

Damage Control Orthopaedics (DCO)

Hvad, hvorfor og hvornår



AO trauma course

Advanced principles of fracture management

24-26/4-2024

Jeppe Barckman

Formål

- Damage Control Orthopedics (DCO)
 - Hvad er DCO
 - Hvorfor skal vi anvende DCO
 - Hvornår skal vi anvende DCO
- Identificere patienter der tåler Early Total Care (ETC)
- Timing af final (definitiv) kirurgi
 - Hvordan finder vi ud af det bedste tidspunkt til definitiv kirurgi

35-årig mand - MC ulykke



Modtagelse

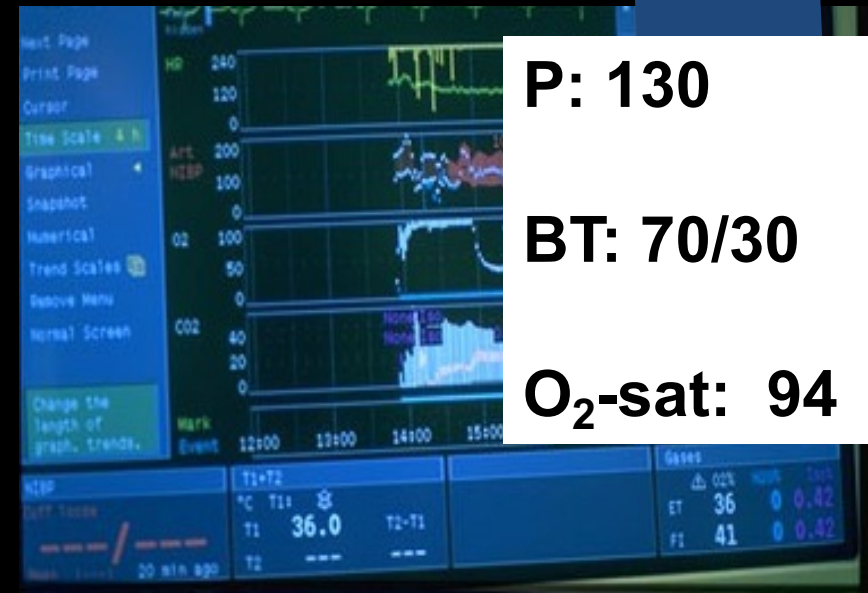
A: Intuberet

B: Sat 94

C: Massiv transfusions
protokol begyndt.

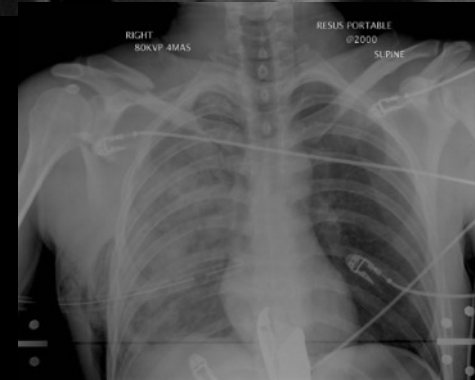
D: GCS 3 (intuberet,
sederet).

E: Flere åbne
ekstremitetsfrakturer



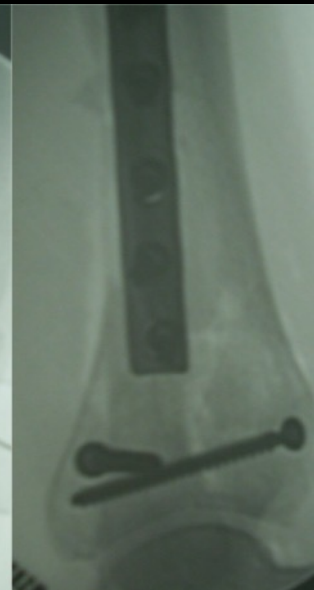
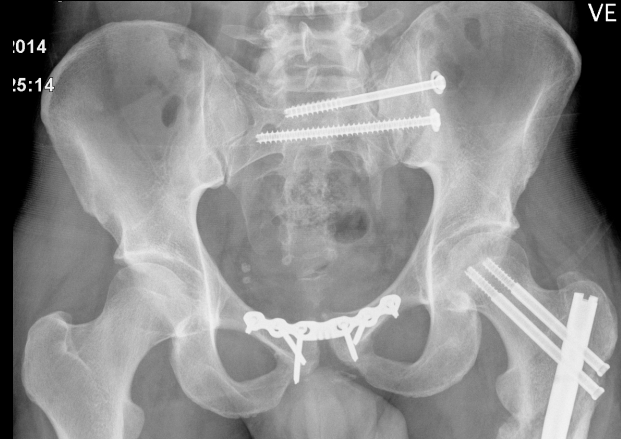
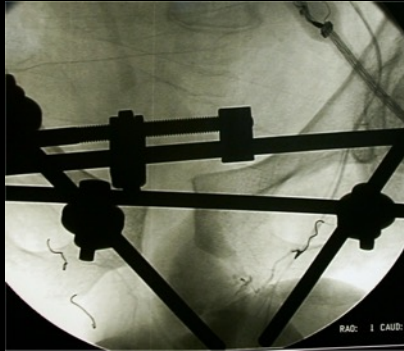
Modtagelse

- A: Intuberet
- B: Sat 98 - lungekontusion
- C: Massiv transfusion- nu stabil.
- D: GCS 3 (intuberet, sederet).
- E: Flere åbne ekstremitetsfrakturer

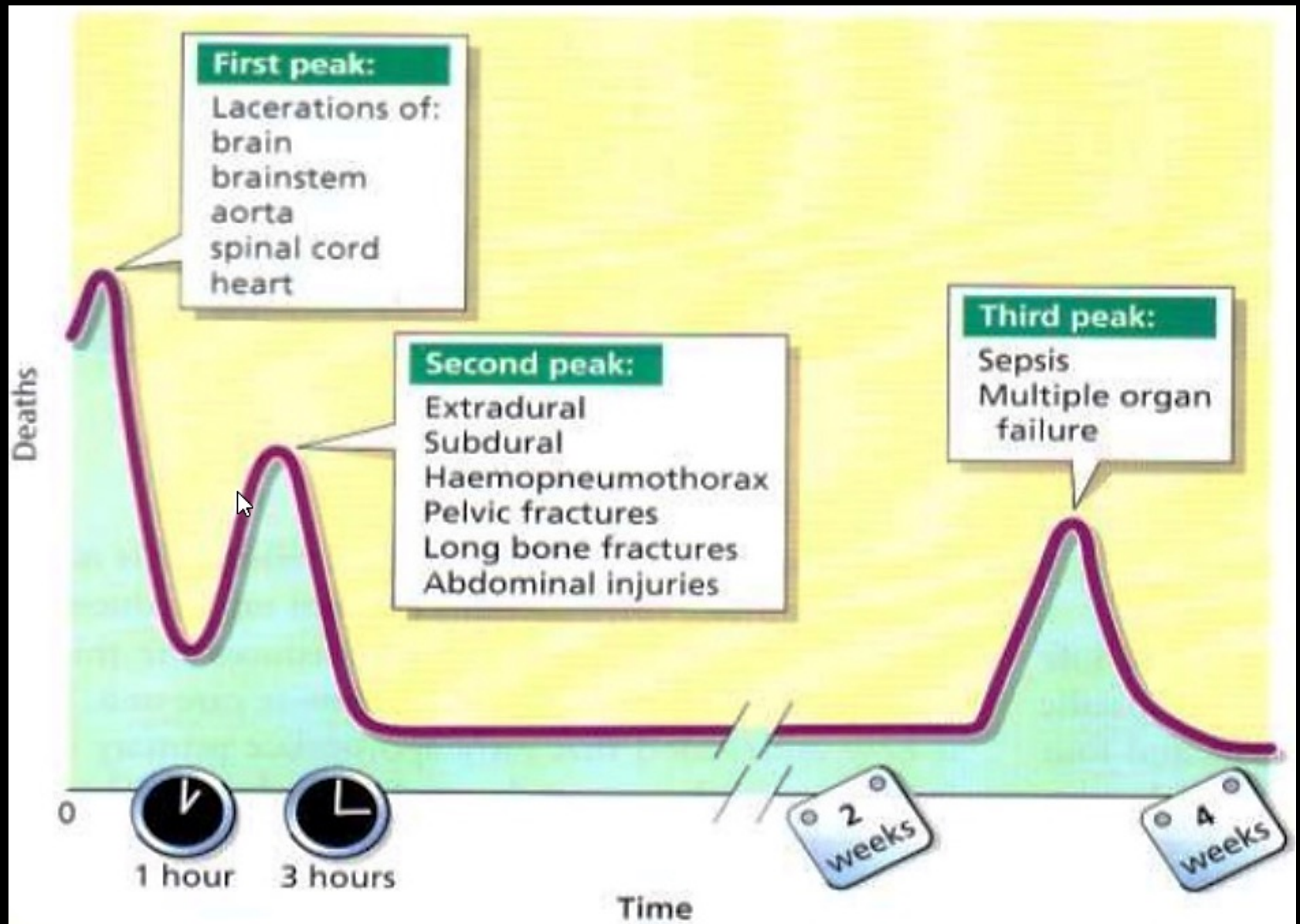


Hvad nu?

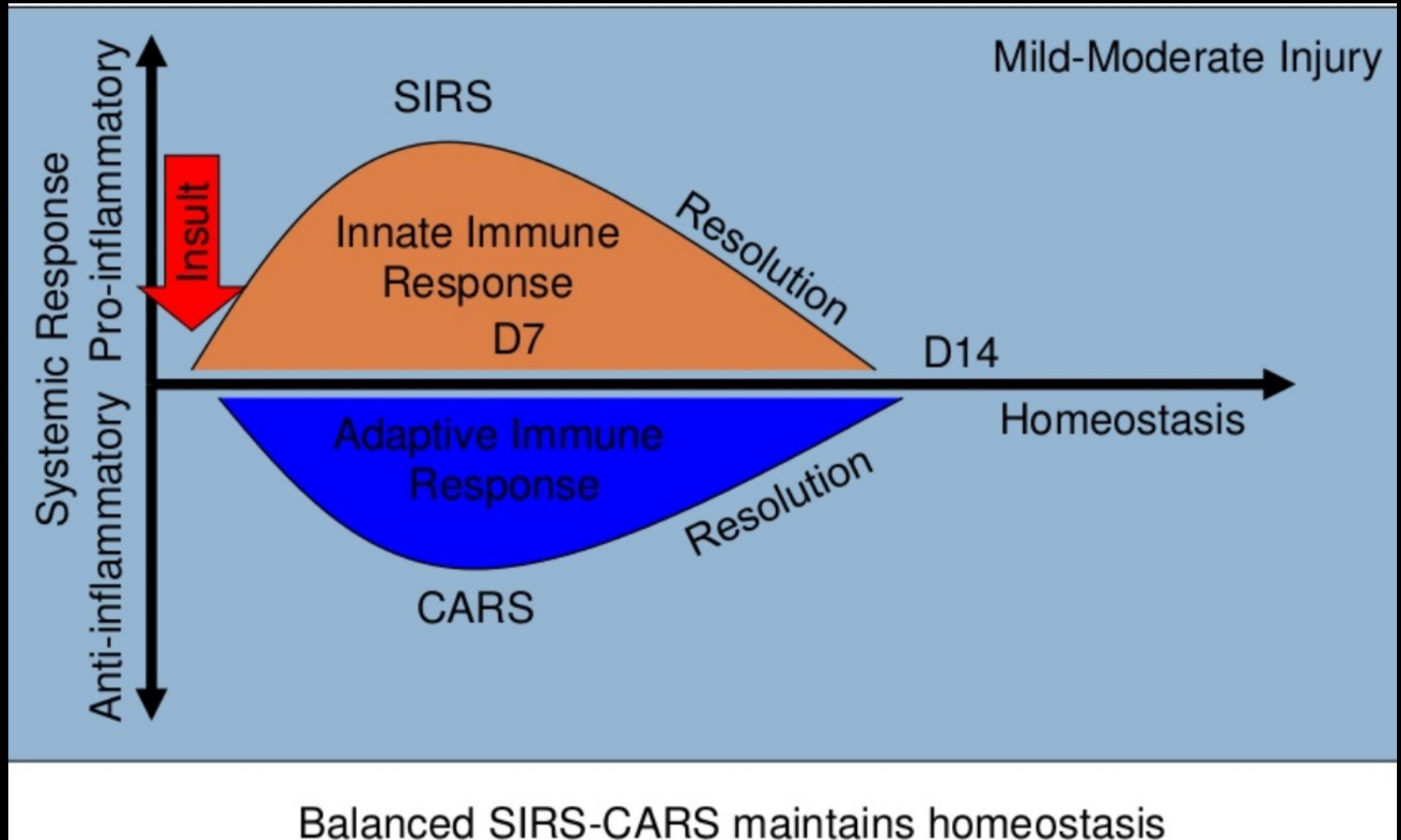
Damage Control Orthopedics vs. Early Total Care



"dødskurve" ved traume

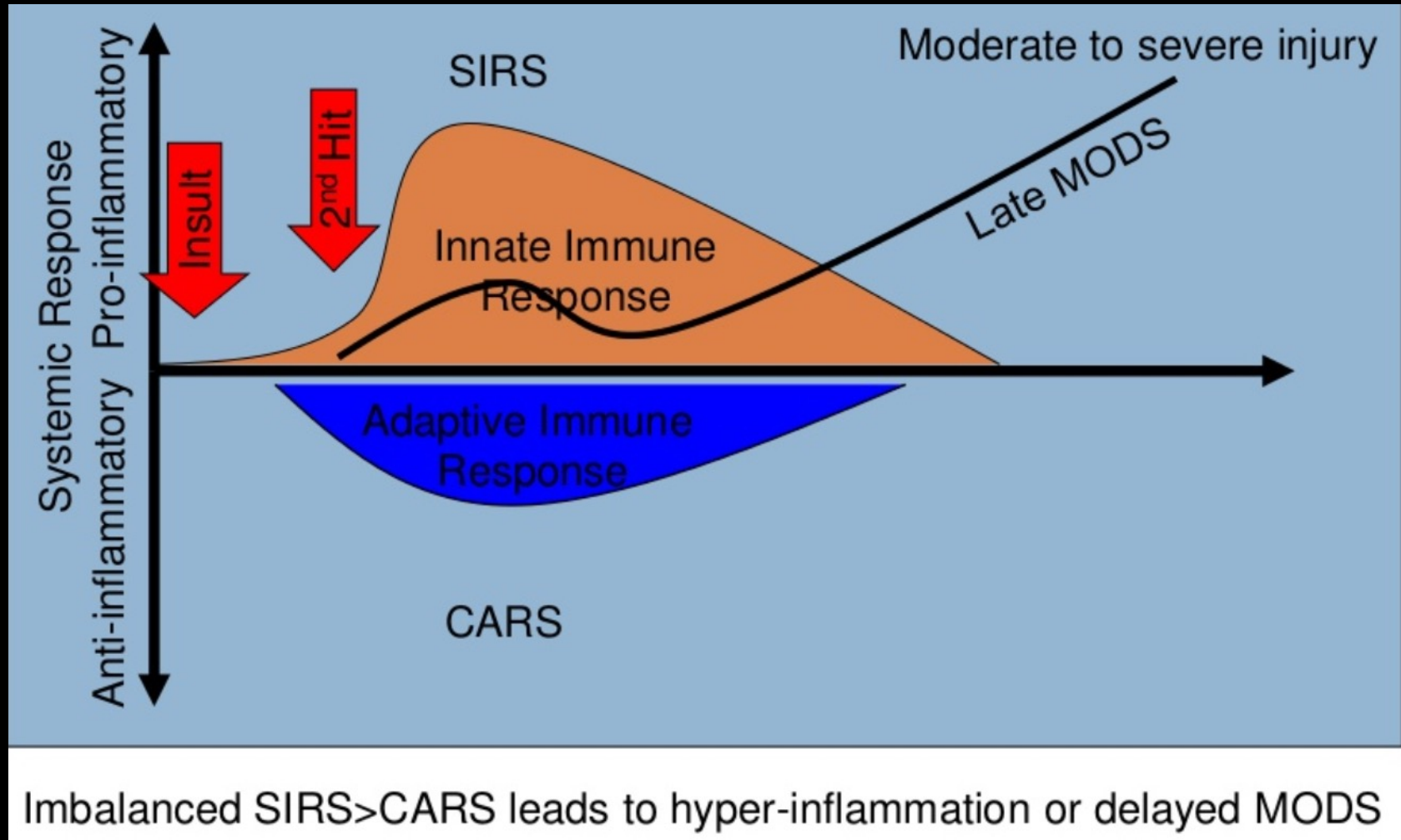


Balanced immunological response



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

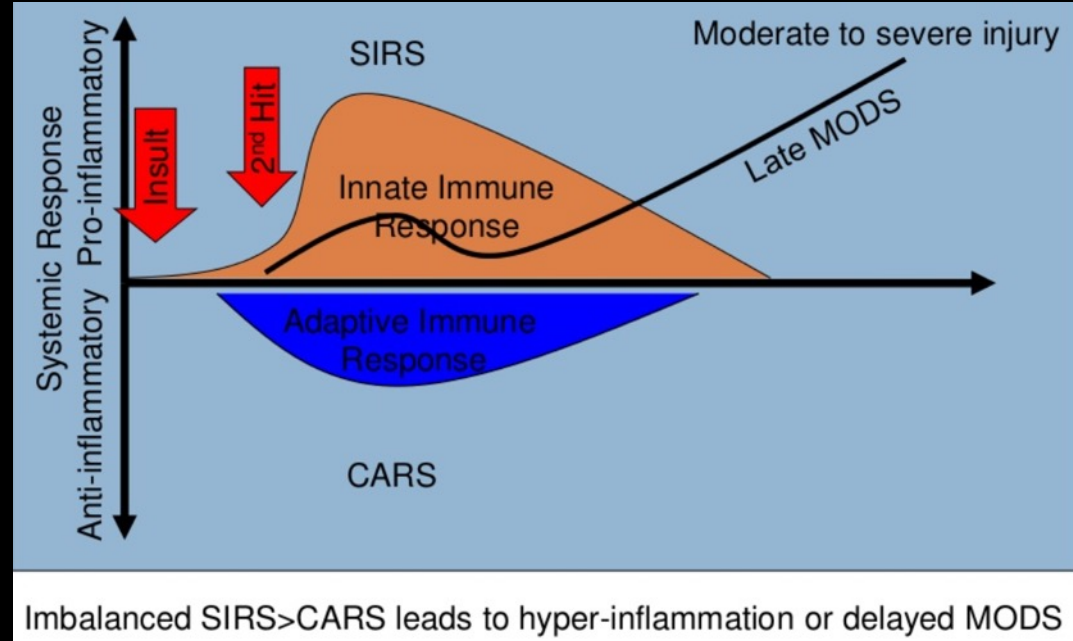


Homeostasis is any self-regulating process by which an organism tends to maintain stability while adjusting to conditions that are best for its survival

2nd Hit

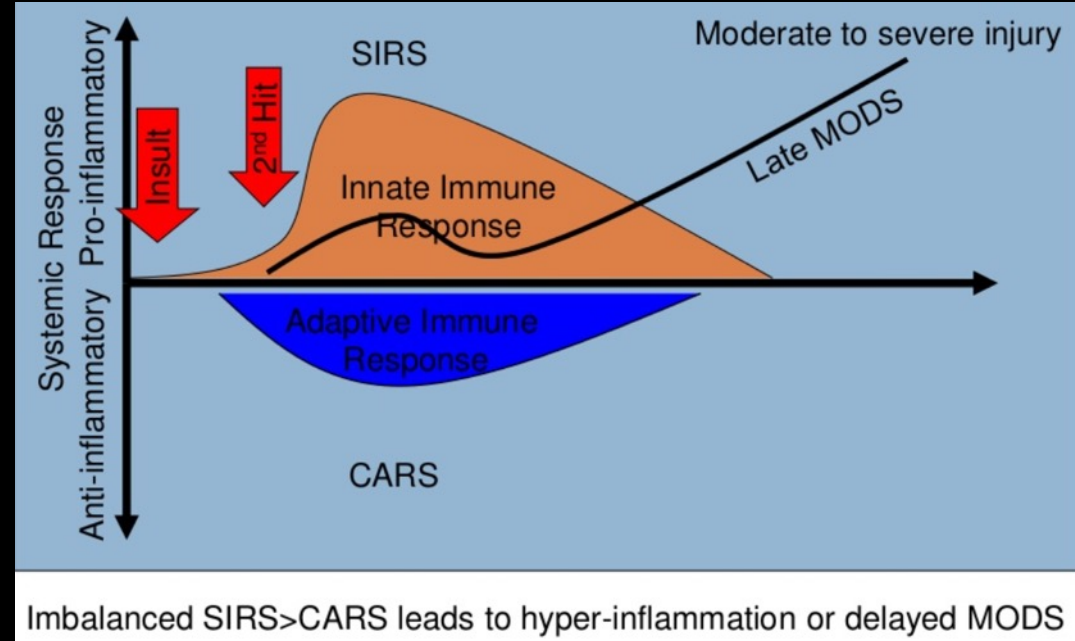
Årsager øget immunologisk respons

- Kirurgi
- Hypotermi,
- Hæmodynamisk shock - Acidosis - coagulopathy
- Iskæmi
- Kontaminering
- Ustabil fraktur
- Smerte



2nd Hit

Mulig konsekvens

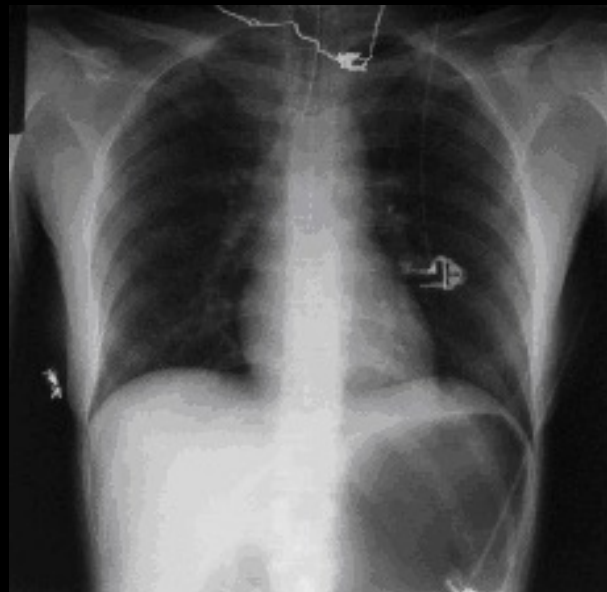


Increased immune response → release of mediators and cytokines → adherence of neutrophils to endothelium → damage endothelium of blood vessels → loss of barrier function in the lungs and in other organs → ARDS and multiple organ failure (MOF)

Case - eksempel

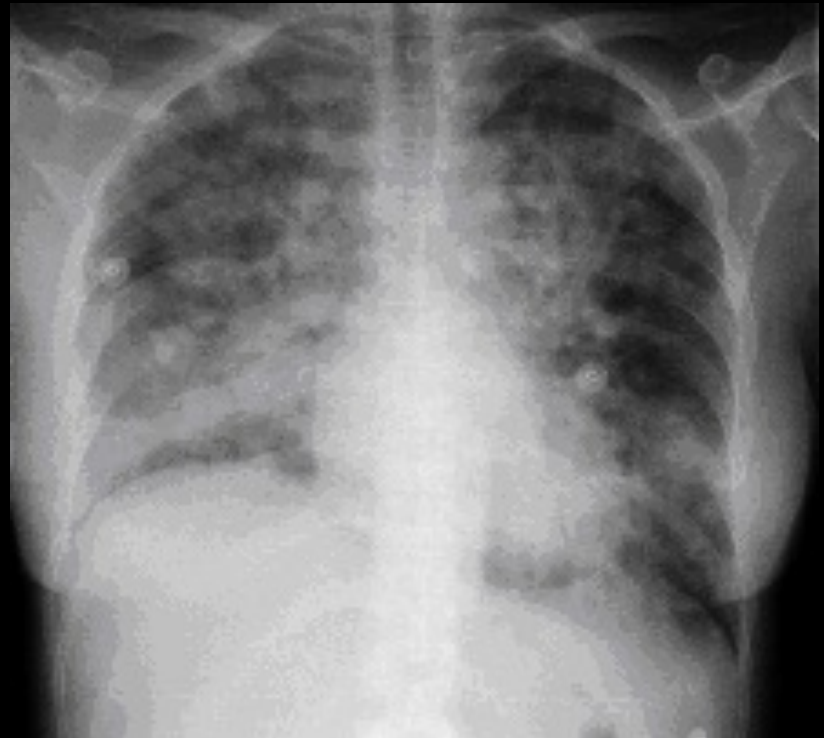
36 årig kvinde, MC ulykke

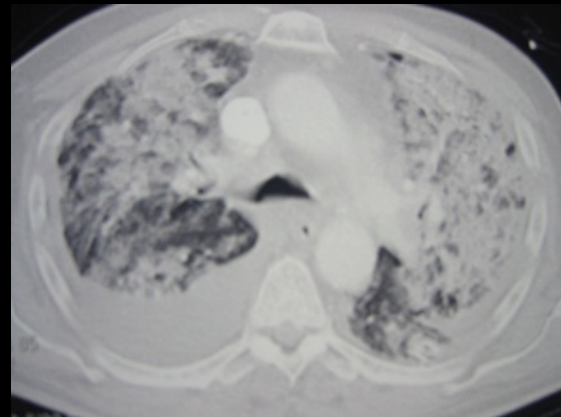
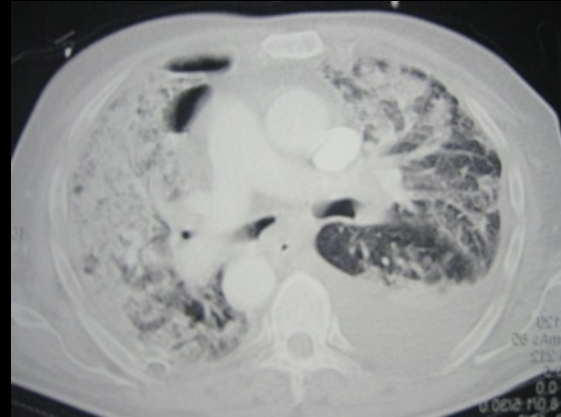
- Venstre crus fraktur, costafrakstur og mindre lungekontusion



Case - eksempel

- ETC med marvsøm dag 1
- Tiltagende respirations insufficiens dag 3







Orthopedic therapy for ARDS?

Prevention!

Hvem skal behandles med DCO?

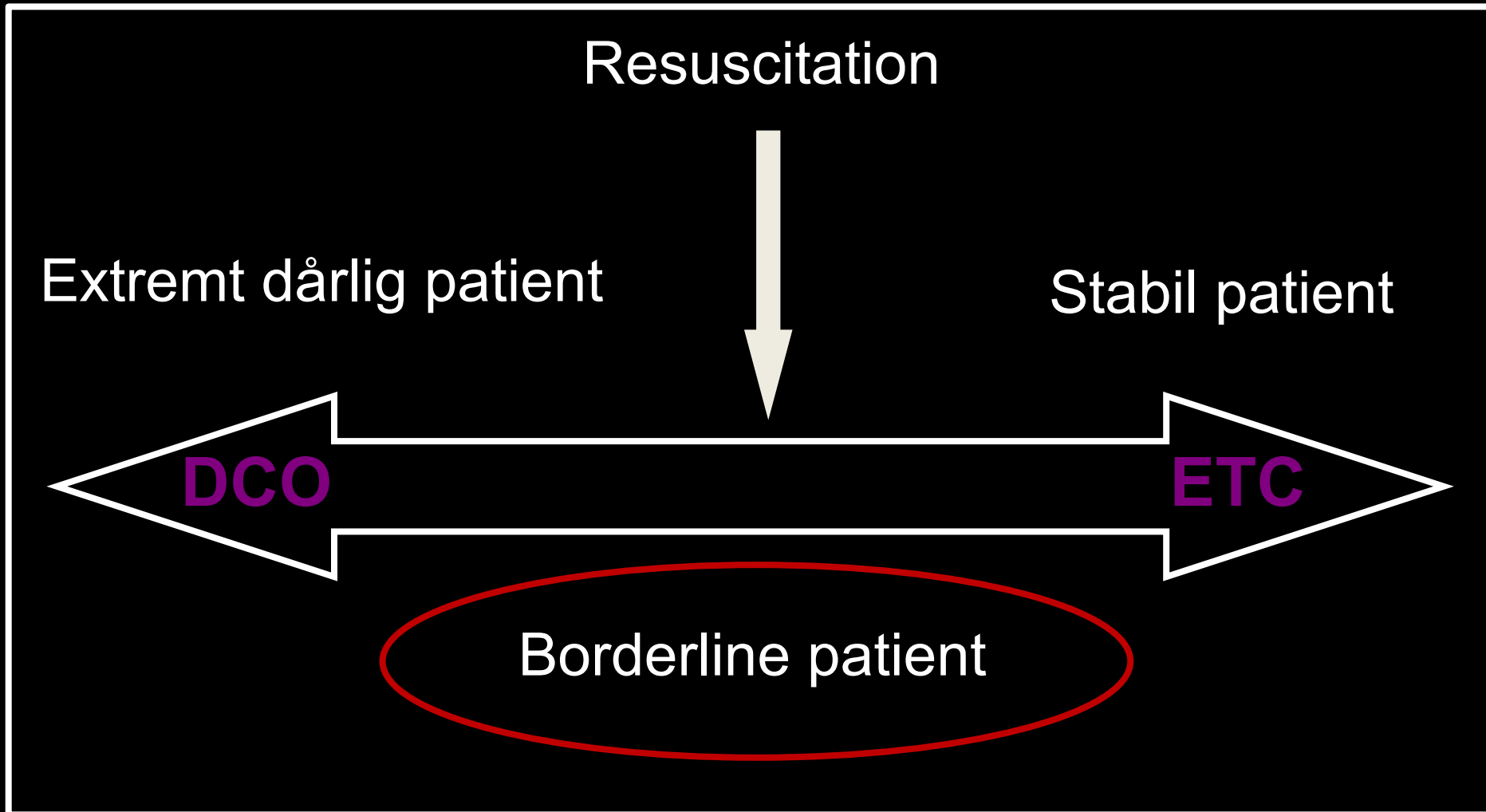


TABLE 1: The assessment of the four clinical grades with the corresponding range of clinical parameters (data from [26]).

	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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	D-Dimer	Normal range	Abnormal	Abnormal	DIC
Temperature		>35°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	AIS ≥ 2	AIS ≥ 2	AIS ≥ 3
	TSS	O	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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Soft tissue injuries	Lung function, PaO ₂ /FiO ₂	>350	300	200–300	<200
	Chest trauma scores, AIS	AIS I or II	AIS ≥ 2	AIS ≥ 2	AIS ≥ 3
	TTS	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 eller flere costafaktur
- Pneumo-/hæmothorax
- Lungekontusion

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Damage Control Orthopaedic

– Et koncept

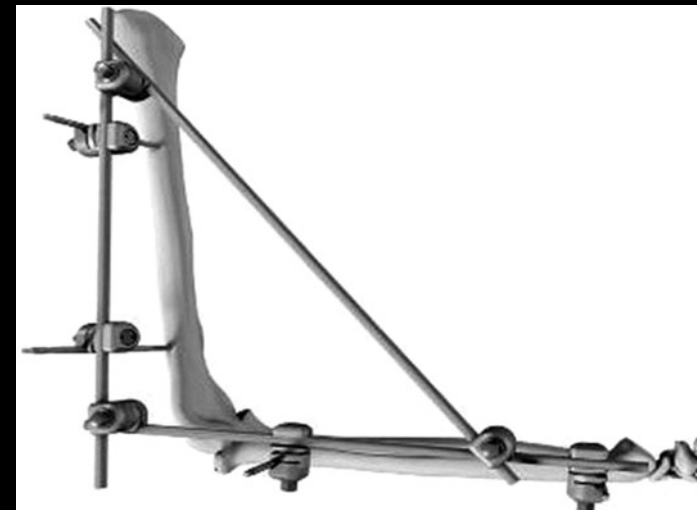
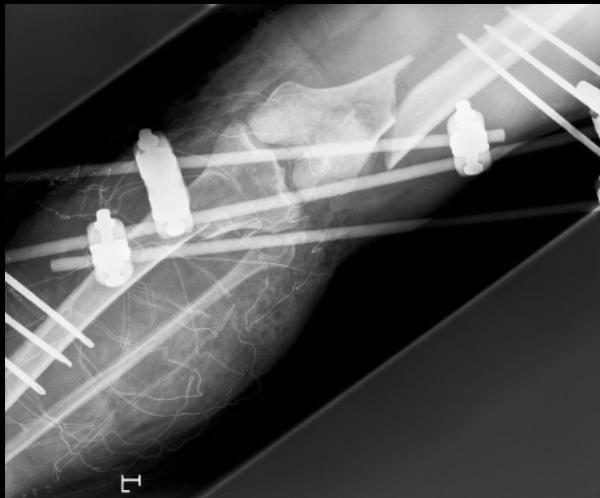
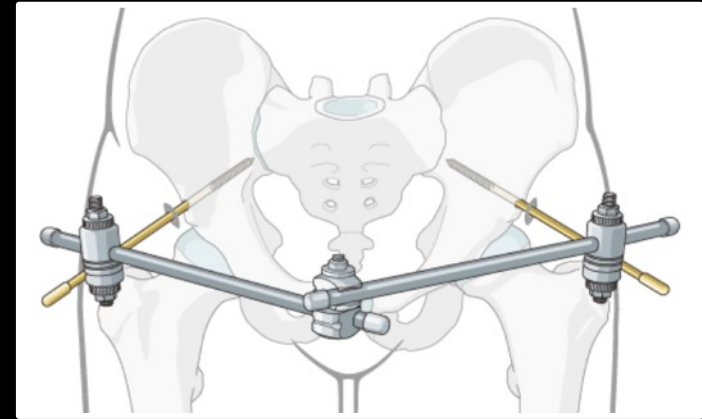
- **Stop skaden**
 - Reponere dislocerede led
 - Debridement af sår
 - Compartment syndrom
 - Stabilisere lange knogler / bækken



Damage Control Orthopaedic

– Et koncept

- **Stop skaden**
 - Reponere dislocerede led
 - Debridement af sår
 - Compartmet syndrom
 - Stabilisere lange knogler / bækken
- **Stabiliser frakturer**
 - ex. fix lange rørknogler / bækken



Damage Control Orthopaedic

– Et koncept

- Stop skaden
 - Reponere dislocerede led
 - Debridement af sår
 - Compartmet syndrom
 - Stabilisere lange knogler / bækken
- Stabiliser frakturer
 - ex. fix lange rørknogler / bækken
- Stabiliser patienten
 - Intensiv



Daglig stuegang på Intensiv !

Kerneparametre:

- Central temperatur
- Koagulation
- Arteriel O₂
- Lactat
- Diurese
- ICP
- Myoglobin



Gennemgå sammen med intensivlæge

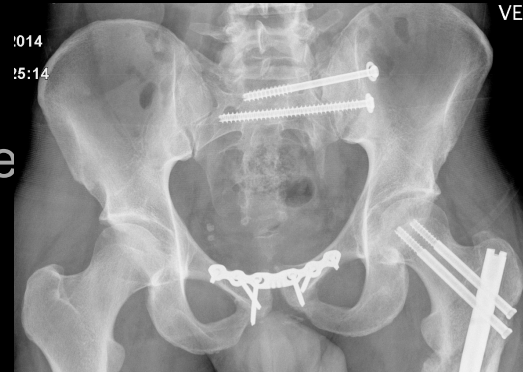
- forklar dine overvejelser om videre kirurgi
- vurdere størrelsen af "second hit"

Damage Control Orthopaedic

– Et koncept

- Stop skaden

- Reponere dislocerede led
- Debridement af sår
- Compartmet syndrom
- Stabilisere lange knogler / bække



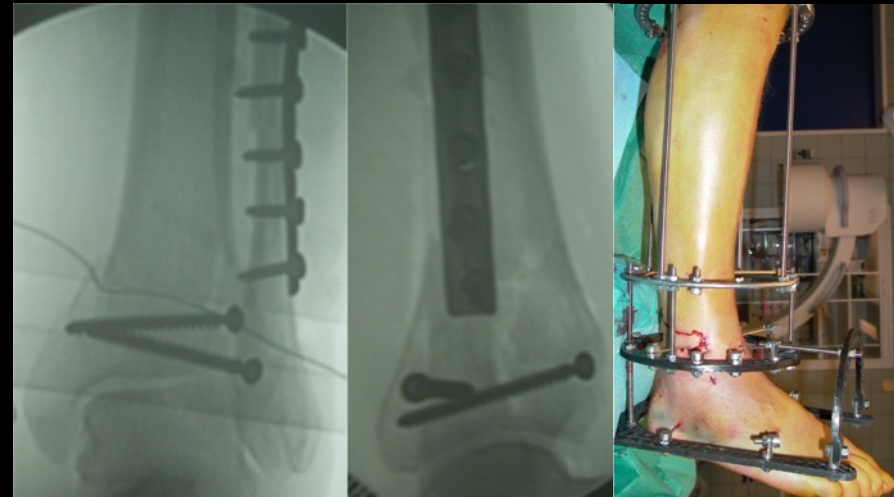
- Stabiliser frakturer

- ex. fix lange rørknogler / bækken

- Stabiliser patienten

- Definitiv kirurgi

- Når patienten er klar
- Den rigtige kirurg



Varighed, Træthed og Komplexitet

- Varighed af operationer er proportional med "second hit",
 - overvåg kerneparametre i samarbejde med anæstesi (lactat > 2)
- Træthed øger ikke den kirurgiske kvalitet
 - vær ærlig over for dig selv
- Vanskelige osteosynteser som kræver langvarig præ-operativ planlægning og særlig ekspertise



Take home

- DCO er et koncept
 - Stop skaden
 - Stabiliser frakturer
 - Stabiliser patienten
 - Definitiv kirurgi
- Hvorfor skal vi anvende DCO
 - For at beskytte pt. mod 2nd Hit
- Hvornår skal DCO anvendes
 - Ved alle ustabile patienter



