

# Damage Control Orthopedics – why, how and when

**AOTrauma Course-Advanced**  
**April 2018, Copenhagen, Denmark**

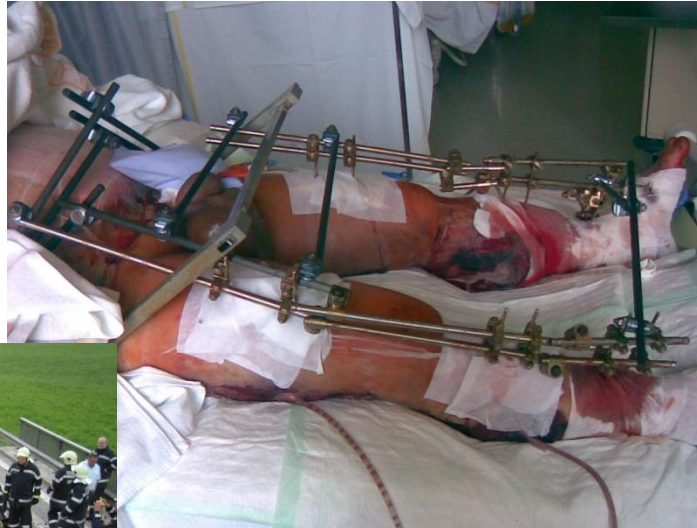
Hagen Schmal - Ortopædkirurgisk afd. O.

  
Region Syddanmark

Odense  
Universitetshospital

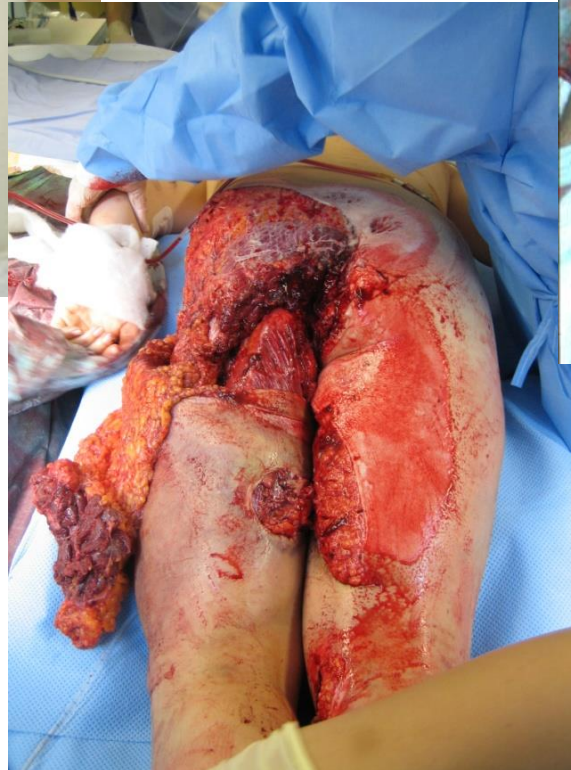


# Multiple injured patient: impressive clinical situations...



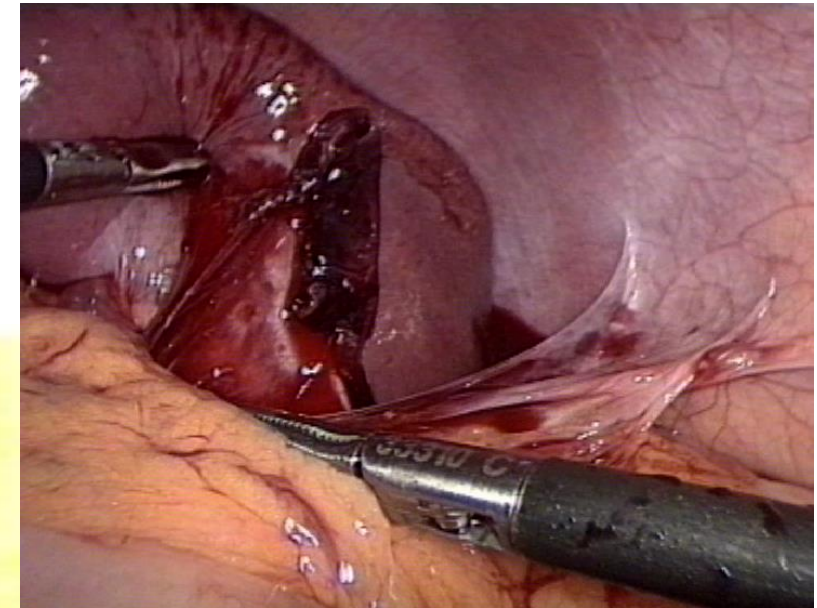
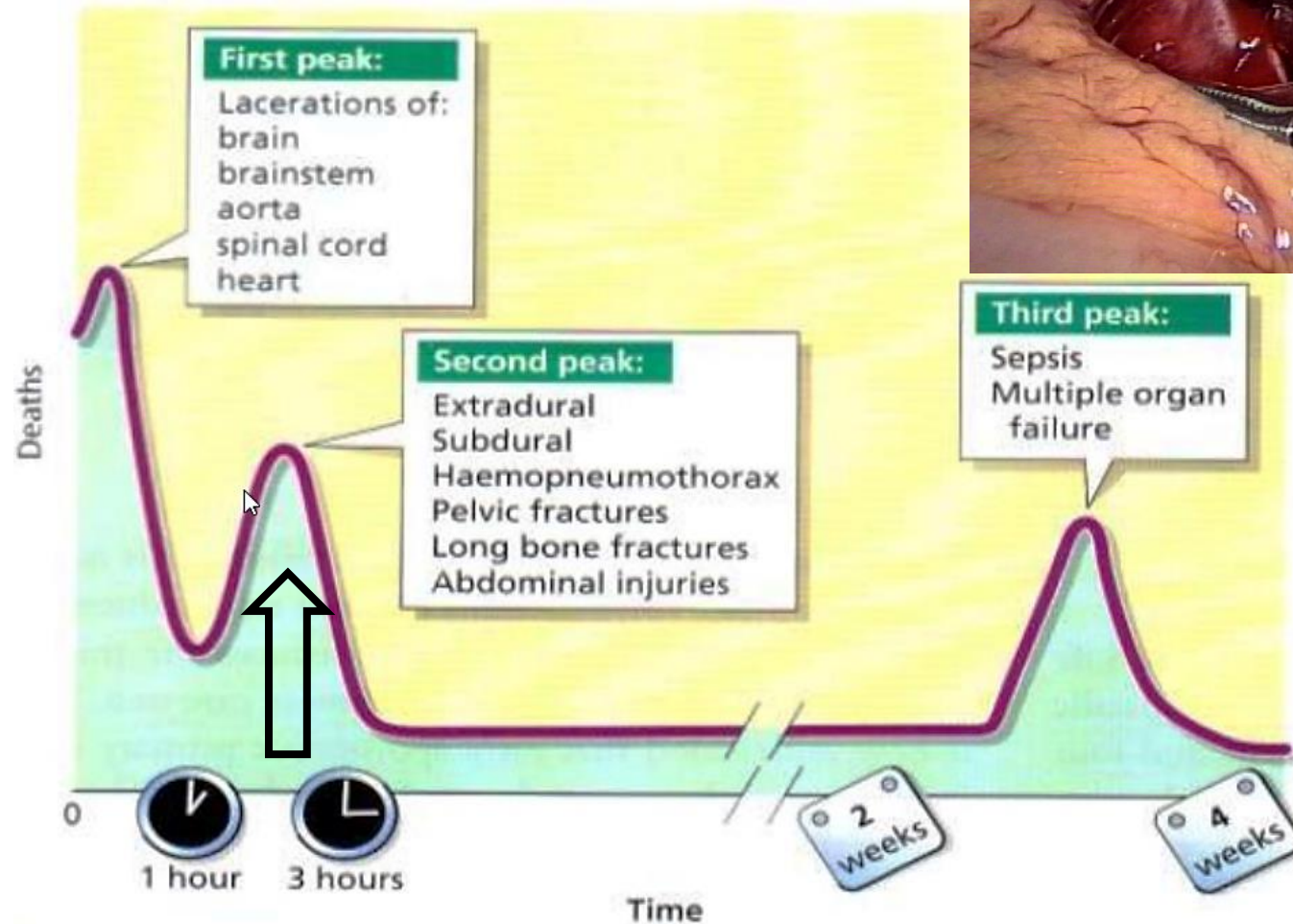


...but not frequently



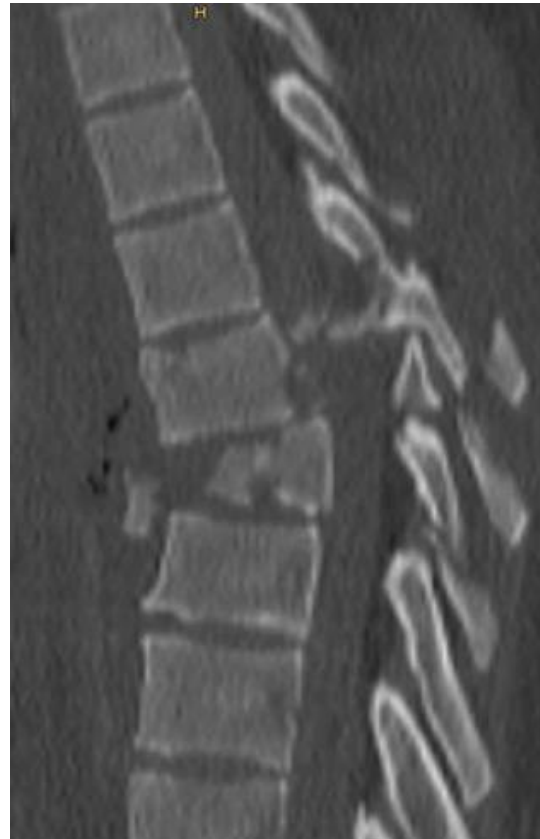
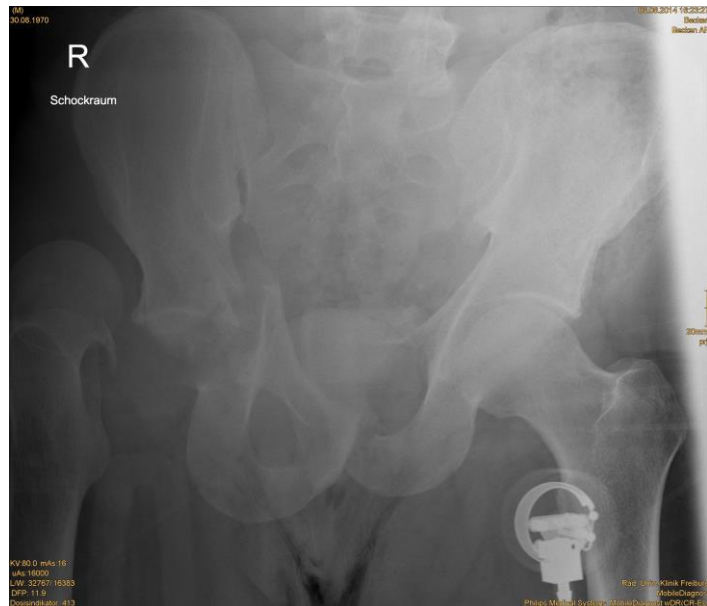
and need for  
guidelines

# ,Treat first, what kills first'

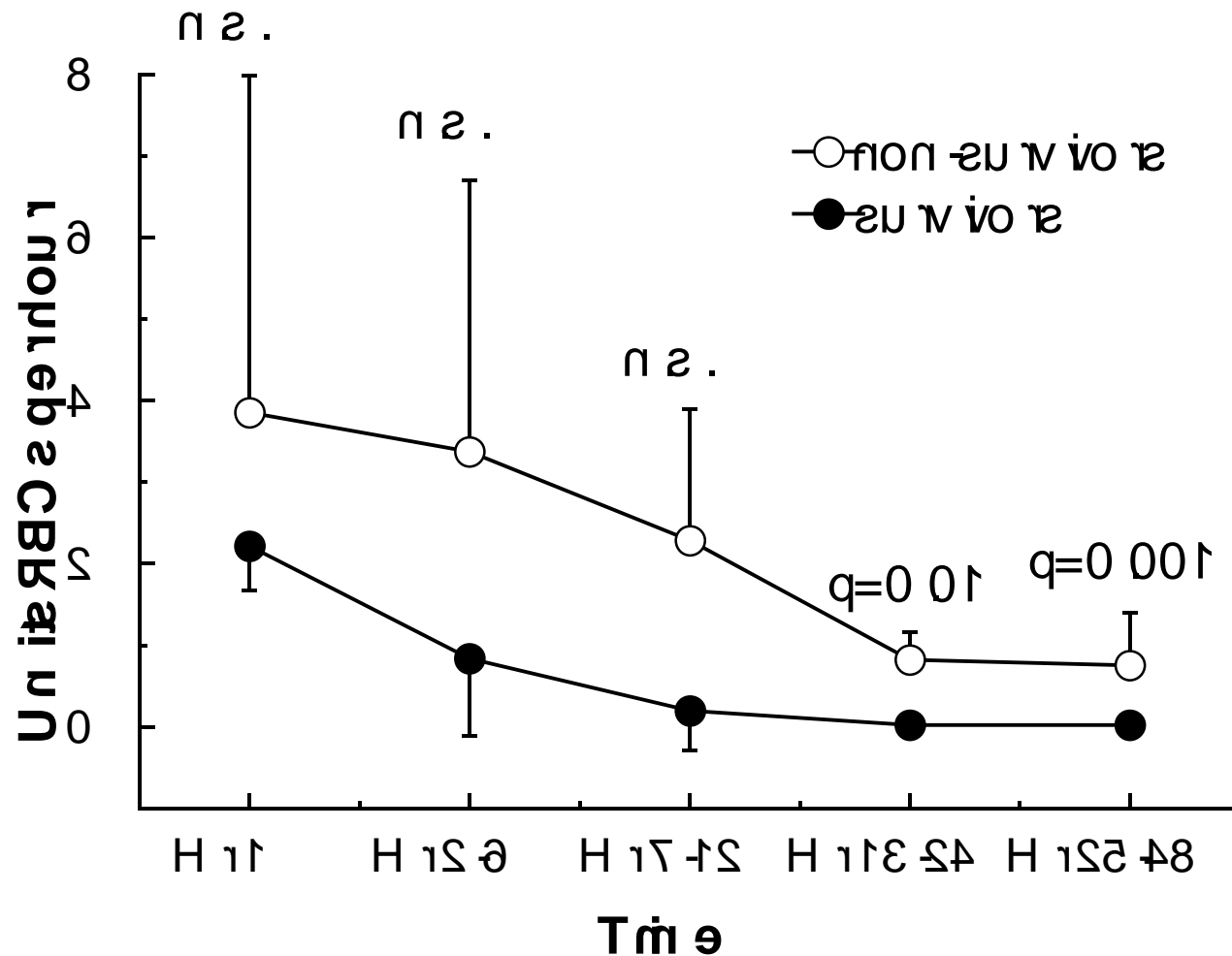




# Focus of DCO



# Hemorrhage control decides about survival (ATLS C) → But how?



Acta Orthop. Belg., 2005, 71, 41-47

ORIGINAL STUDY

Epidemiology and outcome of complex pelvic injury

Hagen SCHMAL, Max MARKMILLER, Alexander T. MEHLHORN, Norbert P. SUDKAMP

From the University of Freiburg Medical Center, Freiburg, Germany

It starts preclinically...

# PELVIC BINDERS

## NO



## YES

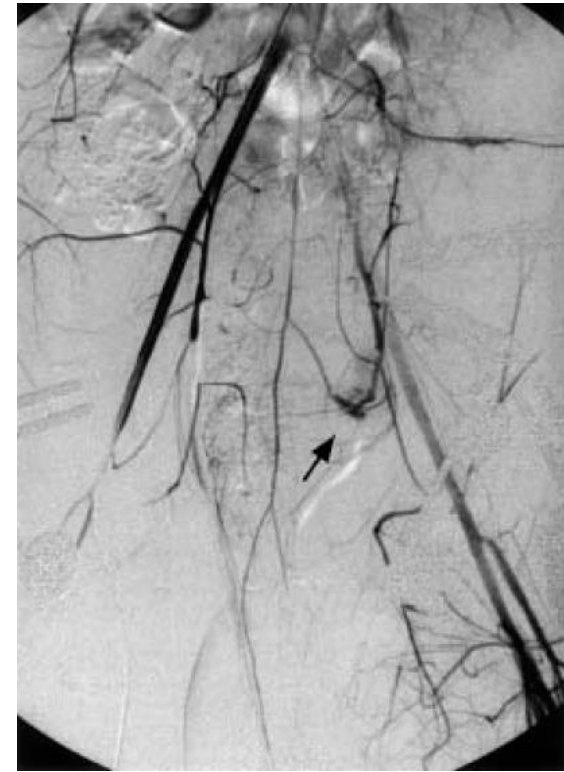


# Evaluation: ATLS

American College of Surgeons

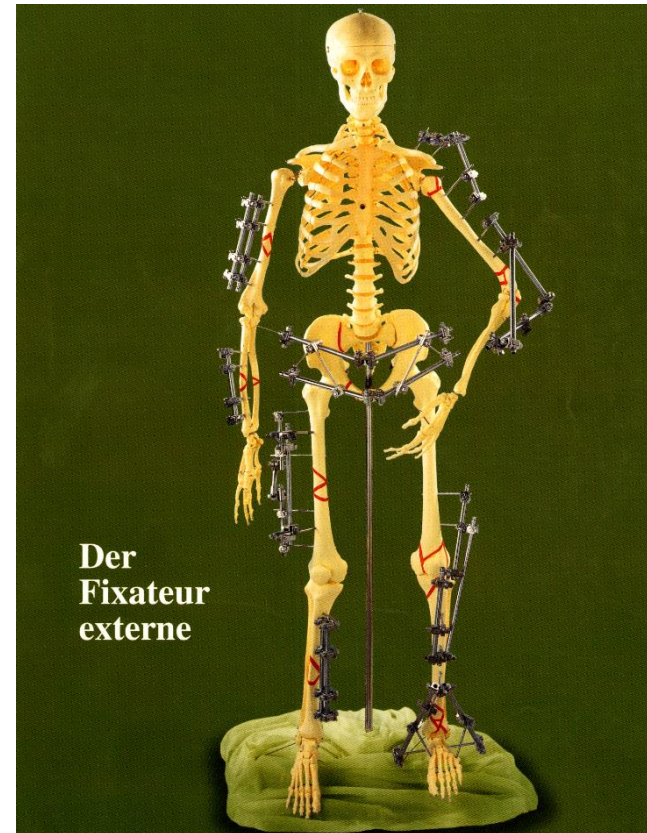
Student Course Manual, 7th Edition

- A** Airway maintenance with cervical spine protection
- B** Breathing and ventilation
- C** Circulation with hemorrhage control
- D** Disability: Neurologic status
- E** Exposure/Environmental control: Completely undress the patient, but prevent hypothermia

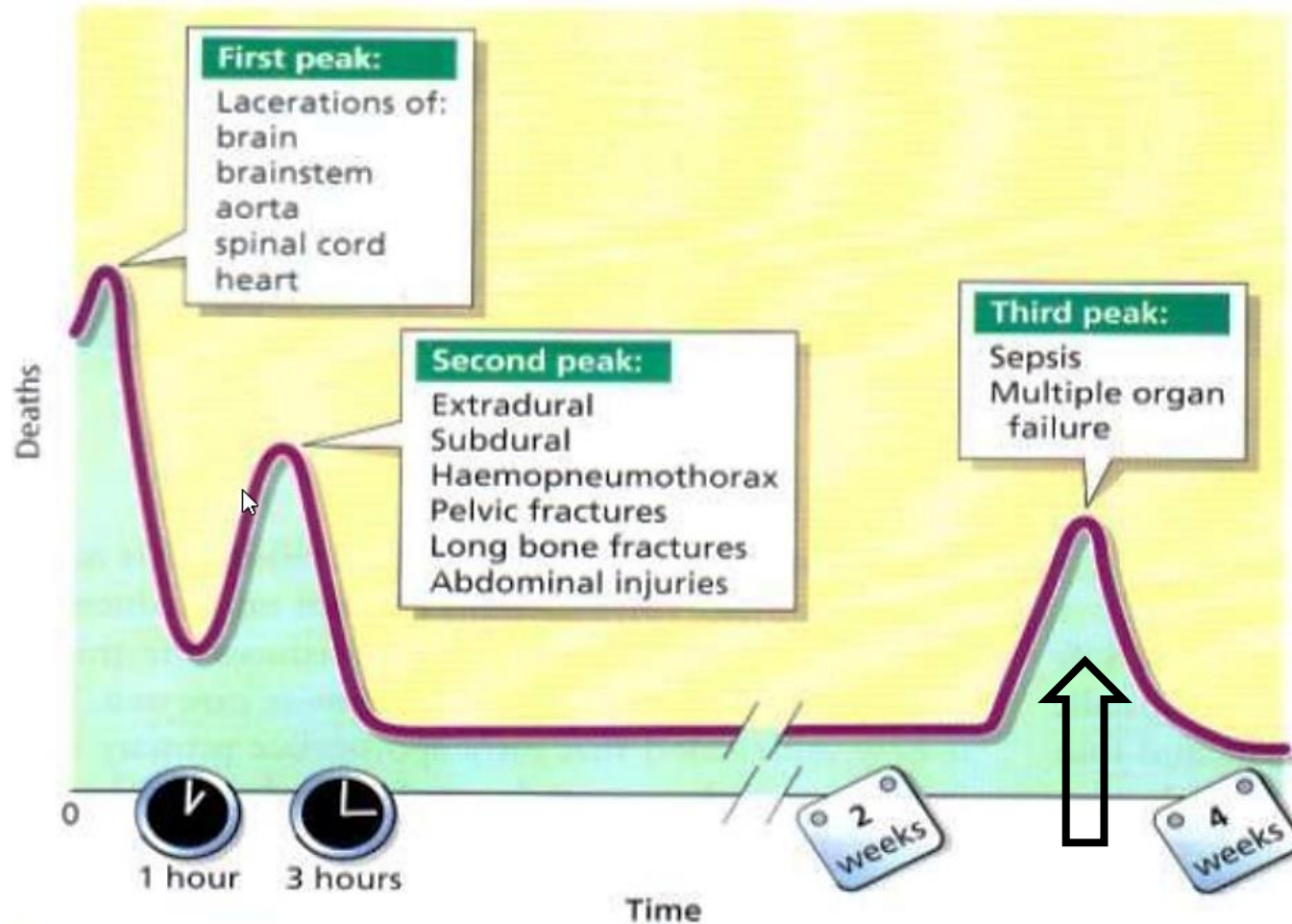




# Working horse: external fixation



# Death because of immunological consequences

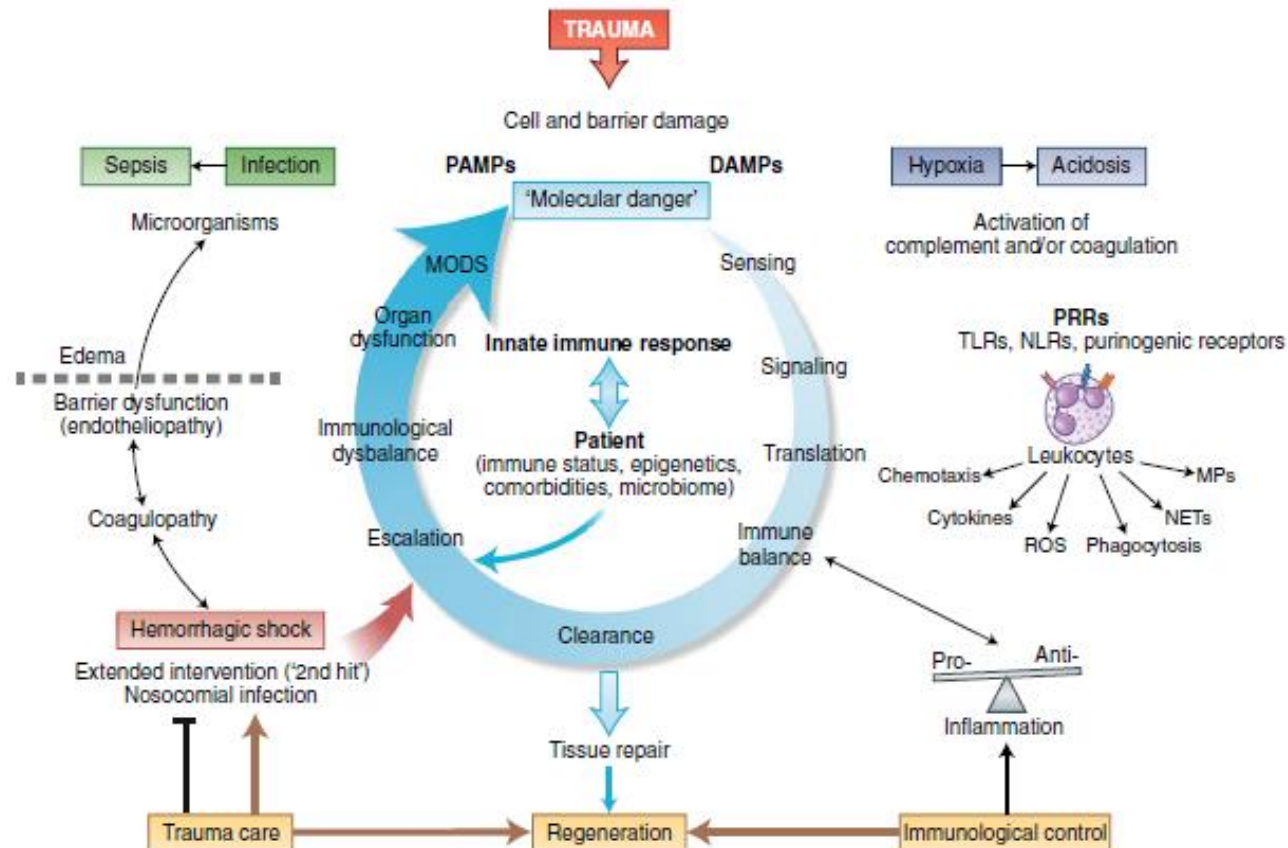


10

# Innate immune responses to trauma

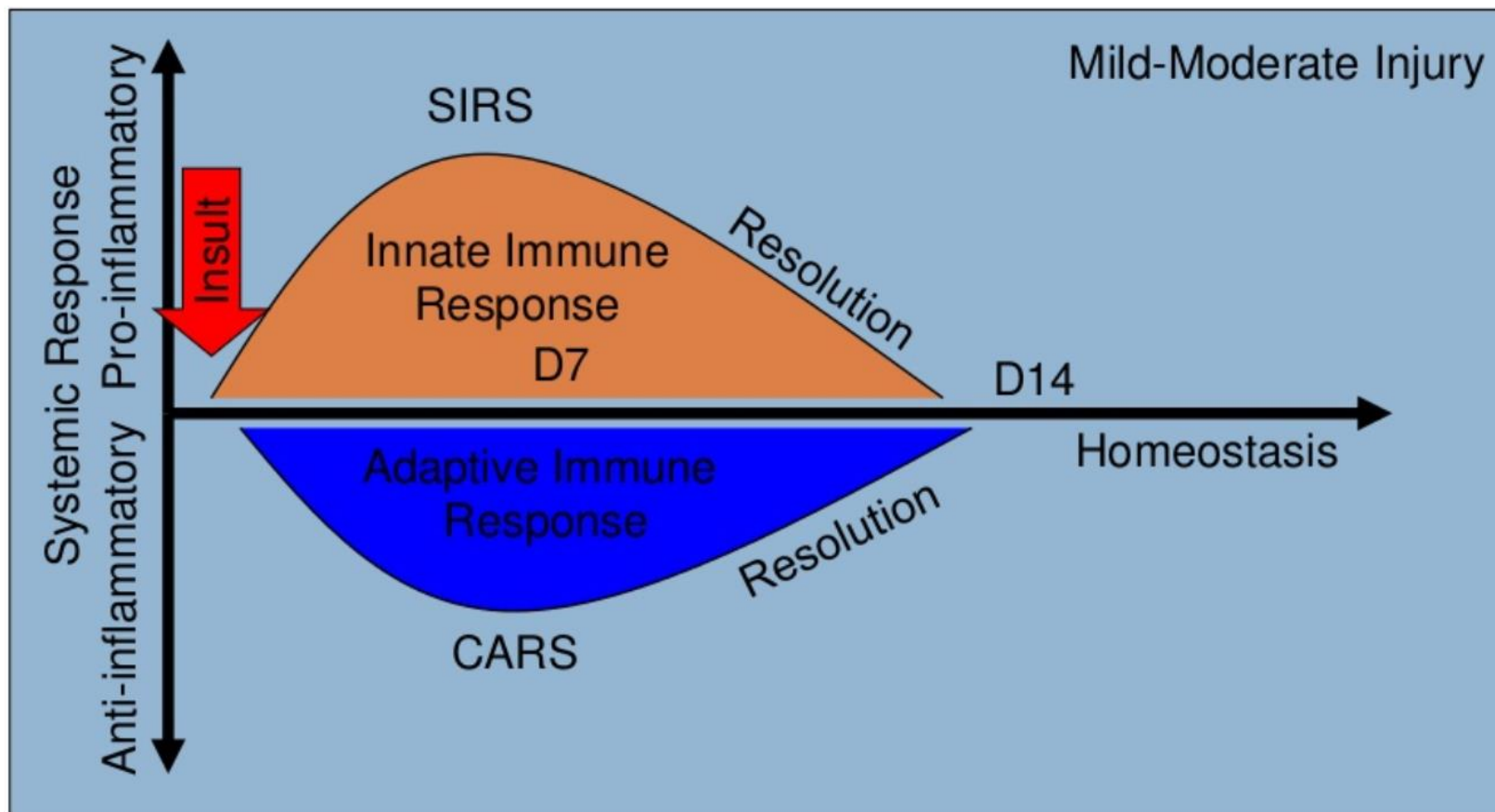
Markus Huber-Lang<sup>1\*</sup>, John D. Lambris<sup>2</sup> and Peter A. Ward<sup>3</sup>

Trauma can affect any individual at any location and at any time over a lifespan. The disruption of macrobarriers and microbarriers induces instant activation of innate immunity. The subsequent complex response, designed to limit further damage and induce healing, also represents a major driver of complications and fatal outcome after injury. This Review aims to provide basic concepts about the posttraumatic response and is focused on the interactive events of innate immunity at frequent sites of injury: the endothelium at large, and sites within the lungs, inside and outside the brain and at the gut barrier.



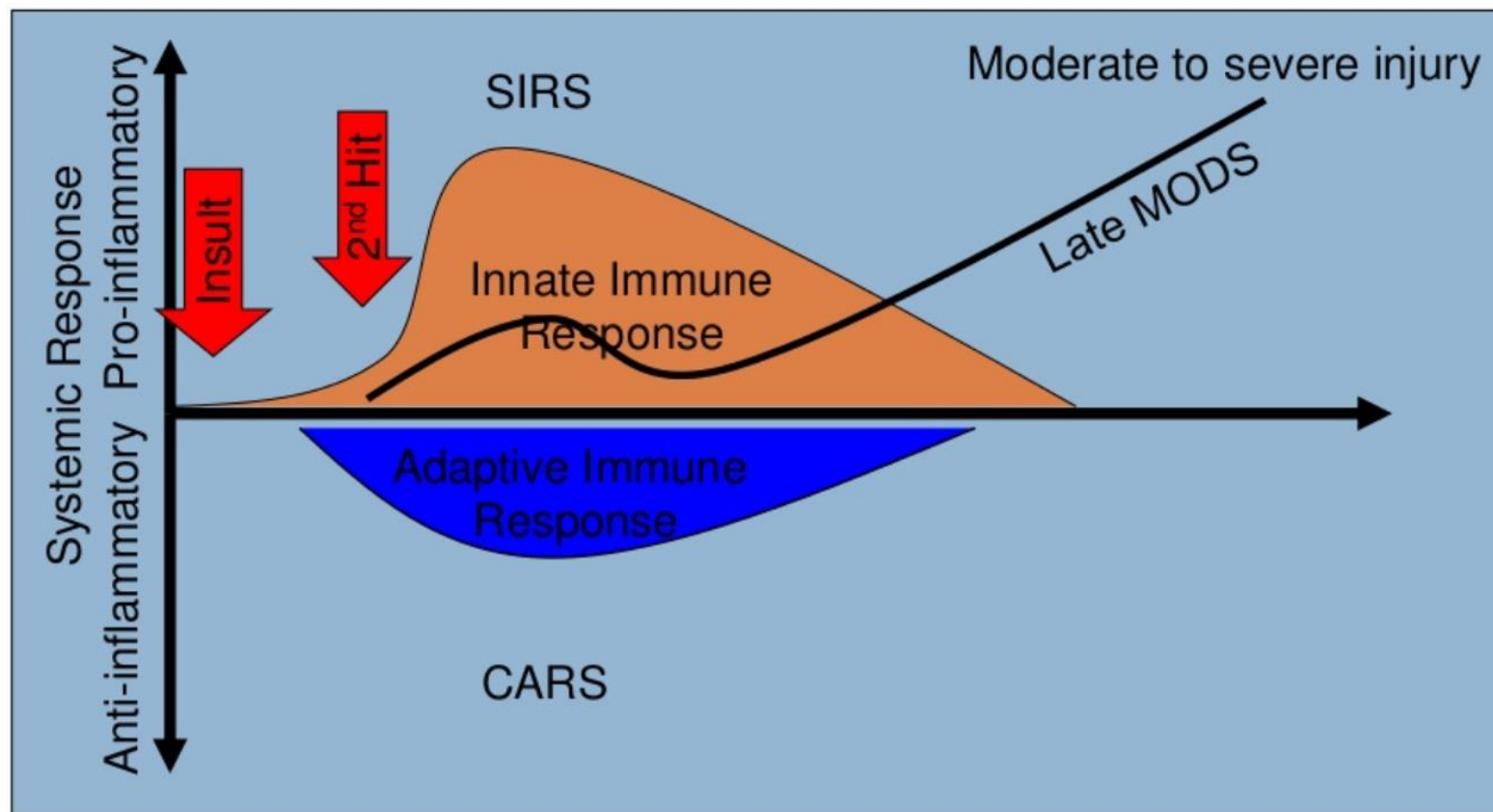


# Balanced immunological response



Balanced SIRS-CARS maintains homeostasis

# Imbalanced immunological response



Imbalanced  $SIRS > CARS$  leads to hyper-inflammation or delayed MODS

# DCO matters...

The Journal of Trauma: Injury, Infection, and Critical Care.

55(1):7-13, JUL 2003

DOI: 10.1097/01.TA.0000075787.69695.4E, PMID: 12855874

Issn Print: 0022-5282

Publication Date: 2003/07/01

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## Impact of Intramedullary Instrumentation versus Damage Control for Femoral Fractures on Immunoinflammation Randomized Analysis

ORIGINAL ARTICLES

Hans-Cristoph Pape; K. Grimme; Mar  
Ellingsen; Frank Hildebrand; B. Wieser

### Impact of the Method of Initial Stabilization for Femoral Shaft Fractures in Patients With Multiple Injuries at Risk for Complications (Borderline Patients)

*Hans-Christoph Pape, MD, FACS,\* Dieter Rixen, MD,† John Morley, MD,‡  
Elisabeth Ellingsen Husebye, MD,§ Michael Mueller, MD,¶ Clemens Dumont, MD,|||  
Andreas Gruner, MD,|| Hans Joerg Oestern, MD,\*\* Michael Bayeff-Filoff, MD,††  
Christina Garving,\*\*\* Dustin Pardini, PhD,‡‡ Martijn van Griensven, PhD,§§  
Christian Krettek, MD, FRACS,¶¶ Peter Giannoudis, MD,‡ and the EPOFF study group*



# Primary Fixation and Delayed Nailing of Long Bone Fractures in Severe Trauma

H. P. Friedl, M.D., R. Stocker, M.D., B. Czermak, M.D., H. Schmal, M.D.,  
and O. Trentz, M.D.

DCO  
↕  
ETC

## Early Definitive Fracture Fixation is Safely Performed in the Presence of an Open Abdomen in Multiply Injured Patients

Glass, Nina E. MD<sup>\*,†</sup>; Burlew, Clay Cothren MD<sup>\*</sup>; Hahnhaussen, Jens MD<sup>‡,§</sup>; Weckbach, Sebastian MD<sup>‡,||</sup>; Pieracci, Fredric M. MD<sup>\*</sup>; Moore, Ernest E. MD<sup>\*</sup>; Stahel, Philip F. MD<sup>‡,¶</sup>

Journal of Orthopaedic Trauma: December 2017 - Volume 31 - Issue 12 - p 624–630  
doi: 10.1097/BOT.0000000000000959  
Original Article

**TABLE 1.** Group I and Group II results

Nailing on	Patients	Mean ISS	ARDS	Mortality
Days 1–4	32	21.4	8/32	4/32
Days 5–14	23	41.8	0	0

ISS, injury severity score; ARDS, adult respiratory distress syndrome.

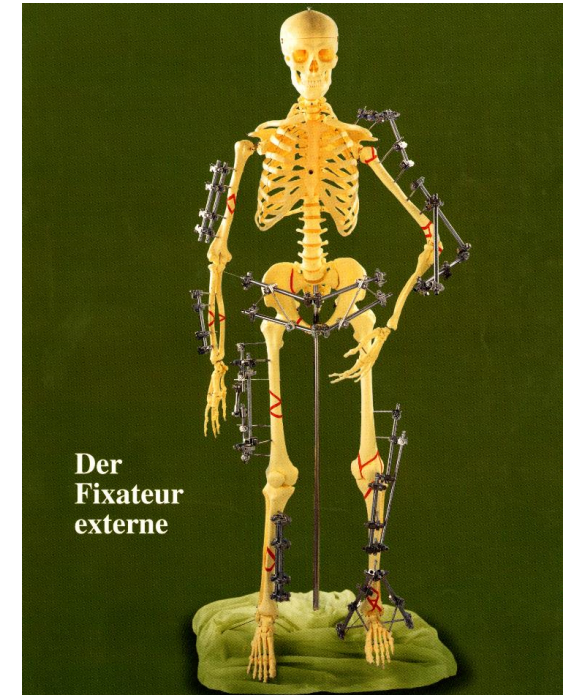
**TABLE 2.** Closed femoral and tibial fractures in the polytraumatized patient

ISS	Recommended stabilization method
Below 25	Primarily intramedullary nailing
Exceeding 40	Primarily external fixation, delayed nailing between days 5 and 14 after trauma

ISS, injury severity score.

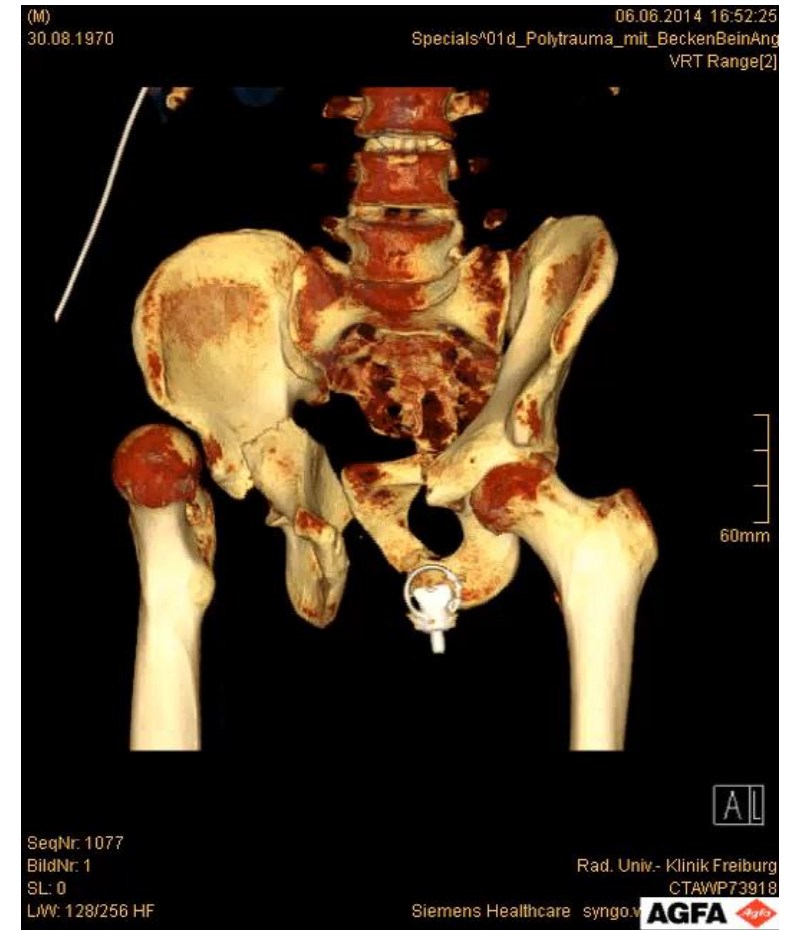
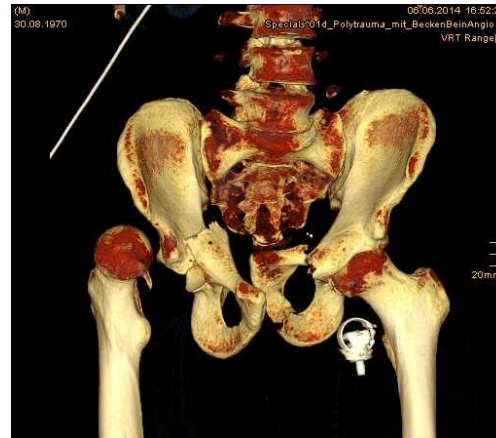
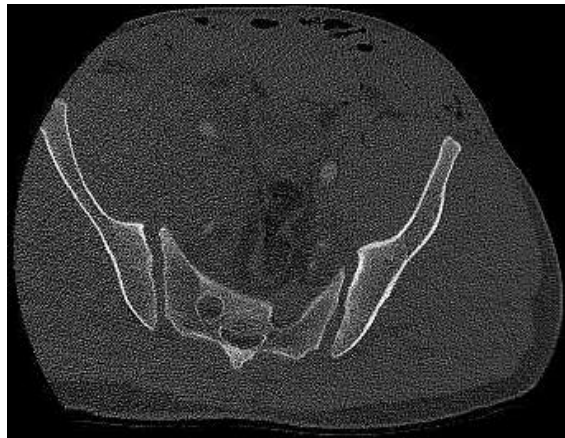
# The period between 24 and 72 hours is the most at-risk time.

- Conceptions
  - „Damage control‘ (unstable)
    - decreases the chances for a second hit
  - „Early total care‘ (stable)
    - Fractures are stabilized prior to the dangerous period.
- Borderline patients:
  - high ISS
  - hypothermia
  - coagulopathy



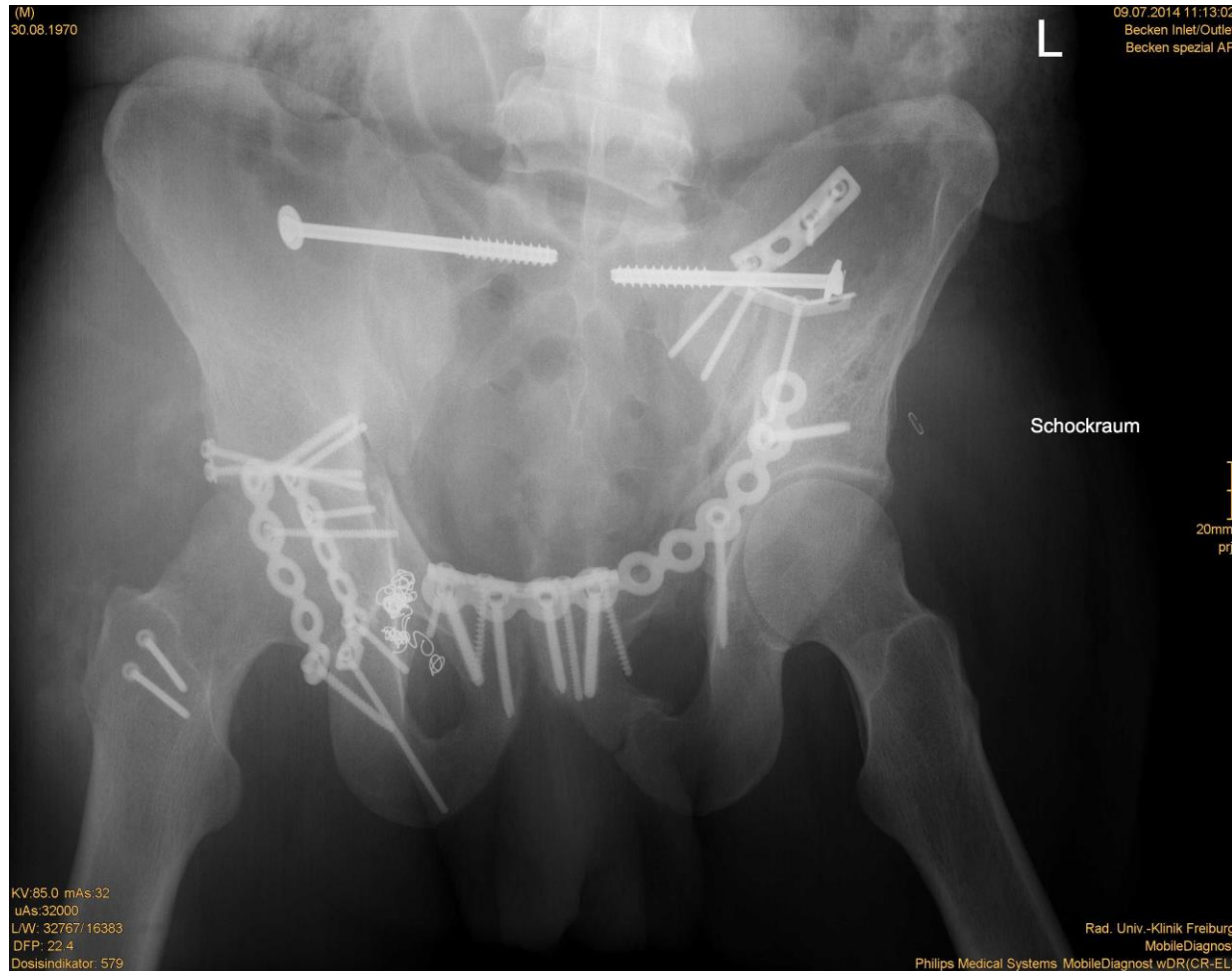
**Be smart:  
Stabilize – not fix.**

# ER-CT





# After about 15 hrs. operation time...



# Educational challenges

- (1) thinking physiologically
- (2) applying damage control resuscitation and surgery
- (3) differing priorities and time management
- (4) impact of environment in pre-clinical or military situations
- (5) managing limited resources
- (6) facing lack of general surgical skills
- (7) encountering different cultural behavior and
- (8) ethical issues


19

World J Surg  
<https://doi.org/10.1007/s00268-018-4460-x>



ORIGINAL SCIENTIFIC REPORT

**Decision-Making in Management of the Complex Trauma Patient:  
Changing the Mindset of the non-trauma Surgeon**

Linda Sonesson<sup>1,6</sup>  · Kenneth Boffard<sup>2,3,4</sup> · Lars Lundberg<sup>1,2</sup> · Martin Rydmark<sup>5</sup> ·  
Klas Karlgren<sup>6</sup>

28-05-2018