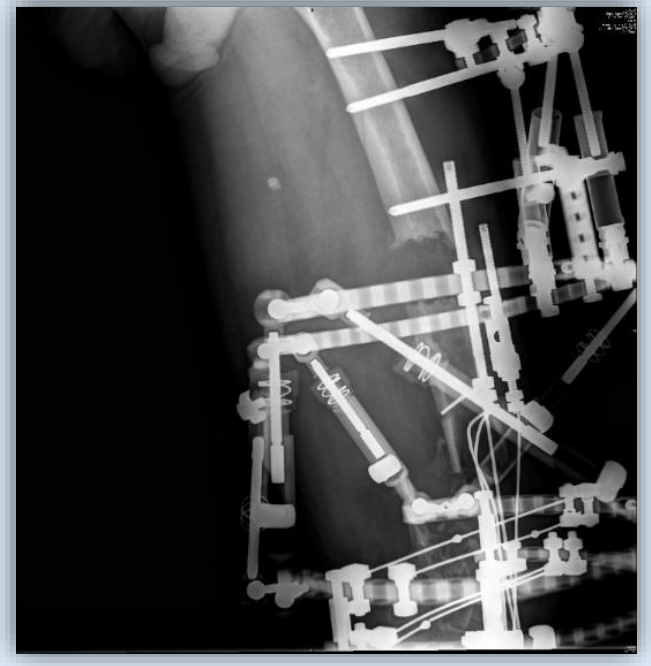


Underwent recurrent debridements removal of Beads and Arthroscopic Debridement of the knee joint (1.5 month after insertion of Beads).

Case 4





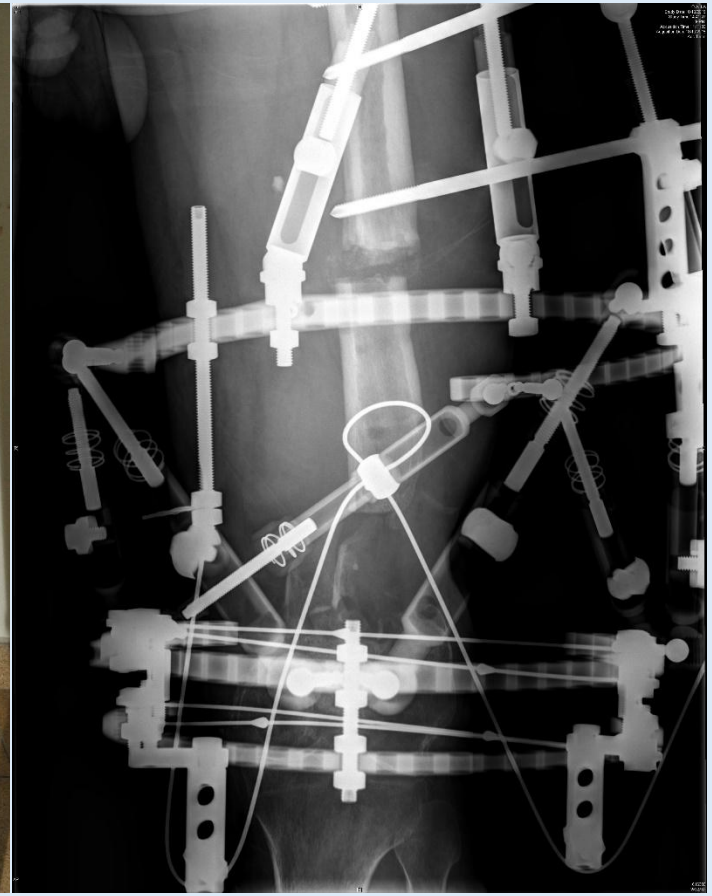


Cable
Bone
Transport

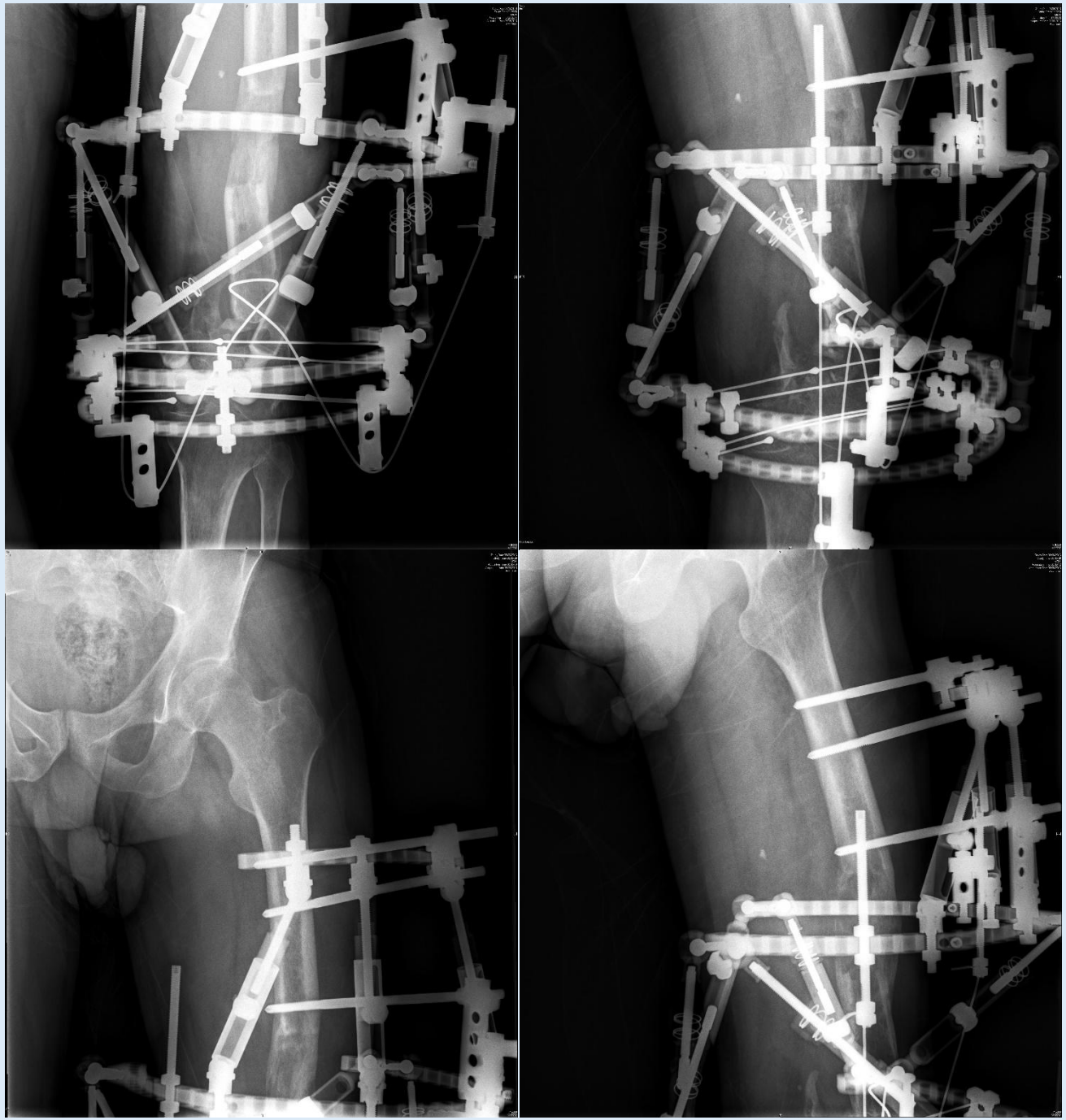
Case 4

Gradual restoration of Knee motions during Bone Transport.

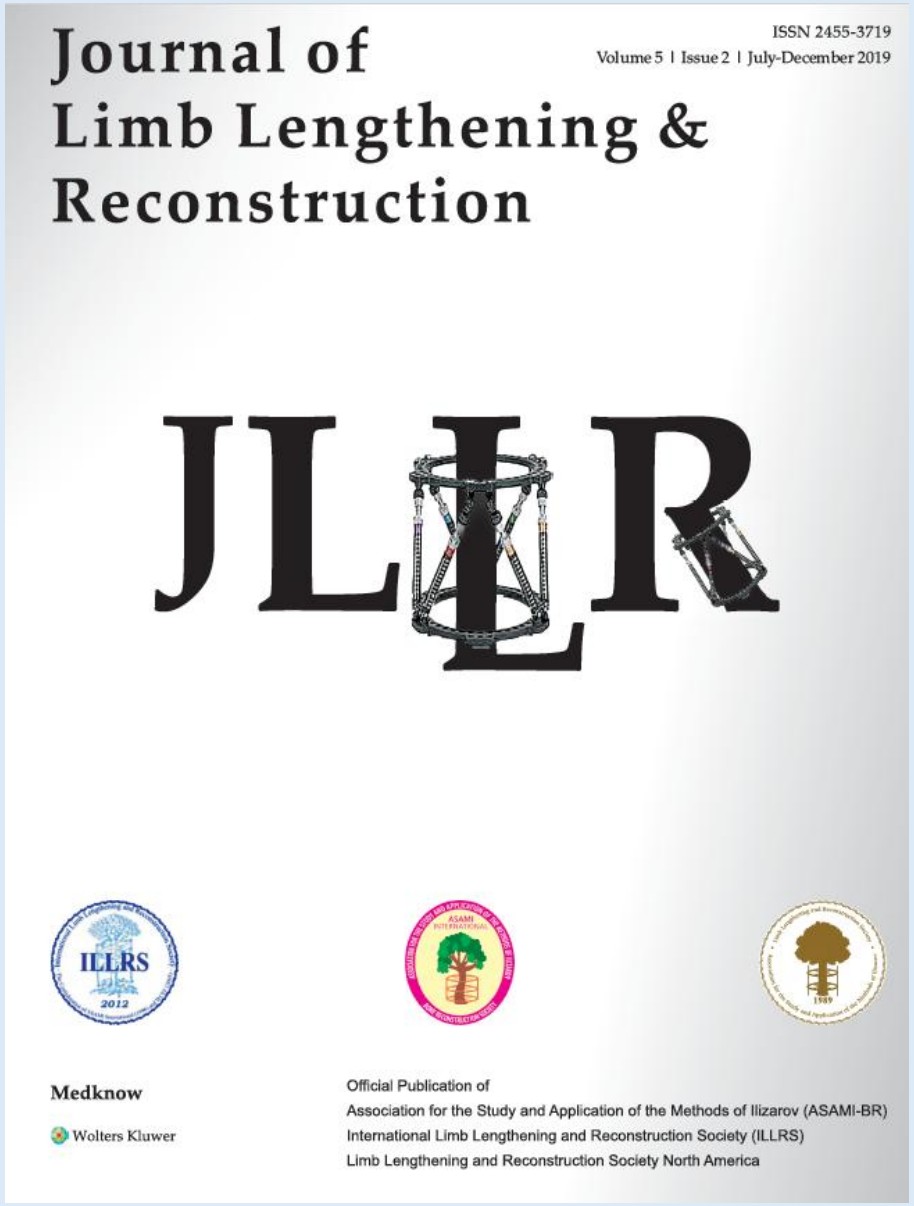
Case 4



Case 4



The Docking Site had united without Bone Grafting.



Original Article

Use of Cable Bone Transport as a Method of Soft Tissue Preservation

Fadi Foad Aboud, Pavel Alexander Nudelman, Haim Shtarker

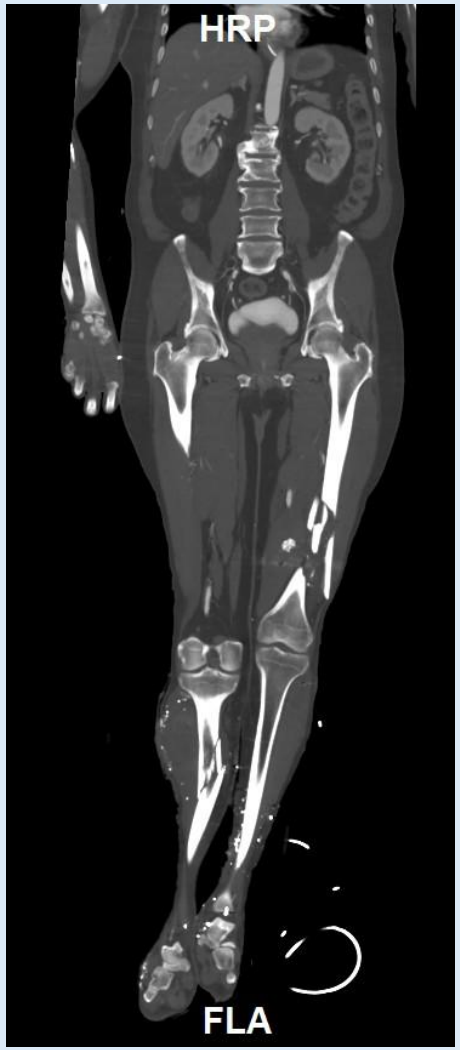
Department of Orthopedic Surgery, Galilee Medical Center, Nahariya, Israel

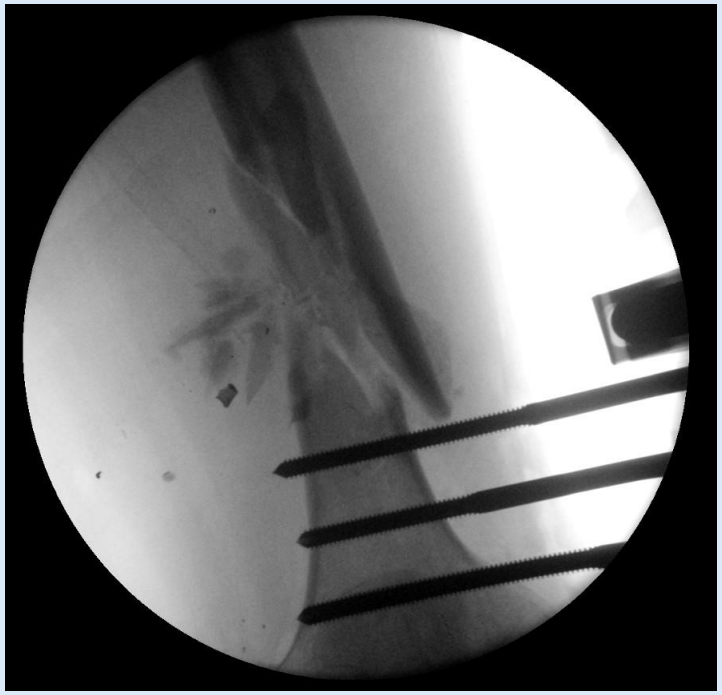
Abstract

Context: Ilizarov method of bone transport is a well-recognized method in treating bone loss; however, soft tissue complications and potential flap compromise associated with the transport process are a major drawback. **Aim:** We propose the use of a central transport system of cables and pulleys, as introduced by Weber in 1998 to help preserve soft tissue cover, retain flap integrity, and decrease patient discomfort. **Design:** This was a retrospective study. **Patients and Methods:** Consecutive series of patients treated for severe bone loss and fragile soft tissue cover, between 2013 and 2018, according to the Weber method of bone transport, were included in the study. In total, six cases were identified. Inclusion criteria were any patient who underwent bone transport using the Weber method due to bone loss caused by trauma or infection. Exclusion criteria were any patient who did not complete the bone distraction process or had a follow-up of <1 month after bone transport apparatus installation. **Results:** Five out of six patients completed the bone transport process; one case was excluded from the results since the patient was lost to follow-up before bone distraction was begun. The average follow-up was 13.2 months; no patient had soft tissue complications, the transport process was painless, and the flap integrity was maintained. Bone regenerate was good in all except one case since the patient was lost to follow-up a month after transport was initiated. **Conclusion:** The Weber method is a reliable technique generating good-quality bone, while maintaining the integrity of the soft tissue envelope, minimizing soft tissue complications associated with the classical method of bone transport. The Weber technique is especially valuable when bone transport is performed in a flap covered area, where the excursion of half pins and K-wires can compromise flap survival.

Keywords: *Bone loss, bone transport, distraction osteogenesis, flap preservation, soft tissue preservation*

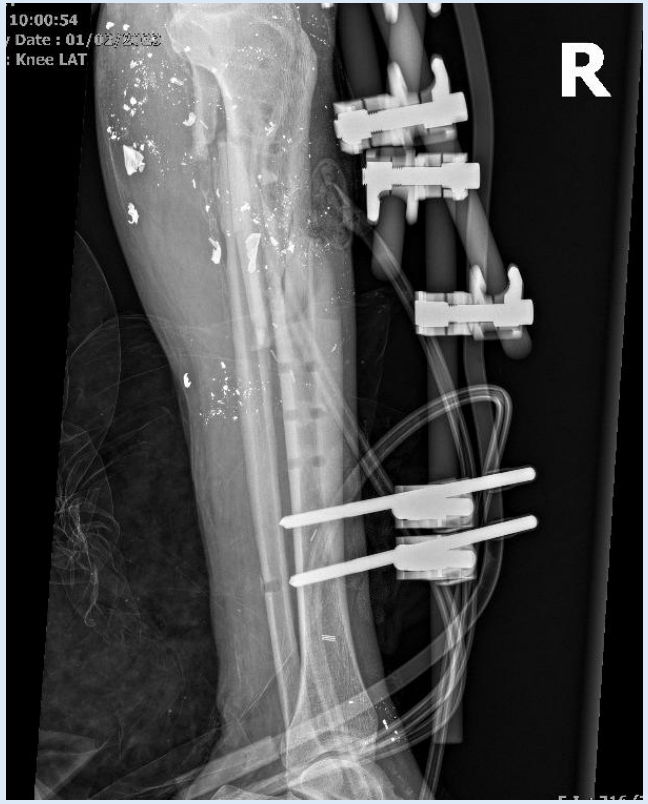
Case 5





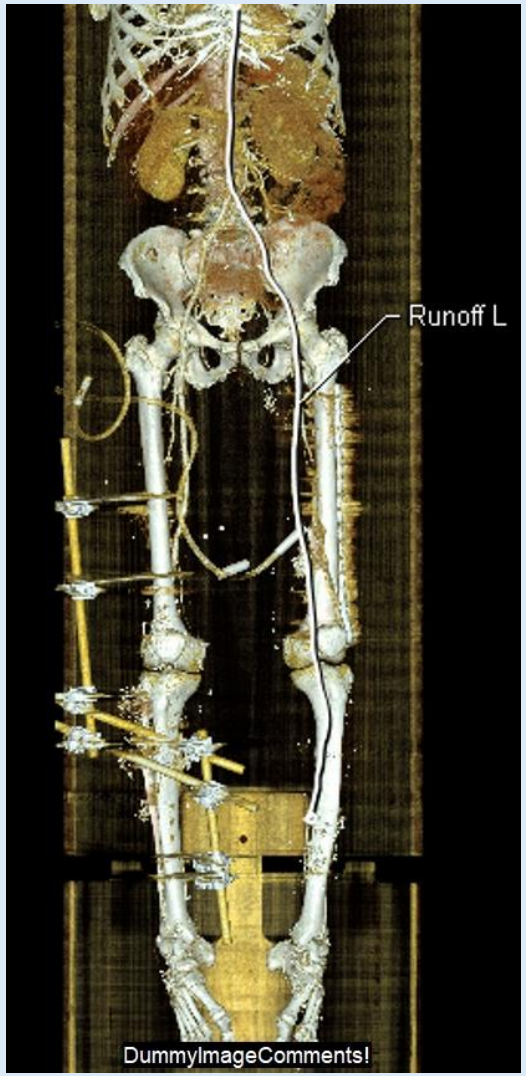
63 y.o. male after high velocity GSW of RT Lower Leg and Knee + Lt Femur. Vascular Injury Rt, Severe soft tissue damage RT

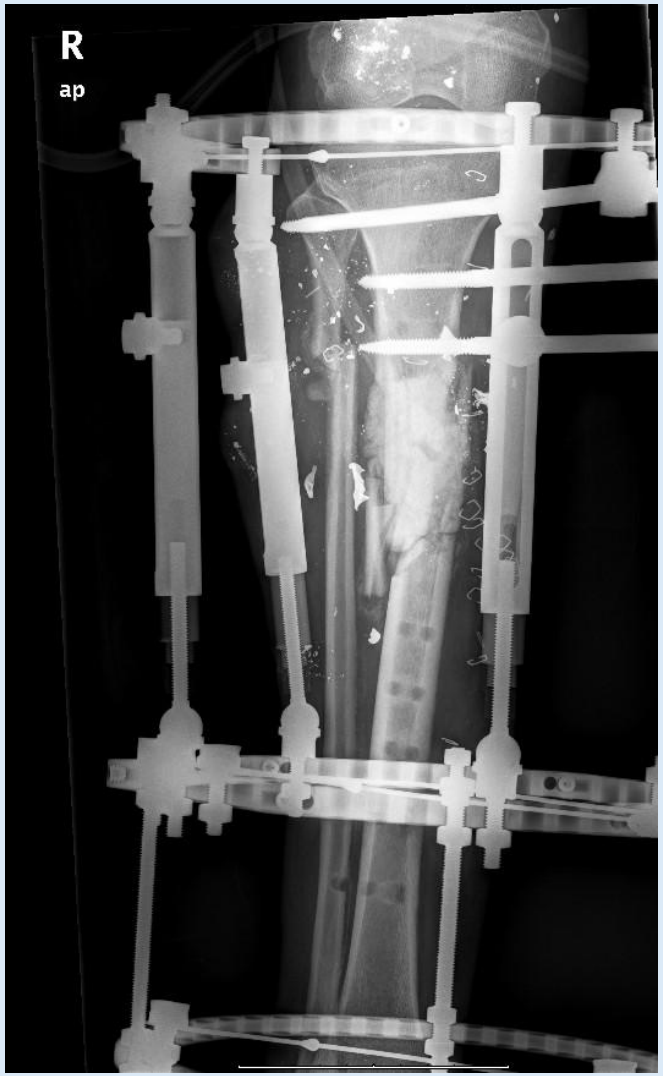
Case 5

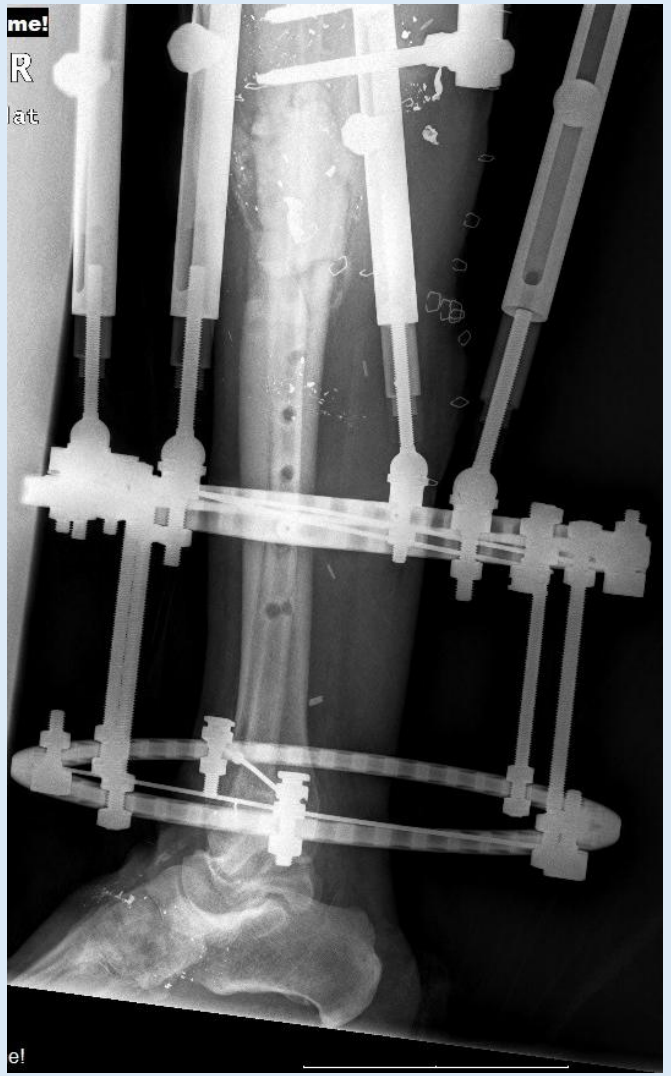


On admission – Bilateral Unilateral EF, Vascular intervention – Repair PTA. Prolonged stay in ICU. 10 days later ORIF RT Femur by Bridging Plate. Presentation of severe infection in GS Fracture of Rt Tibia. Aggressive Debridement, Exchange of Primary EF RT Lower Limb.

Case 5

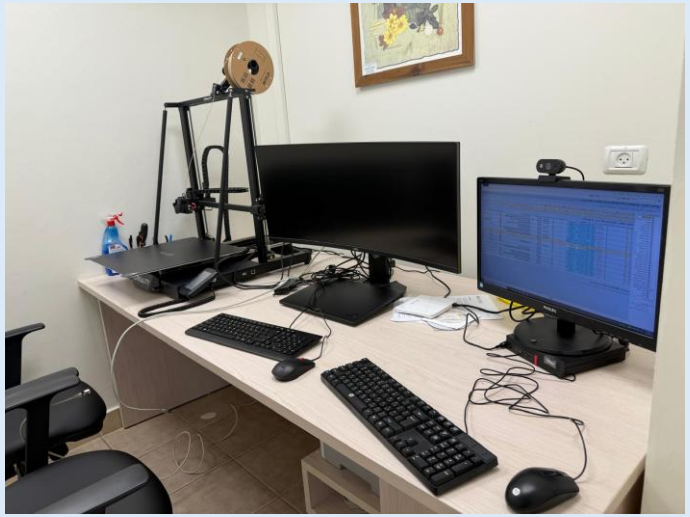


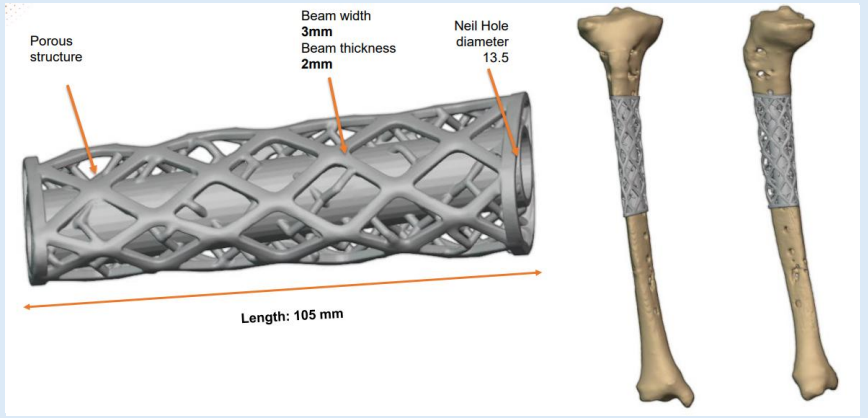


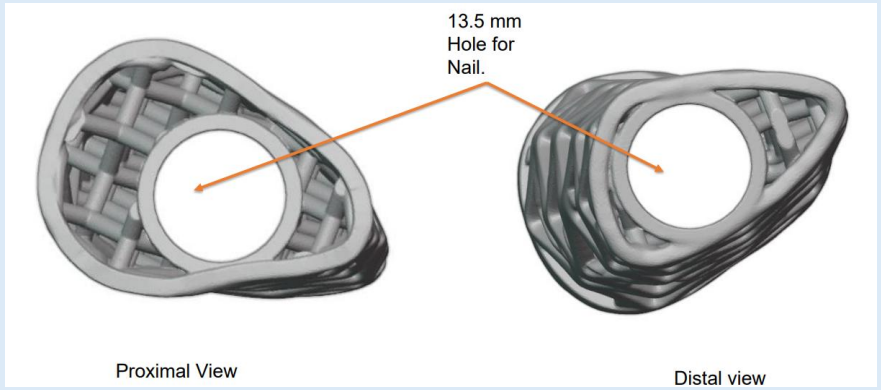


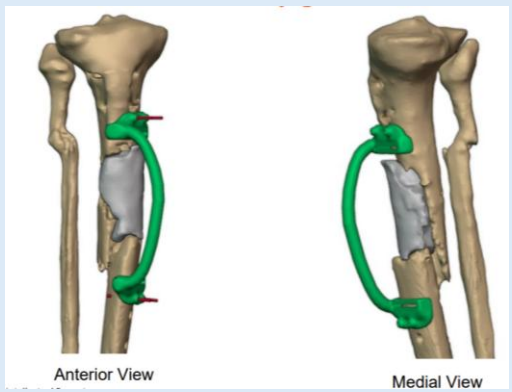
Day 28th after admission.
The patient was stable, transferred to Orthopaedic Dept.
Follow up CT Angiography – TP was not contrasted. Warm Rt Foot, Complete Drop Foot.
After multiple debridement's, additional debridement was performed.
Excision of all non viable bone, insertion of Cement Spacer with antibiotics, conversion to Ilizarov EF.

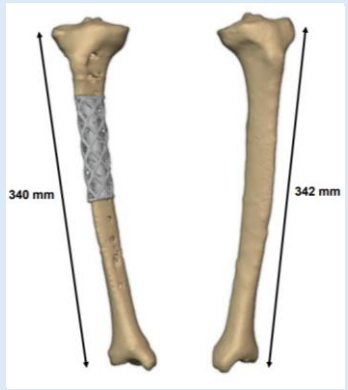
Case 5





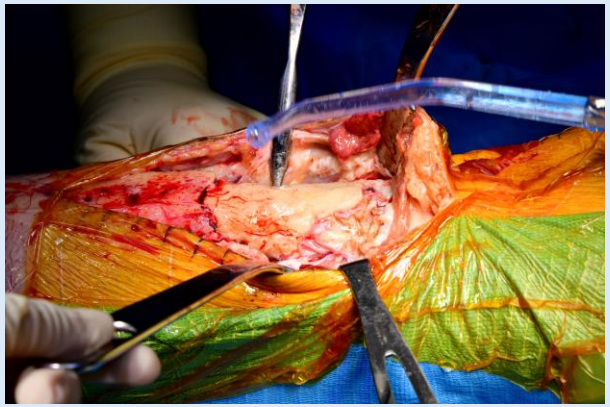
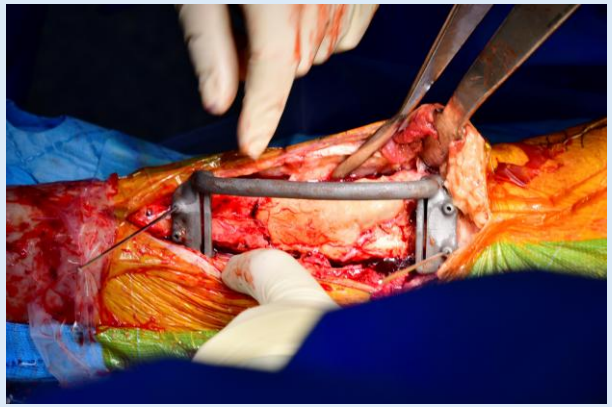


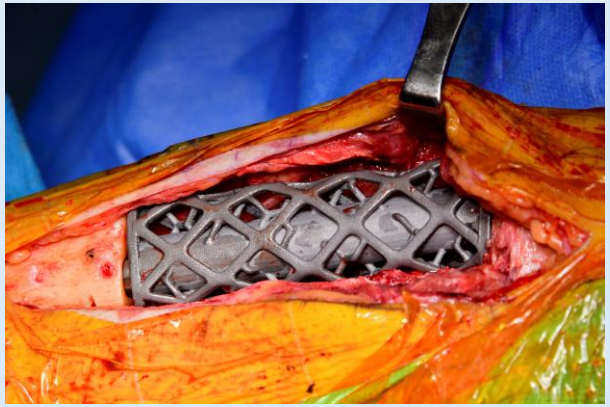


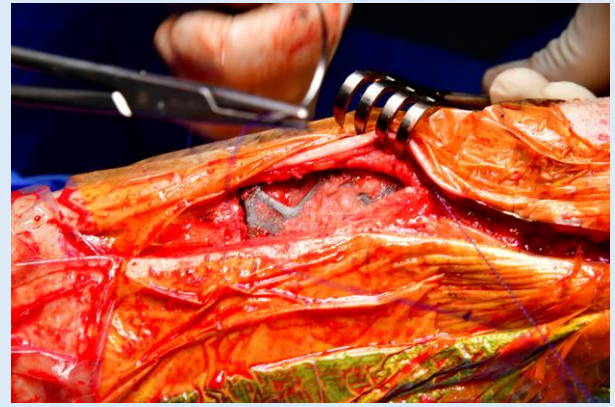


Preoperative planning

Case 5

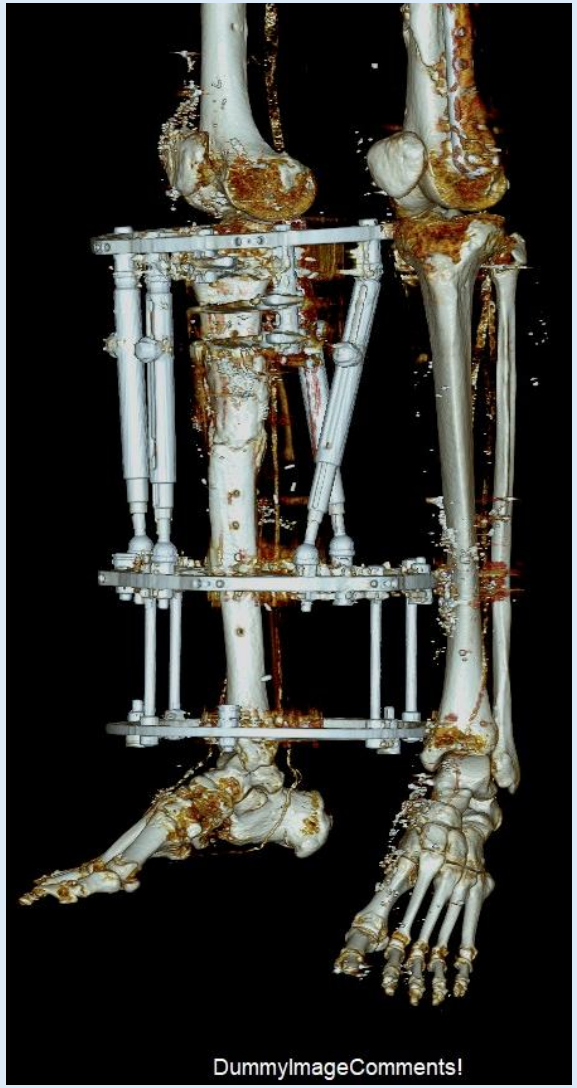



Removal of Cement Spacer, Insertion Titanium Printed Spacer, Insertion of Tibial Interlocking Nail, Morselized Bone inserted into Metal Spacer.

Case 5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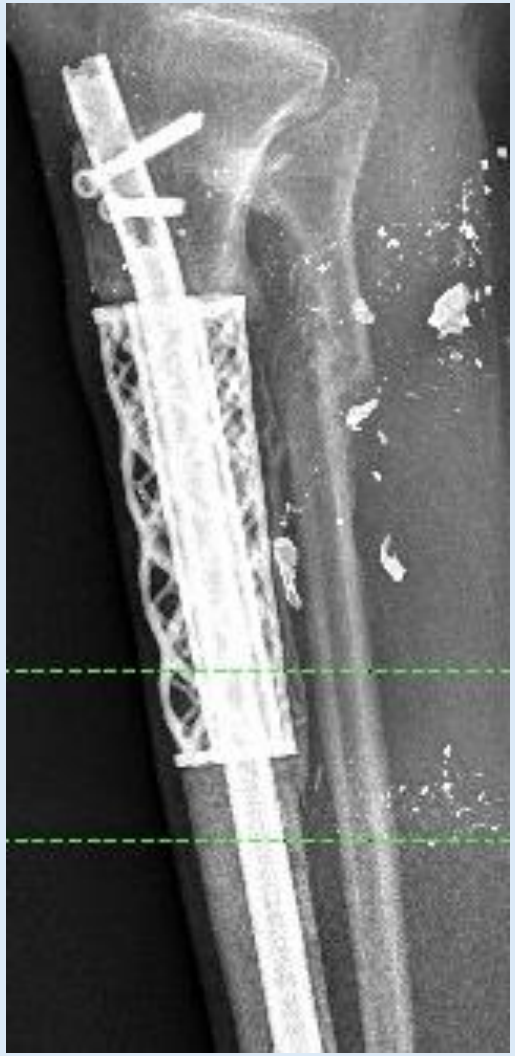
Case 5



Amputations

TABLE 12-3 Index Domains

MESI	PSI	MESS	LSI	NISSSA	HFS 98
Injury Severity Score	Ischemia	Ischemia	Ischemia	Ischemia	Ischemia
Bone	Bone	Bone/tissue	Bone	Bone	Bone
Age	Muscle	Age	Muscle	Muscle	Muscle
Integument injury	Timing	Shock	Skin	Skin	Skin
Nerve			Nerve	Nerve	Nerve
Lag time to operation			Vein	Age	Contamination
Pre-existing disease				Shock	Bacteria
Shock					Onset of treatment

MESI, Mangled Extremity Syndrome Index; MESS, Mangled Extremity Severity Score; NISSSA, Nerve injury, Ischemia, Soft tissue injury, Skeletal injury, Shock, and Age of patient Score; HFS 98, Hanover Fracture Scale 98; PSI, Predictive Salvage Index; LSI, Limb Salvage Index.

Amputations

MESS

- In 1990, Johansen et al. and Helfet et al. proposed and reported on the utility of the Mangled Extremity Severity Score (MESS)

Johansen K, Daines M, Howey T, et al. Objective criteria accurately predict amputation following lower extremity trauma. J Trauma. 1990;30:568–572.

TABLE 12-4 Mangled Extremity Severity Scoring System (MESS)

Criterion	Score
Skeletal/Soft Tissue Injury	
Low energy	1
Medium energy	2
High energy	3
Very high energy	4
Limb Ischemia	
Pulse reduced or absent but normal perfusion	1[a]
Pulseless, diminished capillary refill	2[a]
Cool, paralyzed, insensate, numb	3[a]
Shock	
SBP always >90 mm Hg	0
SBP transiently <90 mm Hg	1
SBP persistently <90 mm Hg	2
Age (yr)	
<30	0
30–50	1
>50	2

[a]Double value if duration of ischemia exceeds 6 hours.
SBP, systolic blood pressure.

Amputations

MESS

- The Mangled Extremity Severity Score (MESS) was developed to discriminate between salvageable and doomed limbs in the setting of lower extremity trauma.
- MESS could provide an early prognosis on the injured limb at time of Emergency Department or initial contact with healthcare system.
- Newer surgical techniques since the development of the score in the late 1980s may alter the outcome of patients with a MESS ≥7.
- Has been validated for upper extremity injuries as well. However as the MESS creator Dr. Johansen suggests, upper extremities are profoundly more important than lower extremities and prosthesis much more primitive, so nearly every effort at salvage should be attempted.
- Only large, prospective, multi-center study of the MESS found that a cut-off of 7 had poor sensitivity and mediocre specificity.
- MESS Creator Dr. Johansen suggests that, due to newer techniques that increase the probability of limb salvage, a higher MESS “cut off” may be considered, perhaps 8 or 9.

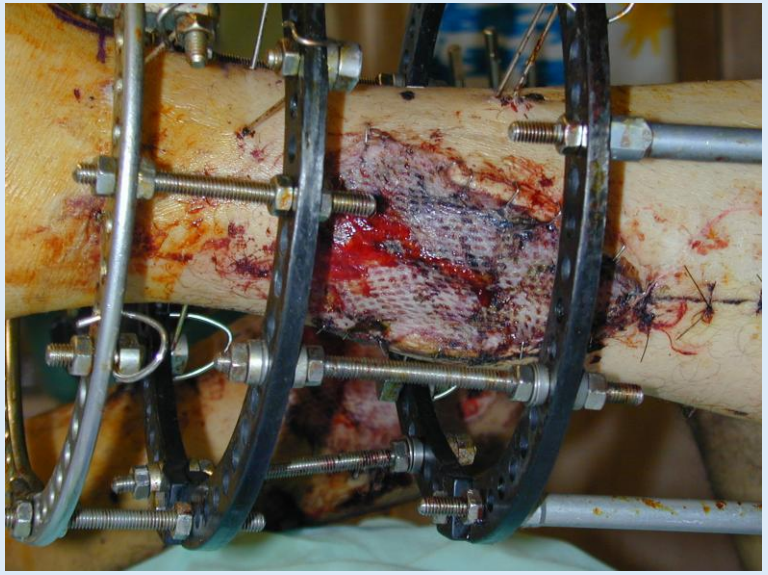
Amputations

Practically.

7????

- Thus using the MESS, for example, in a 30-year-old patient (1 point) with a high-energy open tibia fracture (3 points), with normal perfusion but a diminished pulse secondary to spasm or compression (1 point), who has persistent hypotension before laparotomy related to a spleen injury (2 points) would undergo amputation at the conclusion of the laparotomy despite the fact that the limb perfusion will likely return to normal and splenectomy and appropriate resuscitation will resolve the patient's hypotension.

Amputations



Amputations Case 1

Amputations

Case 1

Amputations

Case 2

Amputations

Amputations Upper Limb

- The level of ischaemia differs in the upper and lower limbs in major arterial injuries. **The critical time allowed for reperfusion in the arm is eight to ten hours which negates the six-hour limit for the MESS in the leg.** These differences make the MESS score inappropriate for application to the upper limb and it is necessary to establish suitable, alternative standards for this site. Surgeons should, therefore, avoid relying on the MESS as a justification for performing amputation of the upper limb when other techniques to repair injuries to blood vessels are available.

The validity of the mangled extremity severity score in the assessment of upper limb injuries
S. Togawa et al. J Bone Joint Surg [Br] 2005;87-B:1516-19.

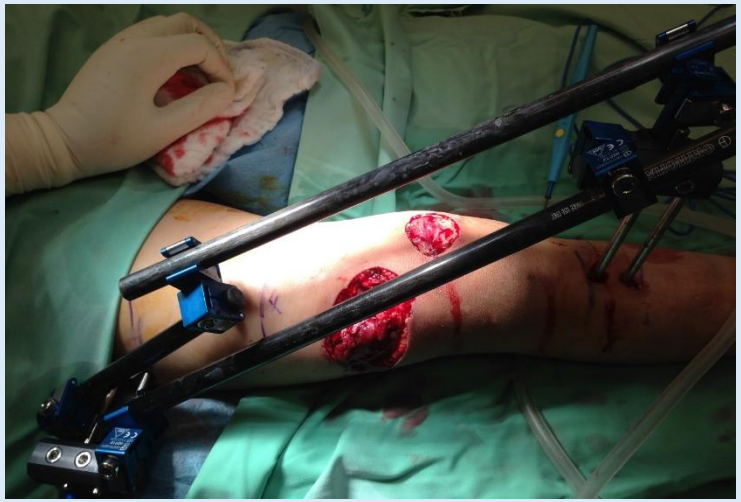
Summary

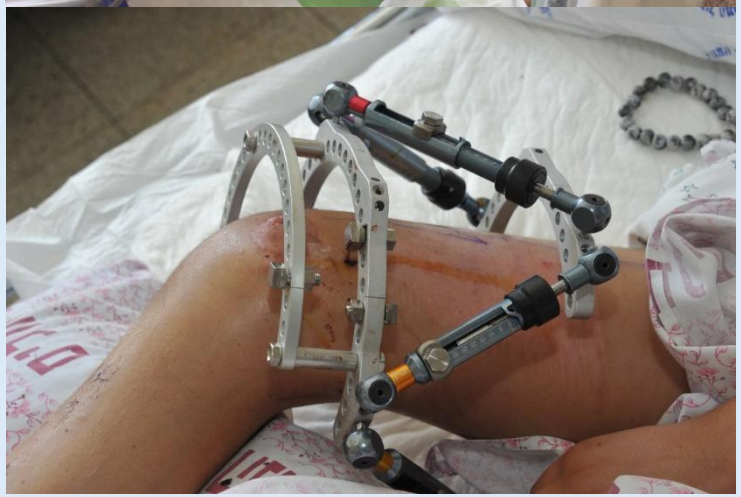
- The decision to amputate or salvage a severely injured lower extremity is a difficult one, which relies not only on the expertise of the orthopedic surgeon but also on the input of subspecialty colleagues (general trauma surgeons, vascular surgeons, and plastic surgeons) as well as the patient. The decision to reconstruct or amputate an extremity cannot depend on limb salvage scores, as all have proved to have little clinical utility. Using current technology and level I trauma center orthopedic clinical experience, combined with multispecialty support, current data appear to suggest that the results of limb reconstruction are equal to those of amputation following severe lower extremity trauma, and this observation should encourage the continued efforts to reconstruct severely injured limbs.

Take-home message

A key for success in the treatment of severe military injuries must include:

- A multidisciplinary approach: orthopedic surgeon, infection disease specialist, plastic surgeon, vascular surgeon, highly reliable microbiology laboratory.
- Multiple debridements in the OR, (5 to even more than 10 times per patient).
- Wide use of external fixation devices.
- Suitable antibiotic treatment (proper drug, proper duration of treatment).
- Wise decision-making in regard to definitive treatment (conversion to internal fixation or insertion of implants).





Conclusions

- **Today, after many years and thousands injured from different military conflicts, we are much more experienced. We have developed our own algorithms and protocols. Today our team has adapted to new realities, developed new behavior in the treatment of mass casualties, especially with severe limbs injuries and multi-drug resistant infections.**


Thank you
for Listening!
ISRAEL ORTHOPAEDIC ASSOCIATION
Galilee
Medical Center