Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Staged Treatment of Patients with Multiple Fractures: What Is the Proper Sequence?

Steven A. Olson, MD
Goldner- Jones Distinguished Professor
Department of Orthopaedic Surgery
Duke University Health System

Disclosures

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

No Disclosures relevant to this presentation

A Recent Overview

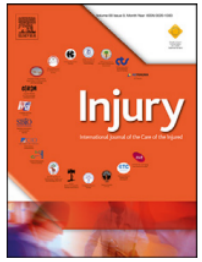
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

ELSEVIER

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury



Timing of major fracture care in polytrauma patients – An update on principles, parameters and strategies for 2020

Check for updates

H.-C. Pape[a,*], S. Halvachizadeh[a], L. Leenen[b], G.D. Velmahos[c], R. Buckley[d], P.V. Giannoudis[e]

[a] Department of Trauma, University Hospital Zurich, University of Zurich, Raemistrasse 100, 8091, Zurich, Switzerland
[b] Department of Trauma, University Medical Centre Utrecht, Suite G04.228, Heidelberglaan 100, 3585 GA, Utrecht, the Netherlands
[c] Dept. of Trauma, Emergency Surgery and Critical Care, Harvard University, Mass. General Hospital, 55 Fruit St., Boston, MA, 02114, USA
[d] Section of Orthopedic Trauma, University of Calgary, Foothills Medical Center, 0490 McCaig Tower, 3134 University Drive NW Calgary, Alberta, T2N 5A1, Canada
[e] Trauma & Orthopaedic Surgery, Clarendon Wing, A Floor, Great George Street, Leeds General Infirmary University Hospital, University of Leeds, Leeds, LS1 3EX, UK

A Lot Has Changed in 20 Years

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

	2000	2020 *unchanged parameters* new parameters
Injury combination	*Polytrauma ISS > 20 and additional thoracic trauma (AIS > 2)*	*Polytrauma ISS > 20 and AIS chest > 2* Thoracic Trauma Score (TTS) > grade 2 (> 3 rib fx, paO_2/FiO_2 <200, LuCo > 1 lobe, bilat.HT/HPT > unilat)
Local injury chest	*Bilateral lung contusion: 1st plain film*	*Bilateral lung contusion: 1st plain film or* Chest CT: • unilateral bisegmental contusion • bilateral uni- or bisegmental contusion • flail chest
Local injury trunk/extremities	*Multiple long bone fractures + truncal injury AIS 2 or more*	*Multiple long bone fractures + truncal injury AIS 2 or more*
Truncal /	*Polytrauma with abdominal /pelvic trauma RR, 90 mm Hg) (Moore 3) and hem. shock*	*Polytrauma with abdominal/pelvic trauma RR, 90 mm Hg) (Moore 3) and hemorrhagic shock*
Major Surgery for non-life saving conditions	*Day 1 surgery (Early total care) or wait until 4-6 (window of opportunity)*	Non life saving surgeries Flexible (day1,2,3) after reassessment according to individual patient physiology: Safe definitive surgery (SDS) and damage control (DCO)
Duration of 1st operative intervention	*Presumed operation time > 6 hours*	*Presumed operation time > 6 hours* intraoperative reassessment: • coagulopathy (ROTEM/FIBTEM) • lactate (< 2.0 - 2.5 mmol/L) • body temperature stable • requirement > 3 pRBC / hour
Blood transfusion requirements	*Massive transfusion* (10 units RBCs per 24 hours)	*Massive transfusion* (10 units RBCs per 6 hours) initiates "goal directed therapy" (massive transfusion protocols)
Intra/ perioperative	*PA-pressure increase during intramedullary nailing .6 mm Hg Initial mean PAP < 24 mm Hg*	• ROTEM/FIBTEM • Lactate clearance < 2.5 mmol/l (24 hrs.)

A Lot Has Changed in 20 Years

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Move towards aggressive resuscitation with targeted red cells and plasma elements to reverse anti-coagulation

Individualized decision making on timing of definitive surgery based on patient's response to resuscitation

	trauma RR, 90 mm Hg) (Moore 3) and hem. shock	*(Moore 3) and hemorrhagic shock*
Major Surgery for non-life saving conditions	*Day 1 surgery (Early total care) or wait until 4-6 (window of opportunity)*	Non life saving surgeries Flexible (day1,2,3) after reassessment according to individual patient physiology: Safe definitive surgery (SDS) and damage control (DCO)
Duration of 1st operative intervention	*Presumed operation time > 6 hours*	*Presumed operation time > 6 hours* intraoperative reassessment: • coagulopathy (ROTEM/FIBTEM) • lactate (< 2.0 - 2.5 mmol/L) • body temperature stable • requirement > 3 pRBC / hour
Blood transfusion requirements *Intra/ perioperative*	*Massive transfusion* (10 units RBCs per 24 hours) *PA-pressure increase during intramedullary nailing .6 mm Hg Initial mean PAP < 24 mm Hg*	*Massive transfusion* (10 units RBCs per 6 hours) initiates "goal directed therapy" (massive transfusion protocols) • ROTEM/FIBTEM • Lactate clearance < 2.5 mmol/l (24 hrs.)

Orthopaedic Priorities In the Multiply Injured Patient

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Life Threatening

- Control of Hemorrhage

Limb Threatening

- Dysvascular Limb
- Compartment Syndrome
- Reduce Dislocations

Immediate Concerns

- Progressive Neurologic Deficit
- Manage Open Fractures
- Stabilize Long Bone Fractures Temporary vs Definitive

Definitive Reconstruction

- Stabilize Fractures with Intra-articular Blood Supply
- Articular Fractures

ABC's

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

In the ATLS Primary Survey – ABCDE

Orthopaedics appears in C – Circulation

<u>There are 5 places a patient can bleed</u>

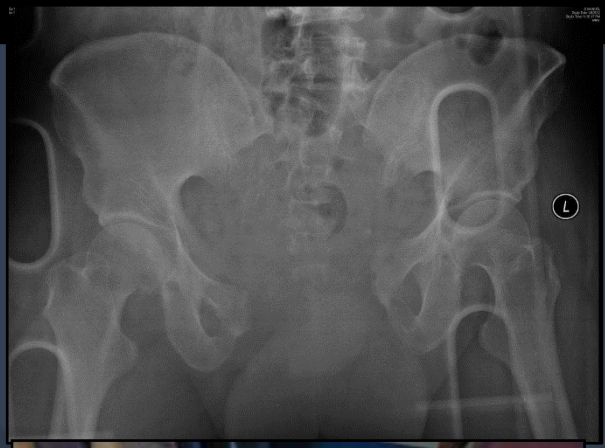
In the Chest

In the Abdomen

In the Retroperitoneum

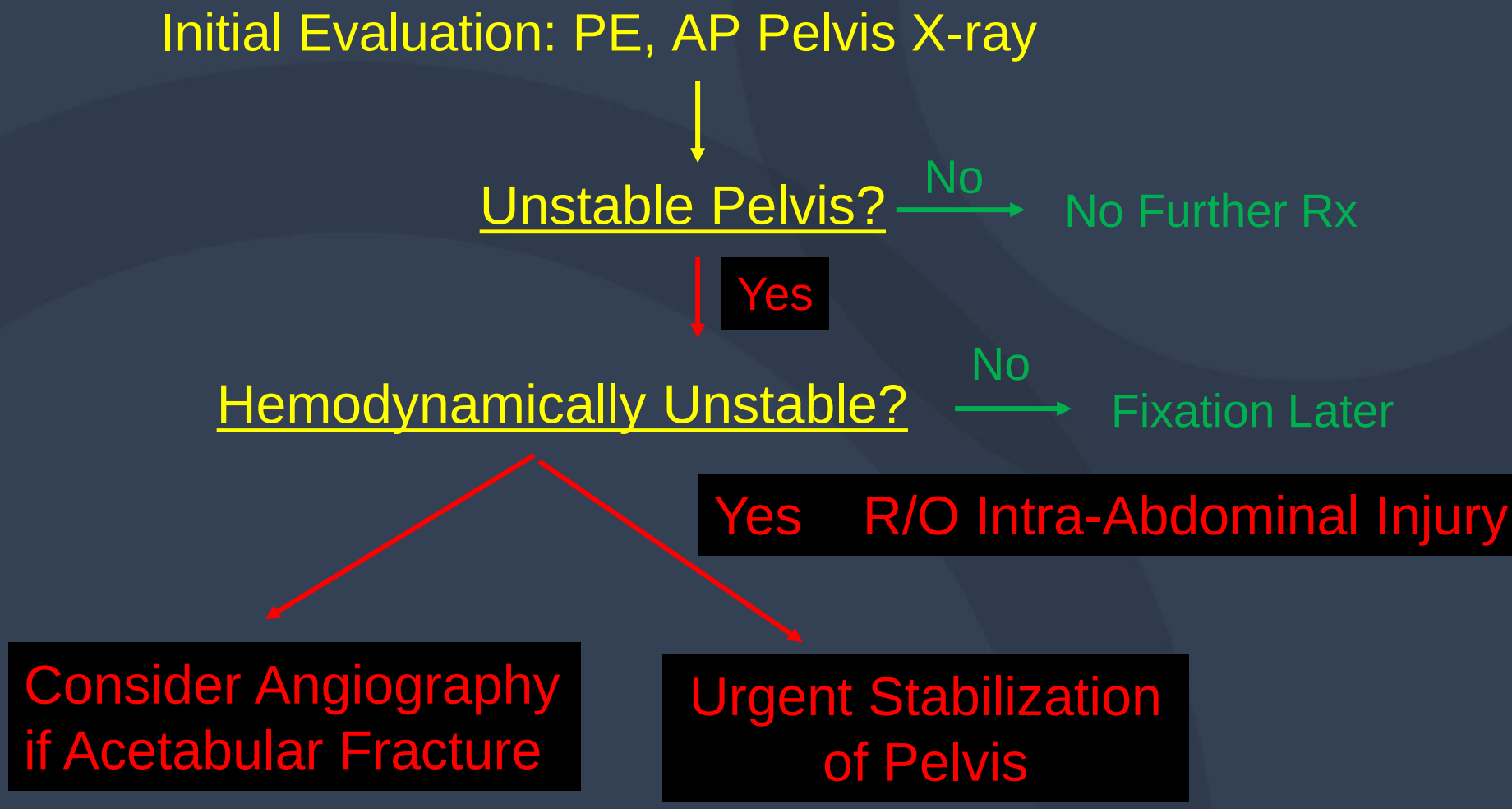
In the Extremities

On the Ground



Acute Pelvic Fx Algorithm

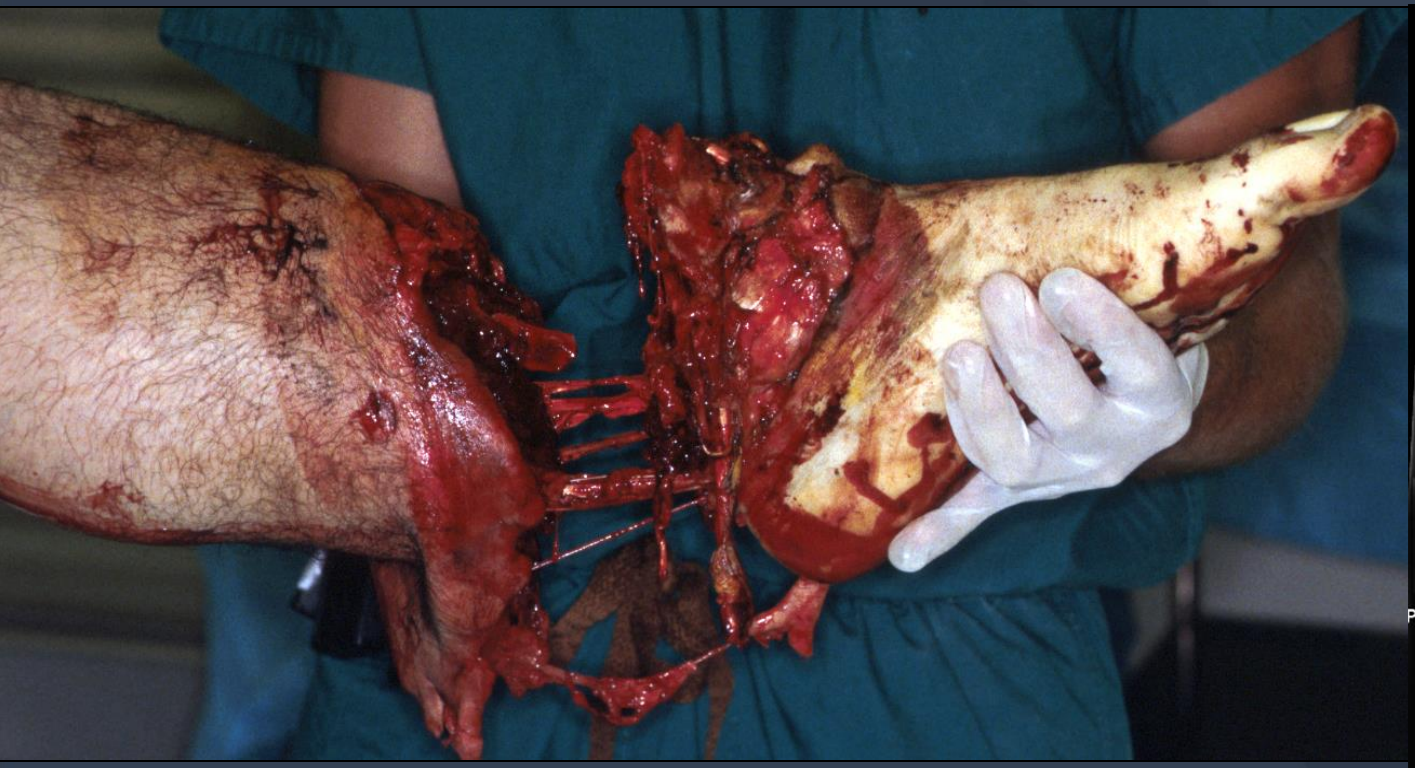
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL



Dysvascular Limb

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Will the limb be functional if reconstructed?



Compartment Syndrome

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Consider Fasciotomy

Do Not Forget to Spilt the Limb – with or without fasciotomy

Reduce Dislocations

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Relatively Easy To Do Quickly

Decreases Patient's Pain

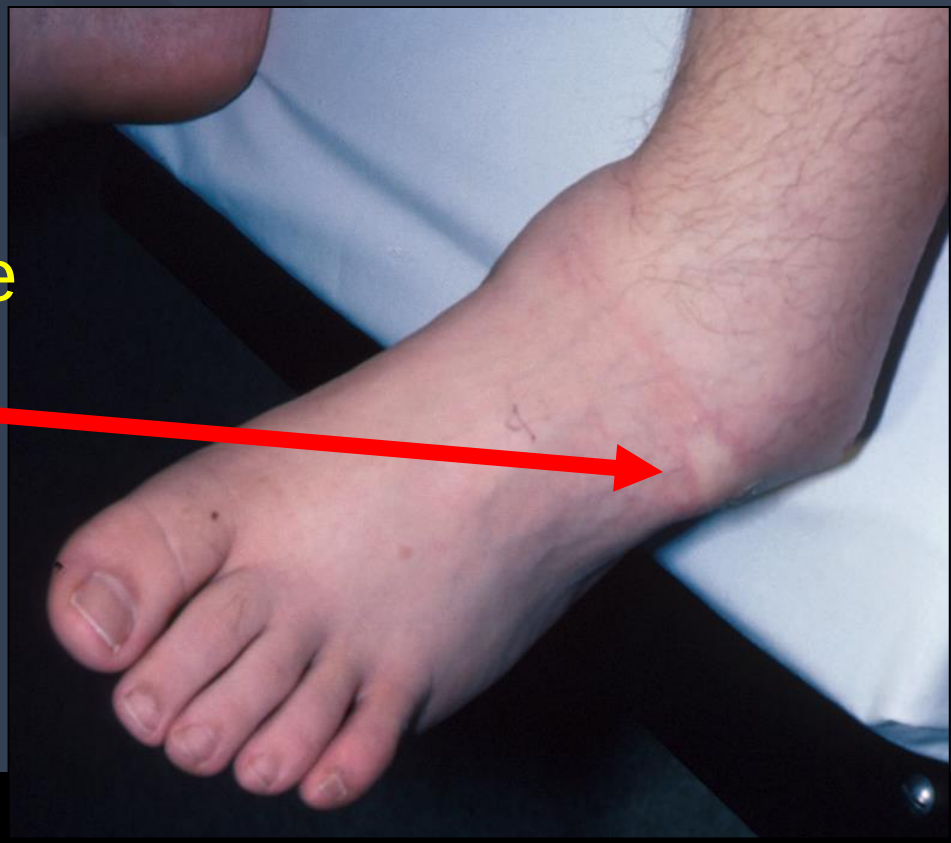
Improves Overall Mobilization

Potential For:

NeuroVascular Compromise

Skin Compromise

Osteonecrosis



Open Fractures

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Early administration of antibiotic therapy in ED

T-QIP Measure for ACS verified trauma centers

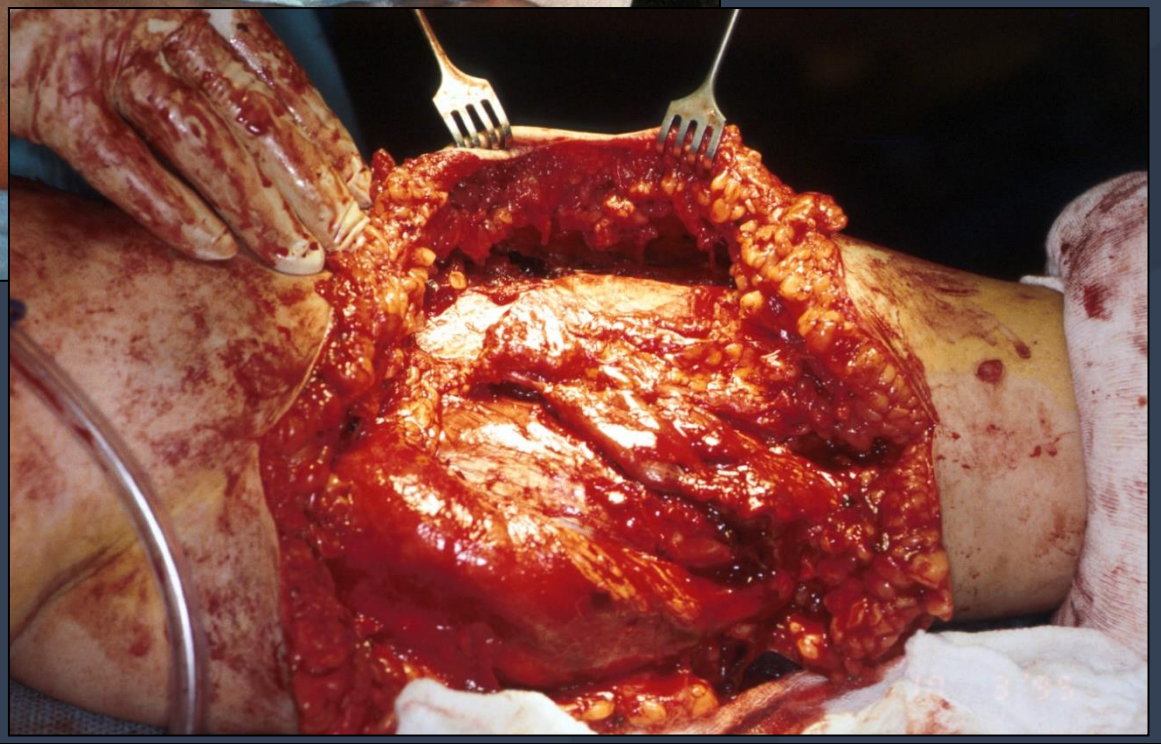
Timely operative debridement and irrigation

The more open the injury - greater need for skeletal stabilization

Zone of Injury Can Be Hidden

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

35 yo Female Ped vs Auto



Femur Fractures in the Blunt Multiple Trauma Patient

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Blunt Trauma Produces a “Pulmonary Failure Septic State” (Today Systemic Inflammatory Response Syndrome)

Delayed Stabilization of Femoral Shaft Fractures

Leads to ↑ Incidence of ARDS,MSOF

Orthopaedic Traumatologists Should Be Involved in the Trauma Team

Seibel, Border, et al Annals of Surgery 1985

Orthopedic Damage Control

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Initial reference to medical "Damage Control" came from General Surgery work packing severe liver injuries.

"… temporary stabilization of fractures soon after injury, minimizing the operative time, and preventing heat and blood loss." Definitive treatment delayed until after patients overall physiology improves.

Scalea et al J Trauma 48(4), 2000.

Femur Fractures

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Give preference to femoral shaft fractures
over minor open fractures
in the unstable patient

Allows early mobilization,

Decreases hemorrhage

Consider IM Fixation
(when appropriate) vs External Fixation
in the under-resuscitated patient

Case Example

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

65 yo female – MVC – Left hip fracture dislocation and right leg injuries

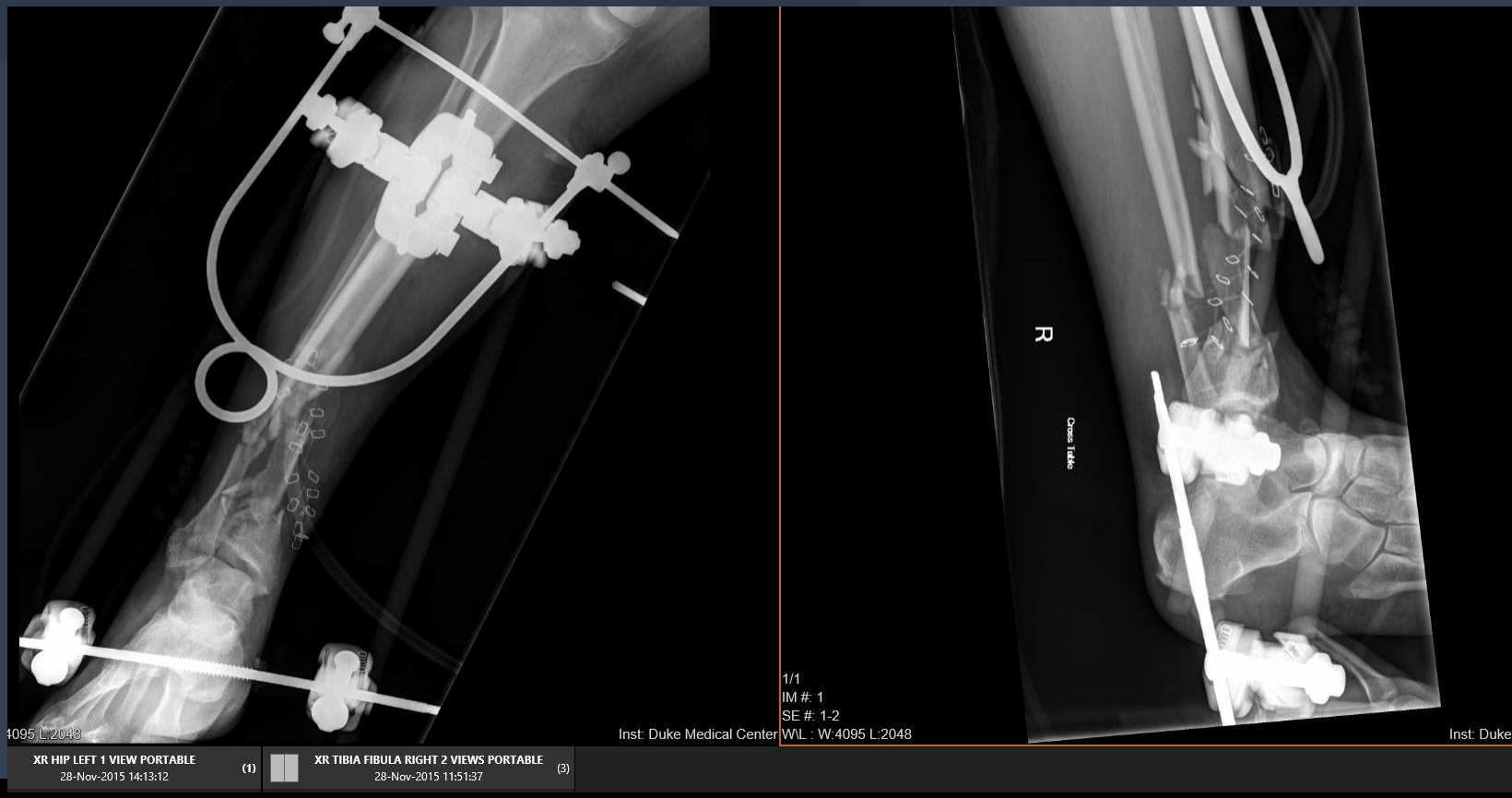
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

The left leg is now her “good leg”

HD#1

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Initial D&I of R open tibia, traction for R femur



HD#2

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

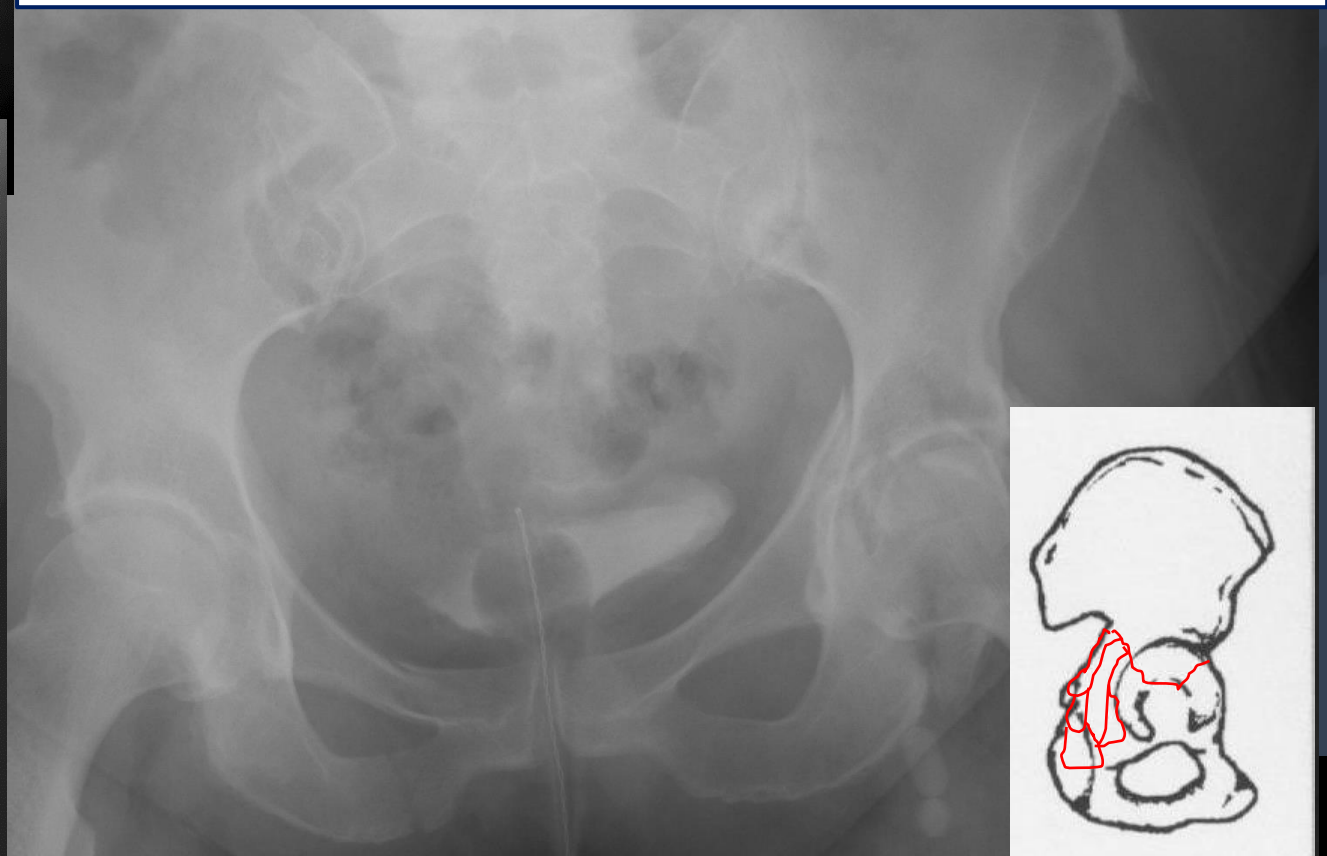
Lactic Acid < 2, FiO2/pAO2 ratio 350, coags OK

HD#5

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

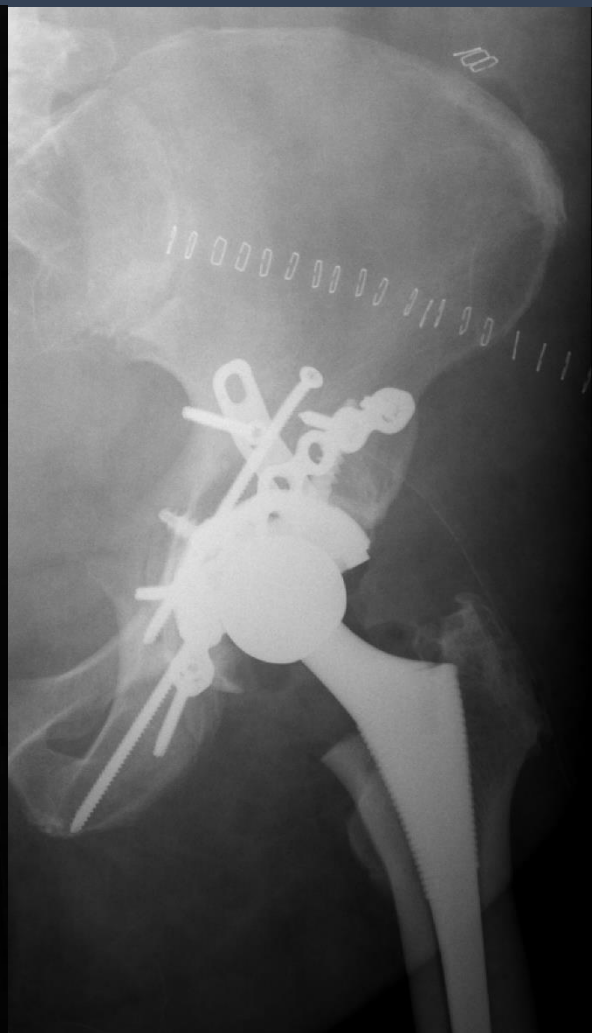
A Transverse with posterior wall pattern
A very comminuted posterior wall
Mild pre-existing OA

A relative indication for Acute ORIF and Primary THR



Post-Op Images

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL



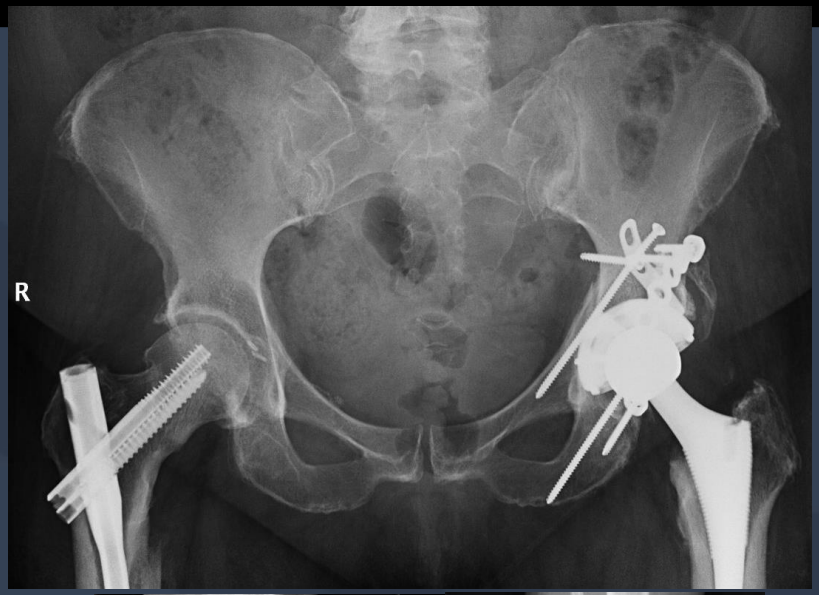
HD#7

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

D&I, ORIF, antibiotic cement spacer, flap coverage open tibia

Follow-Up

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL



Be a Learning Surgeon

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

"There is a fracture, I must fix it"

Orthopaedic Priorities In the Multiply Injured Patient

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Life Threatening

- Control of Hemorrhage

Limb Threatening

- Dysvascular Limb
- Compartment Syndrome
- Reduce Dislocations

Immediate Concerns

- Progressive Neurologic Deficit
- Manage Open Fractures
- Stabilize Long Bone Fractures Temporary vs Definitive

Definitive Reconstruction

- Stabilize Fractures with Intra-articular Blood Supply
- Articular Fractures

Summary

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

- Multiple fractures can have systemic effects
- Early wound debridement is important
- Early skeletal stabilization (temporary or definitive) facilitates pulmonary toilet and enhances care
- Base the extent of early skeletal repair on the the patient's response to resuscitation
- Orthopaedic injuries play a large role in functional outcome of patients surviving polytrauma

Early Fracture Stabilization

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Teach us to live that we may dread
Unnecessary time in bed.
Get people up and we may save
Our patients from an early grave..

R.A.J. Asher, 1947

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Thank you !