

Damage Control Orthopaedics (DCO)

What, why, and when



AO trauma course

Advanced principles of fracture management

7-9/4-2025

Jeppe Barckman

Goal

- Damage Control Orthopaedics (DCO)
 - What is DCO
 - Why do we use DCO
 - When do we use DCO
- Identify patients for Early Total Care (ETC)
- Timing of definitive surgery

35-year-old man - MC trauma



ER

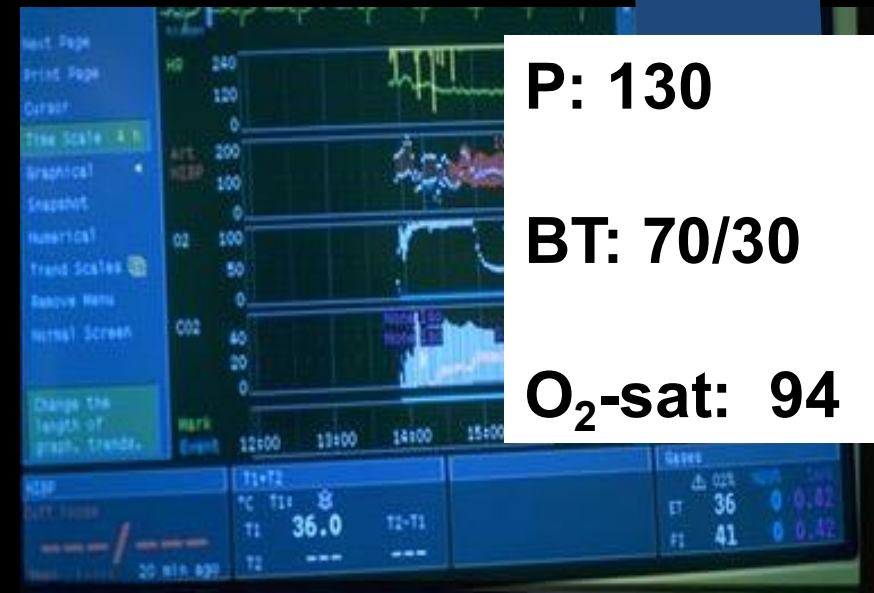
A: Intubated

B: Sat 94

C: Massive transfusions protocol applied.

D: GCS 3 (intubated, sedated).

E: Multiple extremity fractures



ER

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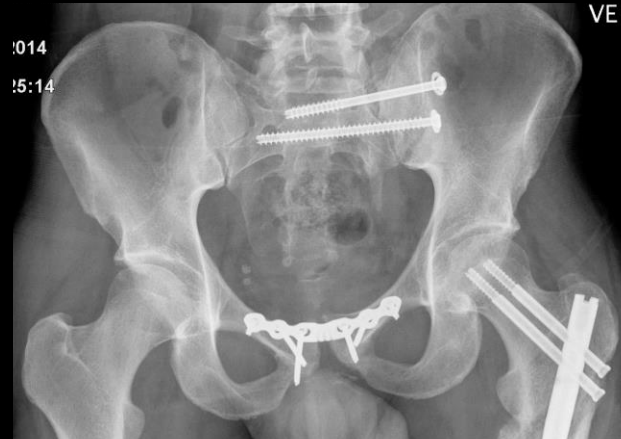
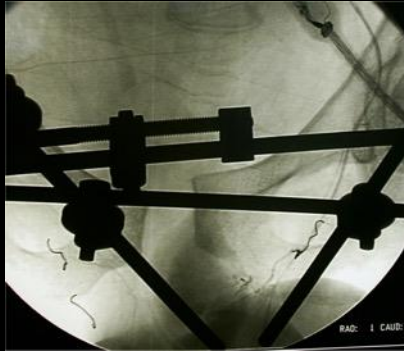
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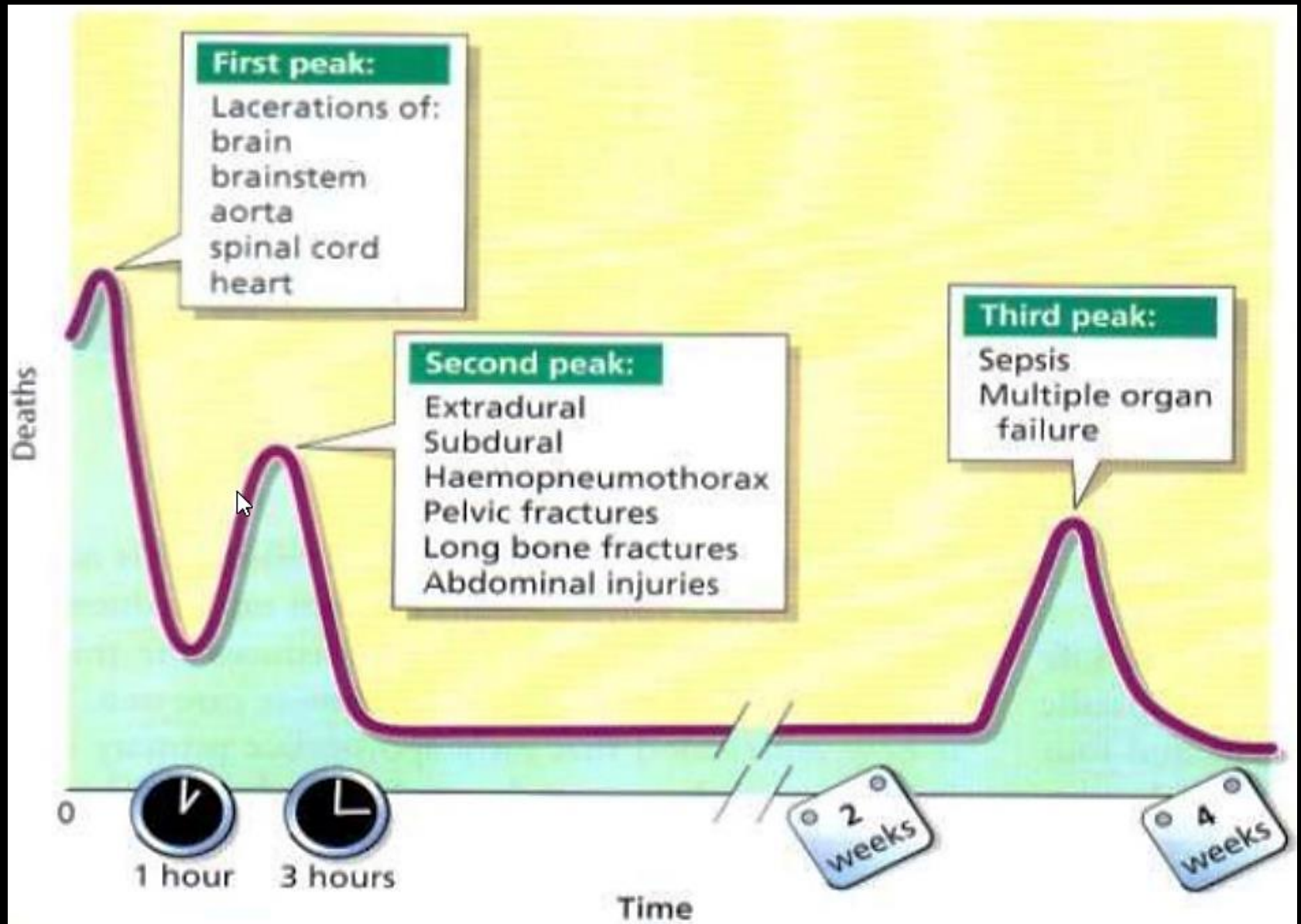
What now?



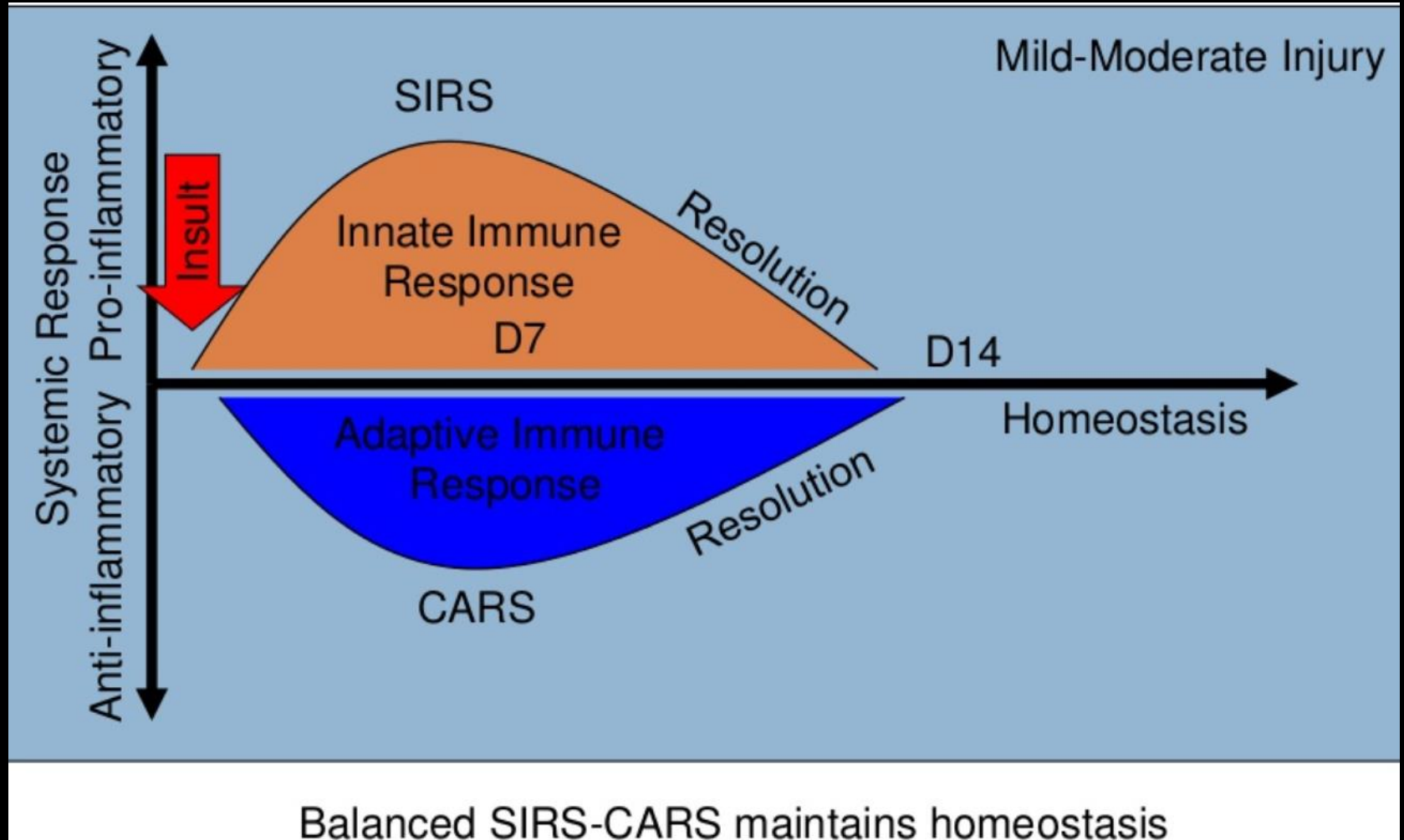
Damage Control Orthopedics vs. Early Total Care



"death curve"

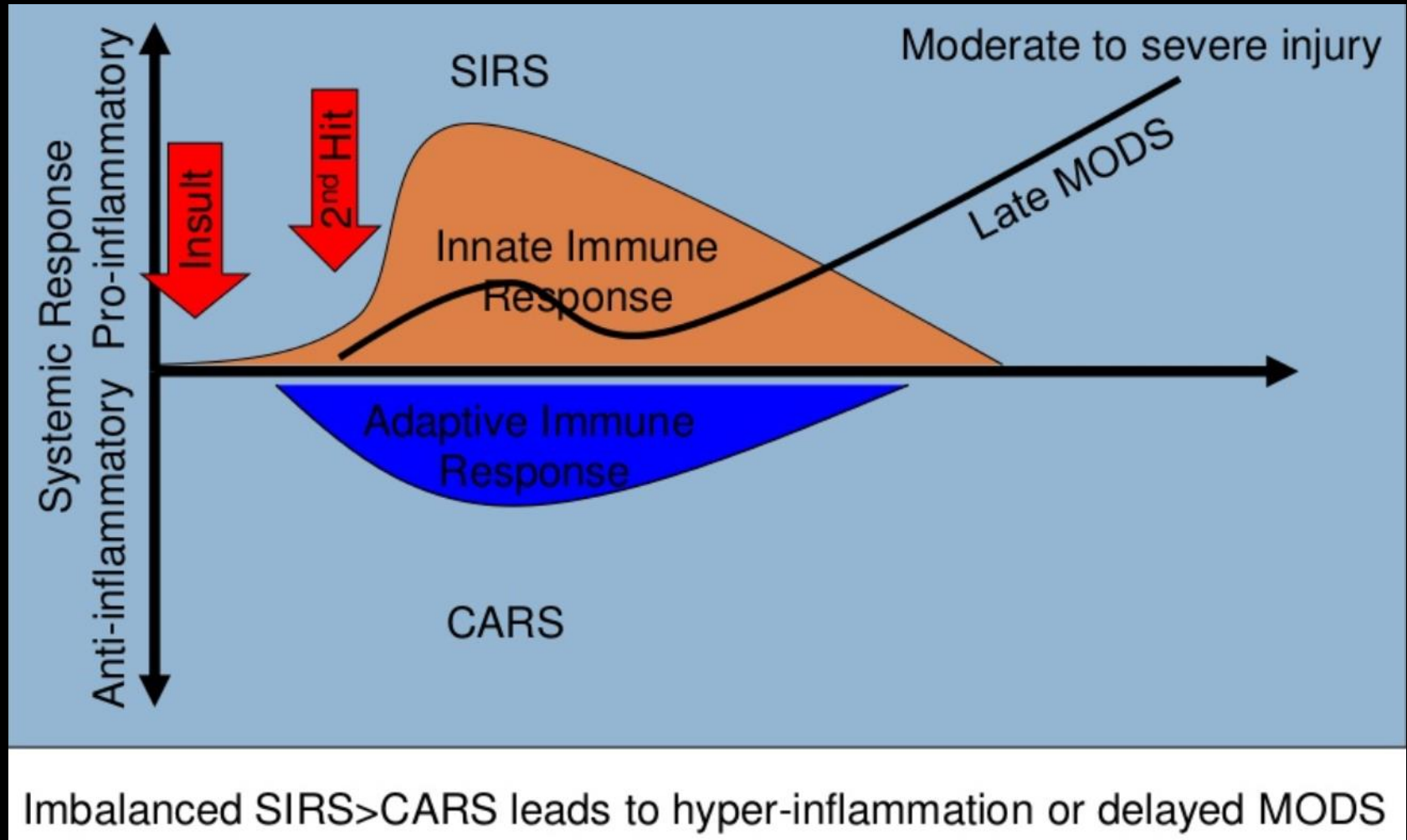


Balanced immunological response



Homeostasis is any self-regulating process by which an organism tends to maintain stability while adjusting to conditions that are best for its survival

Imbalanced immunological response

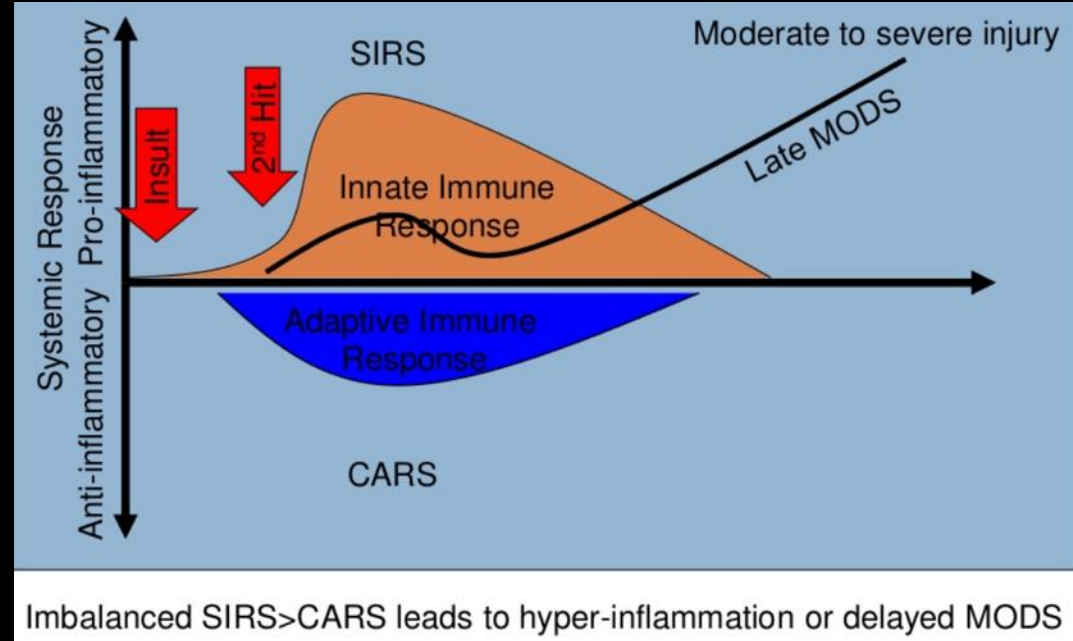


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2nd Hit

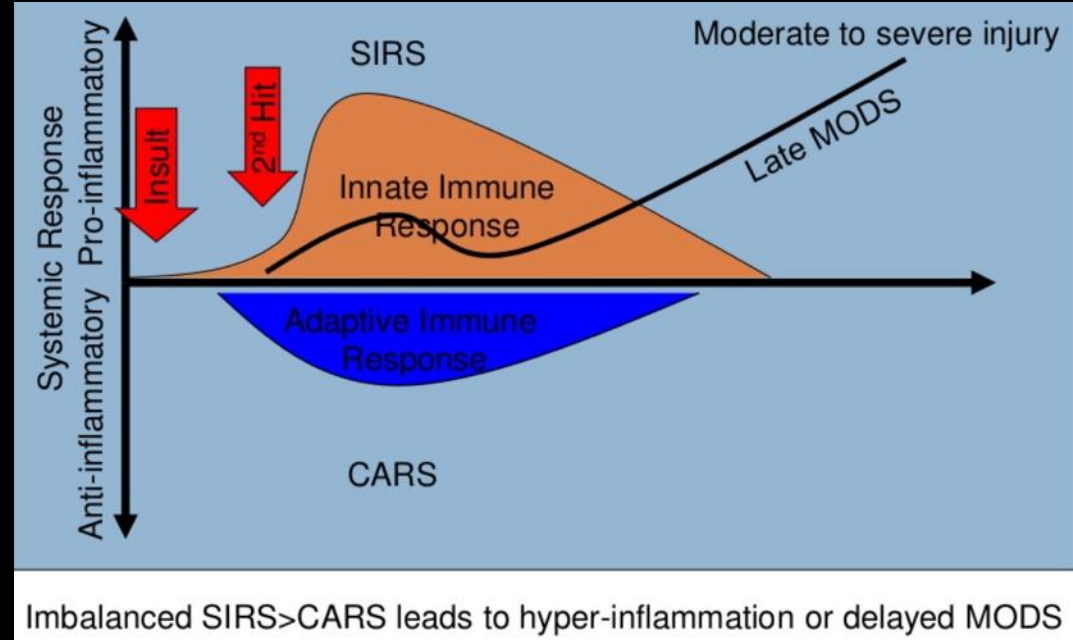
What is the 2nd hit?

- Surgery
- Hypothermia,
- Hemodynamic shock - Acidosis - coagulopathy
- Ischæmic
- Contaminating
- Unstable fraktur
- Pain



2nd Hit

Consequence



Increased immune response → release of mediators and cytokines → adherence of neutrophils to endothelium → damage endothelium of blood vessels → loss of barrier function in the lungs and in other organs → ARDS and multiple organ failure (MOF)

Case - example

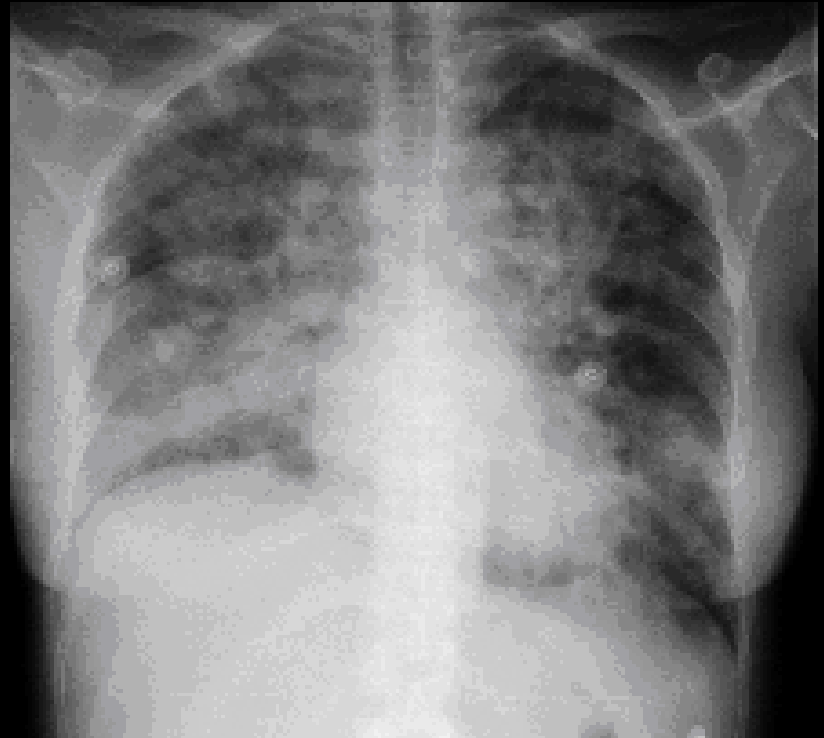
36-year-old woman, MC crash

- Left femur fracture, Multiple rib fractures

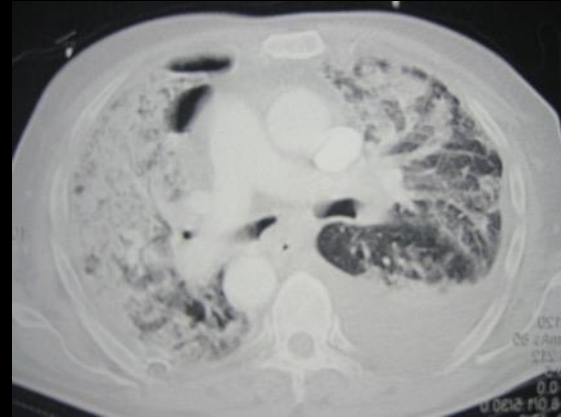
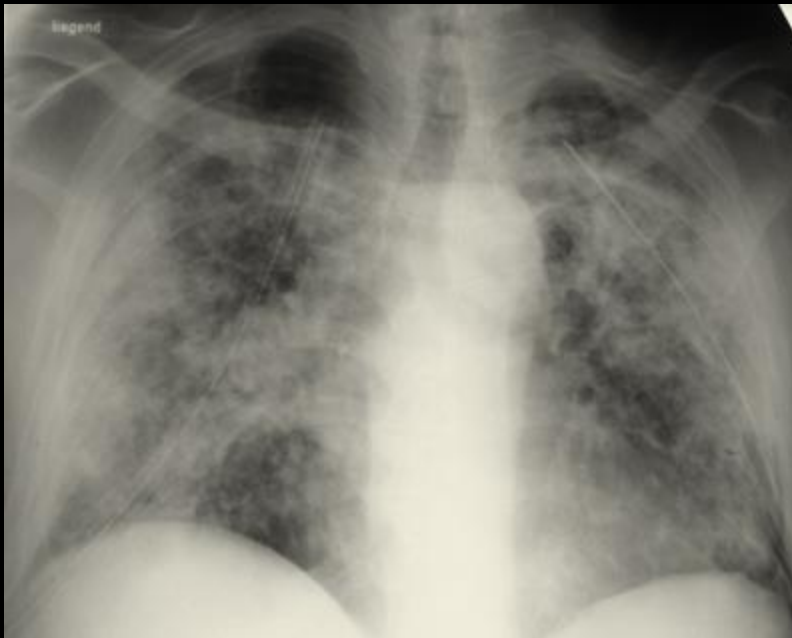


Case - example

- Day 1 - ETC with a reamed nail
- Day 3 – Increasing respiratory insufficiency



ARDS





Orthopedic therapy for ARDS?

Prevention!

Who needs DCO?

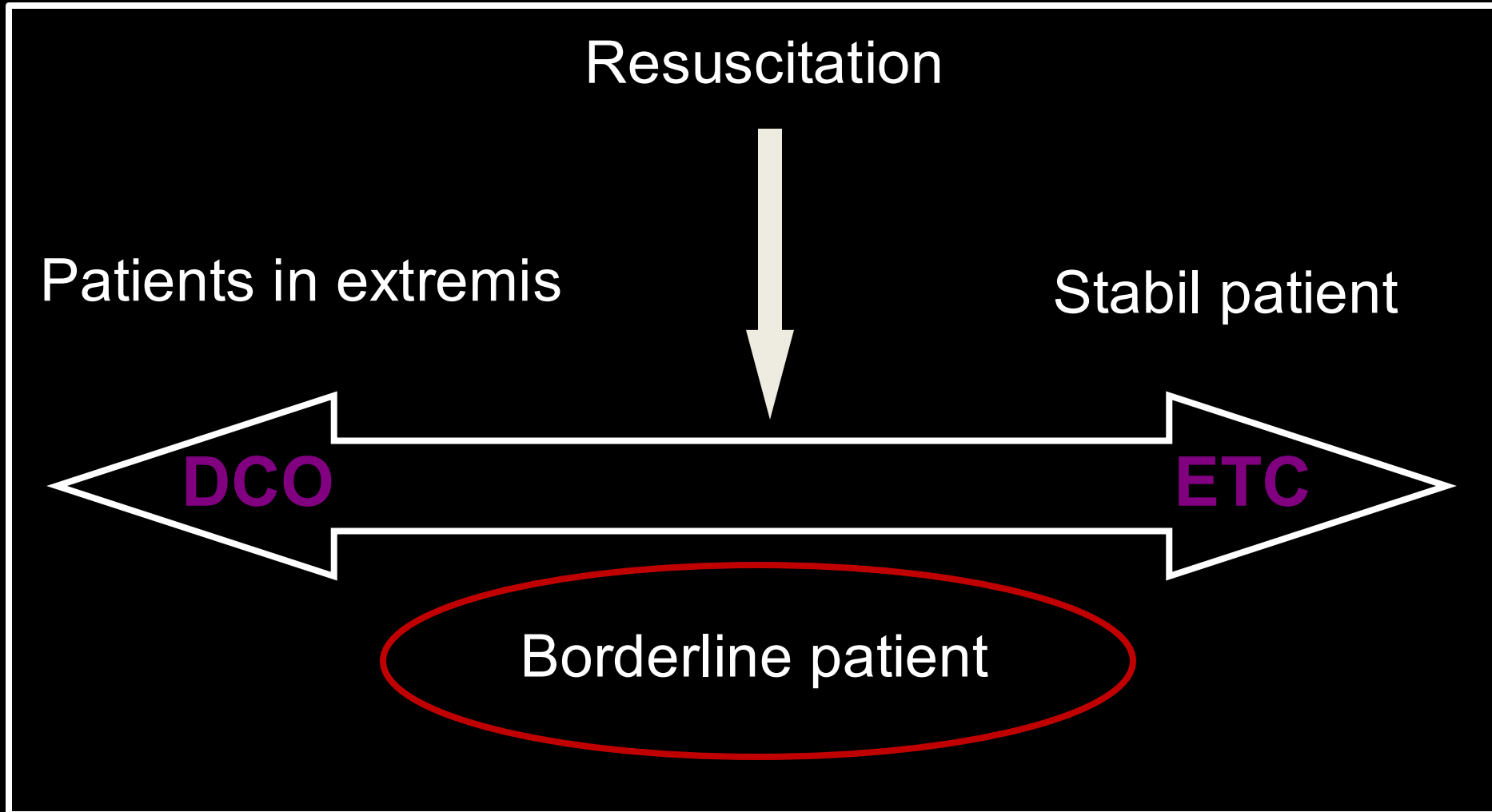


TABLE 1: The assessment of the four clinical grades with the corresponding range of clinical parameters (data from [26]).

	Parameter	Stable (grade I)	Borderline (grade II)	Unstable (grade III)	In extremis (grade IV)
Shock	BP (mmHg)	≥ 100	80–100	60–90	< 50 –60
	Blood units (2 h)	0–2	2–8	5–15	> 15
	Lactate levels	Normal range	Approx 2.5	> 2.5	Severe acidosis
	Base deficit (mmol/L)	Normal range	No data	No data	> 6 –18
	ATLS classification	I	II–III	III–IV	IV
	UO (mL/h)	> 150	50–150	< 100	< 50
Coagulation	Platelet count ($\mu\text{g/mL}$)	> 110000	90000–110000	< 70000 –90000	< 70000
	Factor II and V (%)	90–100	70–80	50–70	< 50
	Fibrinogen (g/dL)	> 1	Approx 1	< 1	DIC
	D-Dimer	Normal range	Abnormal	Abnormal	DIC
Temperature		$> 35^\circ\text{C}$	33 – 35°C	30 – 32°C	30°C or less
Soft tissue injuries	Lung function, PaO ₂ /FiO ₂	> 350	300	200–300	< 200
	Chest trauma scores, AIS	AIS I or II	$\text{AIS} \geq 2$	$\text{AIS} \geq 2$	$\text{AIS} \geq 3$
	TSS	O	I–II	II–III	IV
	Abdominal trauma (moore)	$\leq \text{II}$	$\leq \text{III}$	III	$\geq \text{III}$
	Pelvic trauma (AO classification)	A	B or C	C	C (crush, rollover with abd trauma)
	Extremities	AIS I or II	AIS II–III	AIS III–IV	Crush, rollover, extremities

Abbreviations: BP: blood pressure, ATLS: advanced trauma life support, UO: urine output, TTS: thoracic trauma score, AIS: abbreviated injury scale, DIC: disseminated intravascular coagulation.

H. C. Pape, P. V. Giannoudis, C. Krettek, and O. Trentz, “Timing of fixation of major fractures in blunt polytrauma: role of conventional indicators in clinical decision making,” *Journal of Orthopaedic Trauma*, vol. 19, no. 8, pp. 551–562, 2005.

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	Chest trauma scores, AIS	AIS I or II	AIS ≥ 2	AIS ≥ 2	AIS ≥ 3
	TSS	0	I–II	II–III	IV
	Abdominal trauma (moore)	≤II	≤III	III	≥III
	Pelvic trauma (AO classification)	A	B or C	C	C (crush, rollover with abd trauma)
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Thorax AIS >2

- 3 or more rib fractures
- Pneumo-/haemothorax
- Lung contusion

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Damage Control Orthopaedic

– A concept

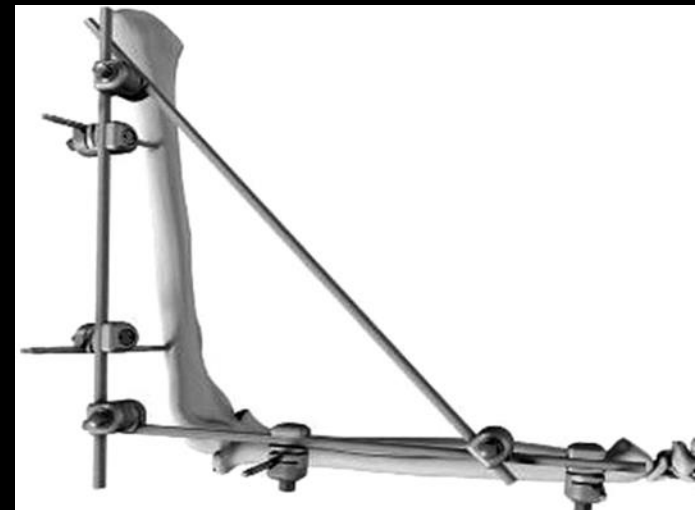
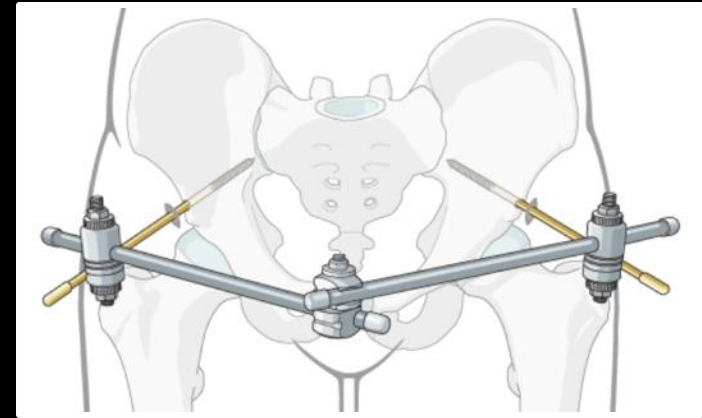
- **Stop the injury**
 - Reduce luxated joints
 - Debridement
 - Compartment syndrome
 - Stabilize bone and pelvic fracture



Damage Control Orthopaedic

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 - Stabilize bone and pelvic fracture
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 - External fixation, cast



Damage Control Orthopaedic

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 - Reduce luxated joints
 - Debridement
 - Compartment syndrome
 - Stabilize bone and pelvic fracture
- Stabilize fractures
 - External fixation, cast
- Stabilize the patient
 - Intensive care



Daily rounds in the intensive care unit

Core parameters:

- Central temperature
- Coagulation
- Arterial O₂
- Lactate
- Diuresis
- ICP
- Myoglobin



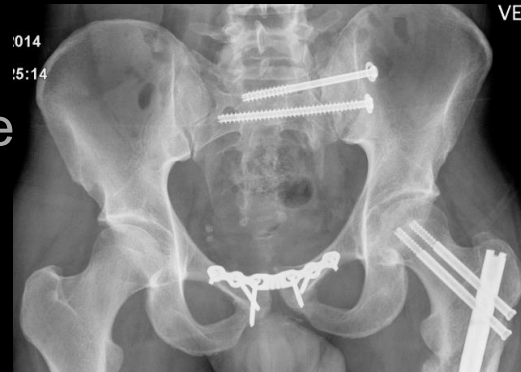
Talk to the intensivist.

- Explain the plan for definitive surgery and estimate the “second hit.”
- Is the patient physiologically ready

Damage Control Orthopaedic

– A concept

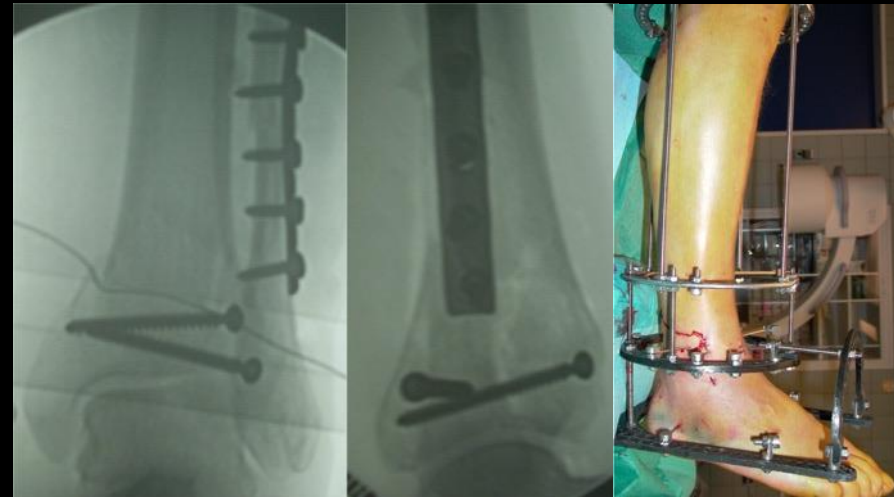
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 - Reduce luxated joints
 - Debridement
 - Compartment syndrome
 - Stabilize bone and pelvic fracture



- **Stabilize fractures**
 - External fixation, cast

- **Stabilize the patient**
 - Intensive care

- **Definitive surgery**
 - When the patient is ready
 - The right surgeon



Take home

- DCO is a concept
 - Stop the injury
 - Stabilize fractures
 - Stabilize the patient, and then
 - Definitive surgery
- Why do DCO
 - To minimize 2nd Hit
- When to do DCO
 - In all unstable trauma patients.



