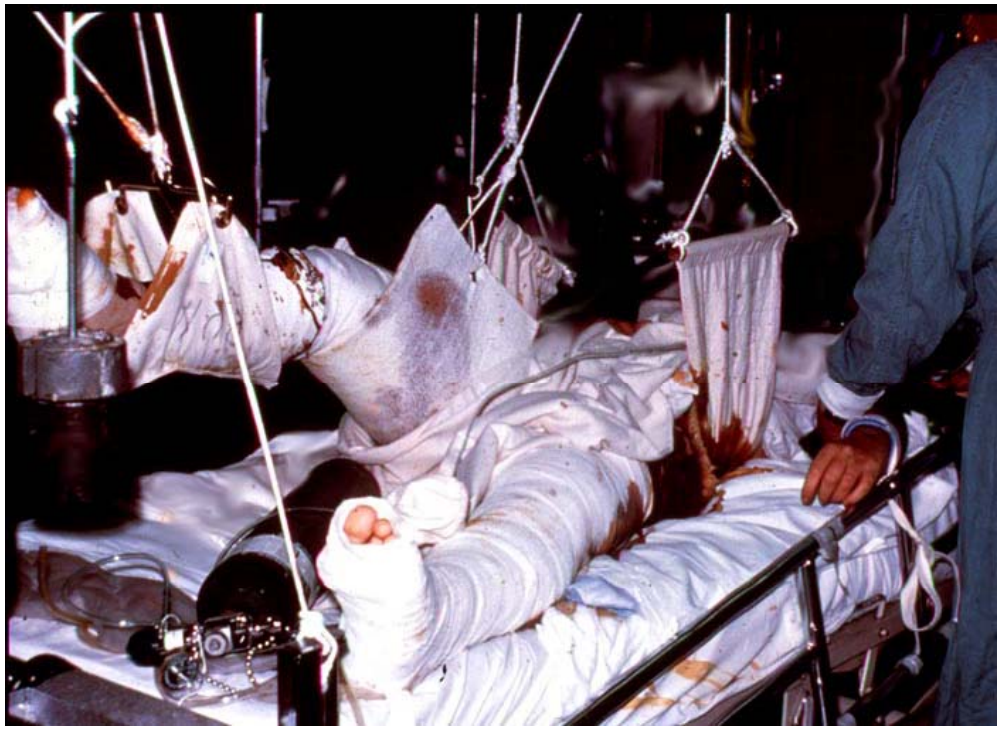


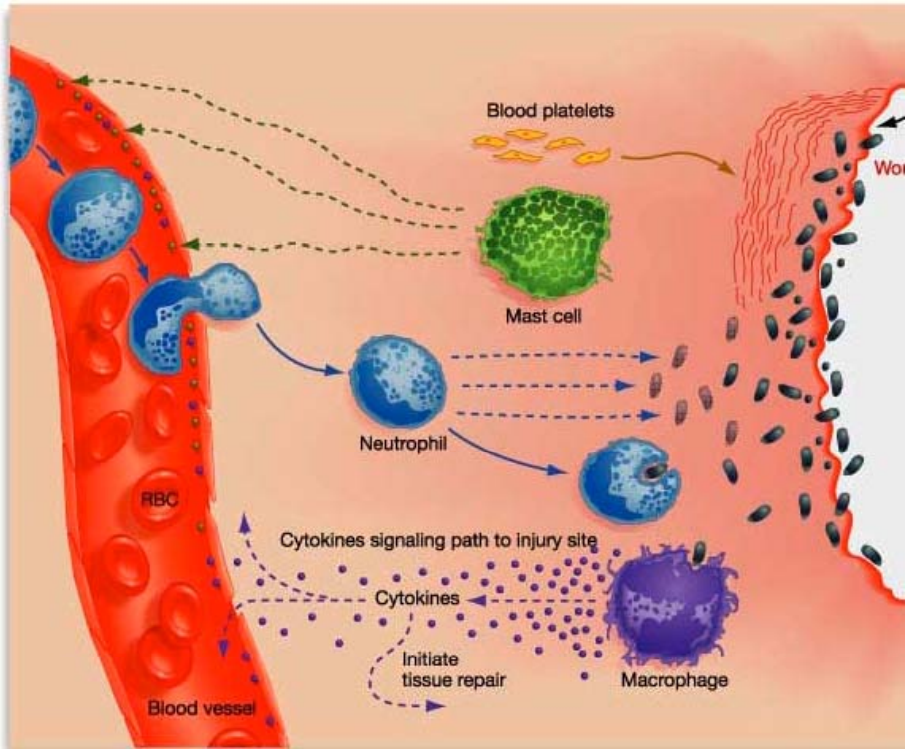
Multitraume og Damage Control

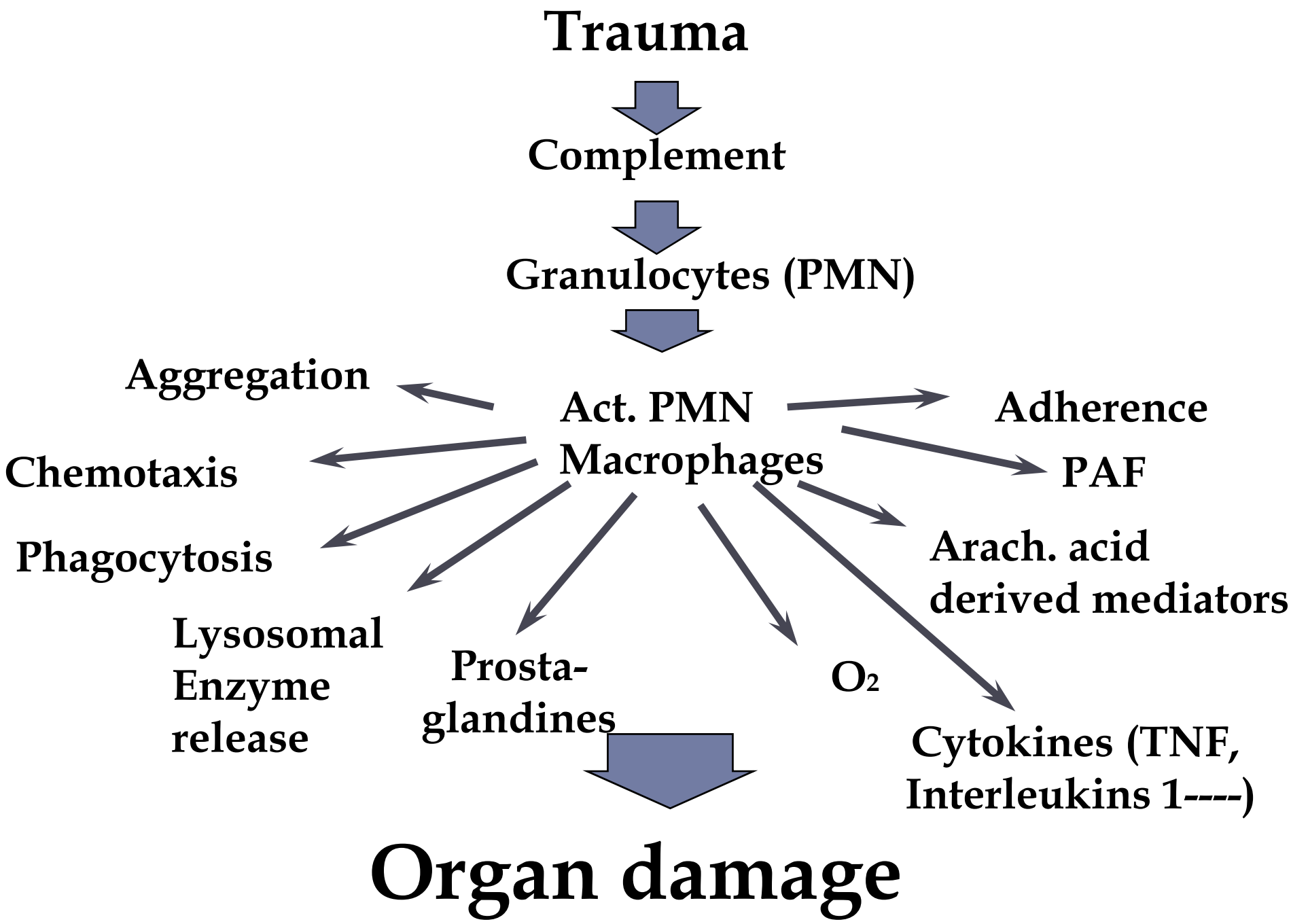
How to do no further harm

Polytrauma is a systemic disease !

Inflammation

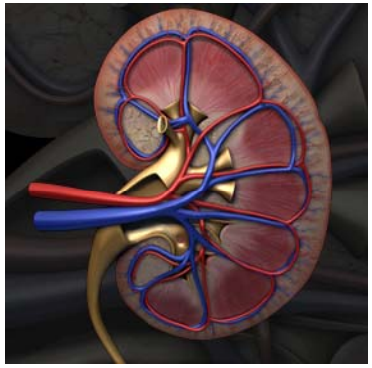
- Normally a local process
- Controlling and fighting down exogen bacterial and nonbacterial factors

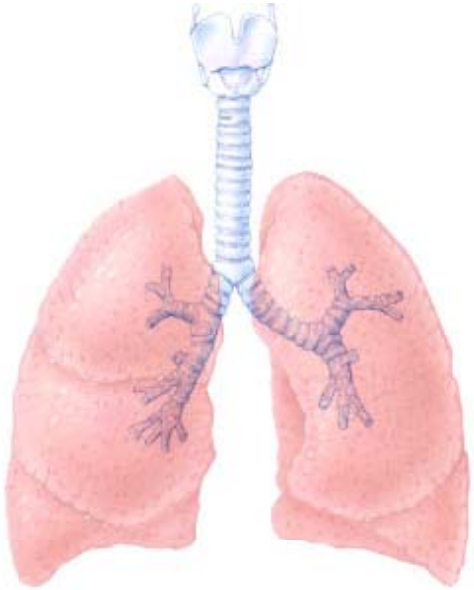


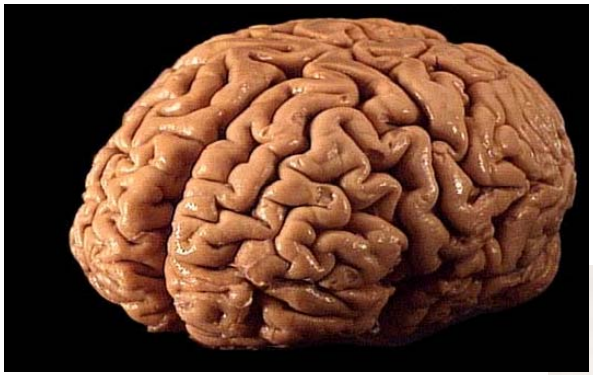

Trauma
Complement
Granulocytes (PMN)
Act. PMN
Macrophages
Aggregation
Chemotaxis
Phagocytosis
Lysosomal
Enzyme
release
Prosta-
glandines
O2
Cytokines (TNF,
Interleukins 1----)
Arach. acid
derived mediators
PAF
Adherence
Organ damage

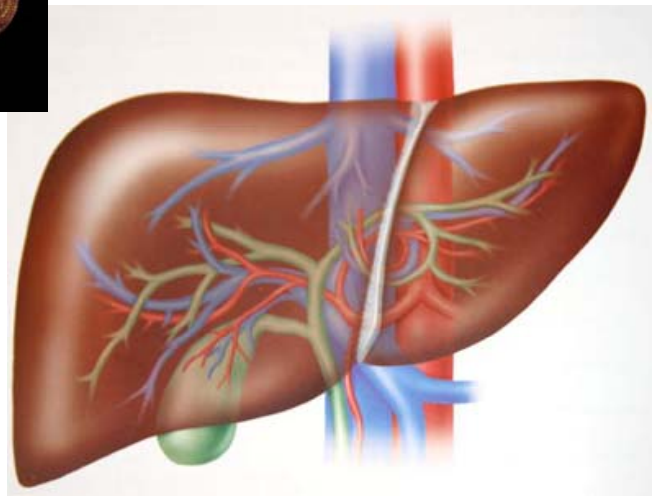
Target organs

- Lungs
- Kidneys
- Brain
- Liver
- Heart

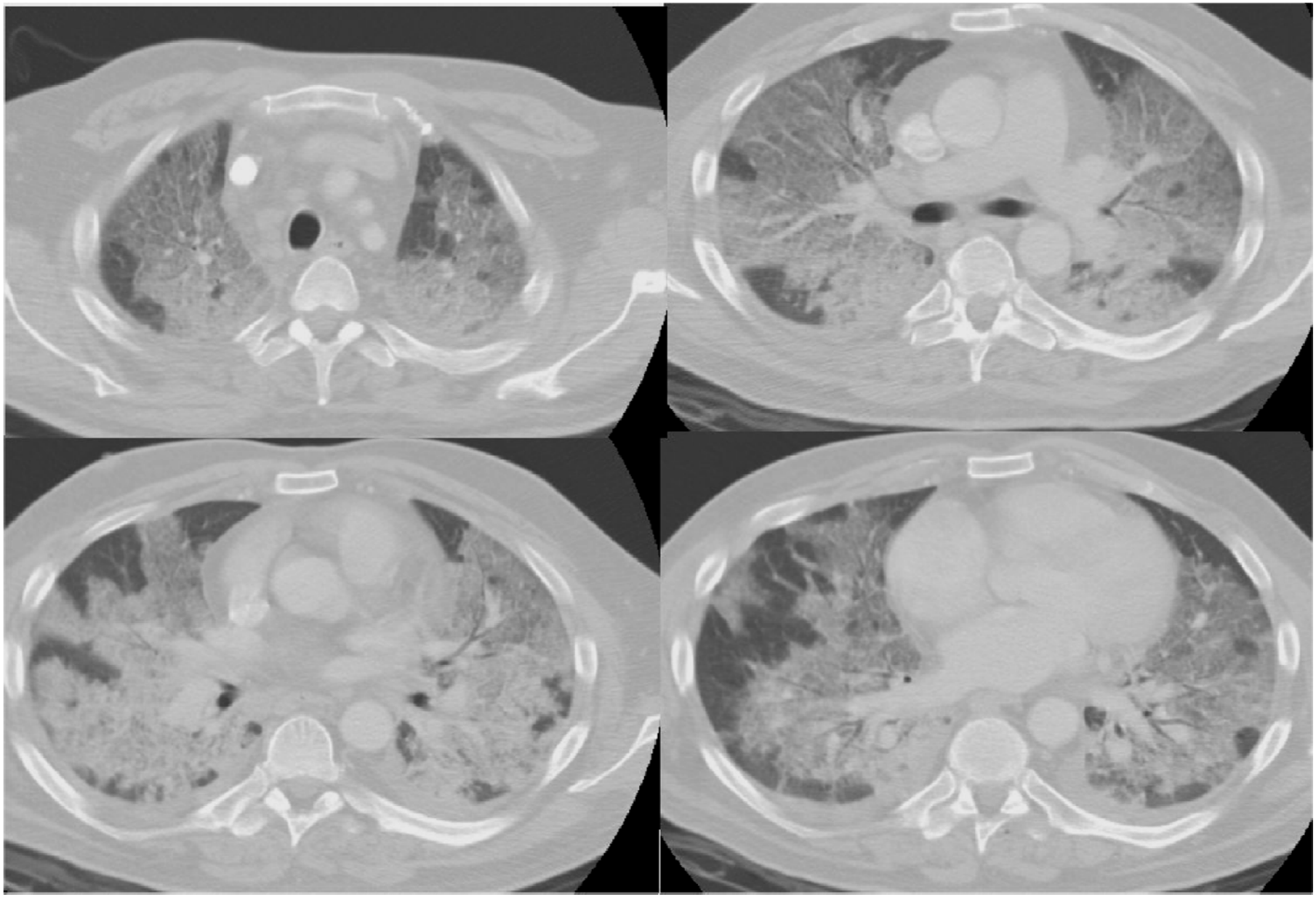








ARDS

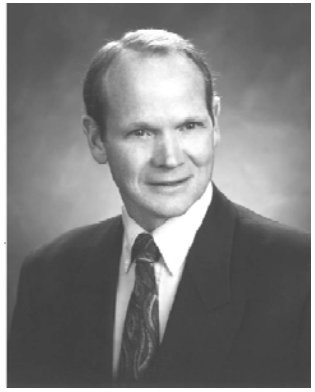


How to avoid or minimize SIRS

- Aggressive prevention and treatment of all conditions favoring development of SIRS
  - prevent shock
  - prevent hypoxia
  - prevent hypothermia
  - **early stabilization of fractures**
  - aggressive debridement of necrotic tissue

Frakturstabilisering – hvorfor?

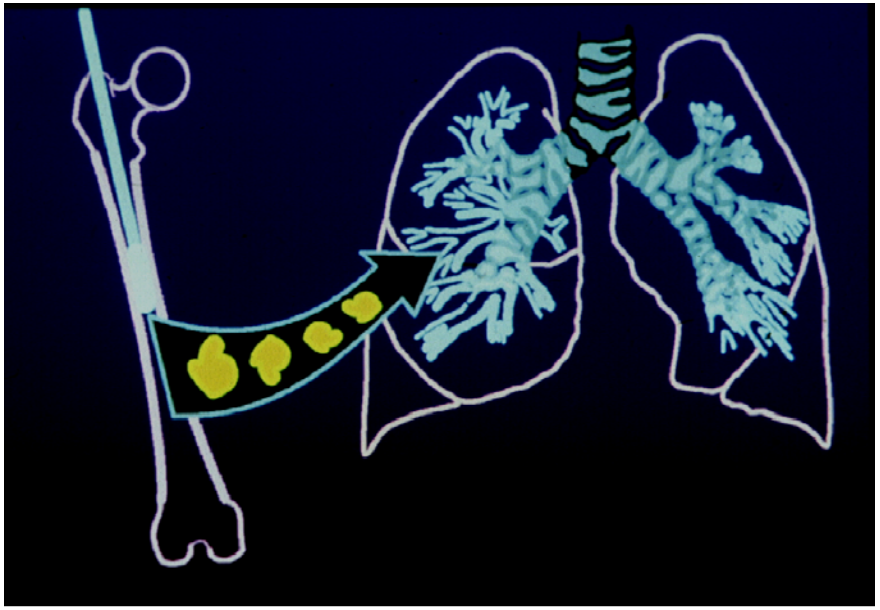
(Early v Delayed Stabilization of Femoral Fractures.
Bone, L et al: JBJS 1989)



- Flere pulmonale komplikationer ved sen osteosyntese (marvsøm) af femurfraktur
- Frakturer skal stabiliseres så tidligt som muligt, helst indenfor det første døgn – især ved multitraumatiserede patienter

1982	*Riska & Myllynen*
1982	*Goris et al.*
1985	*Seibel et al.*
1985	*Johnson et al.*
1989	*Bone et al.*

Early Total Care

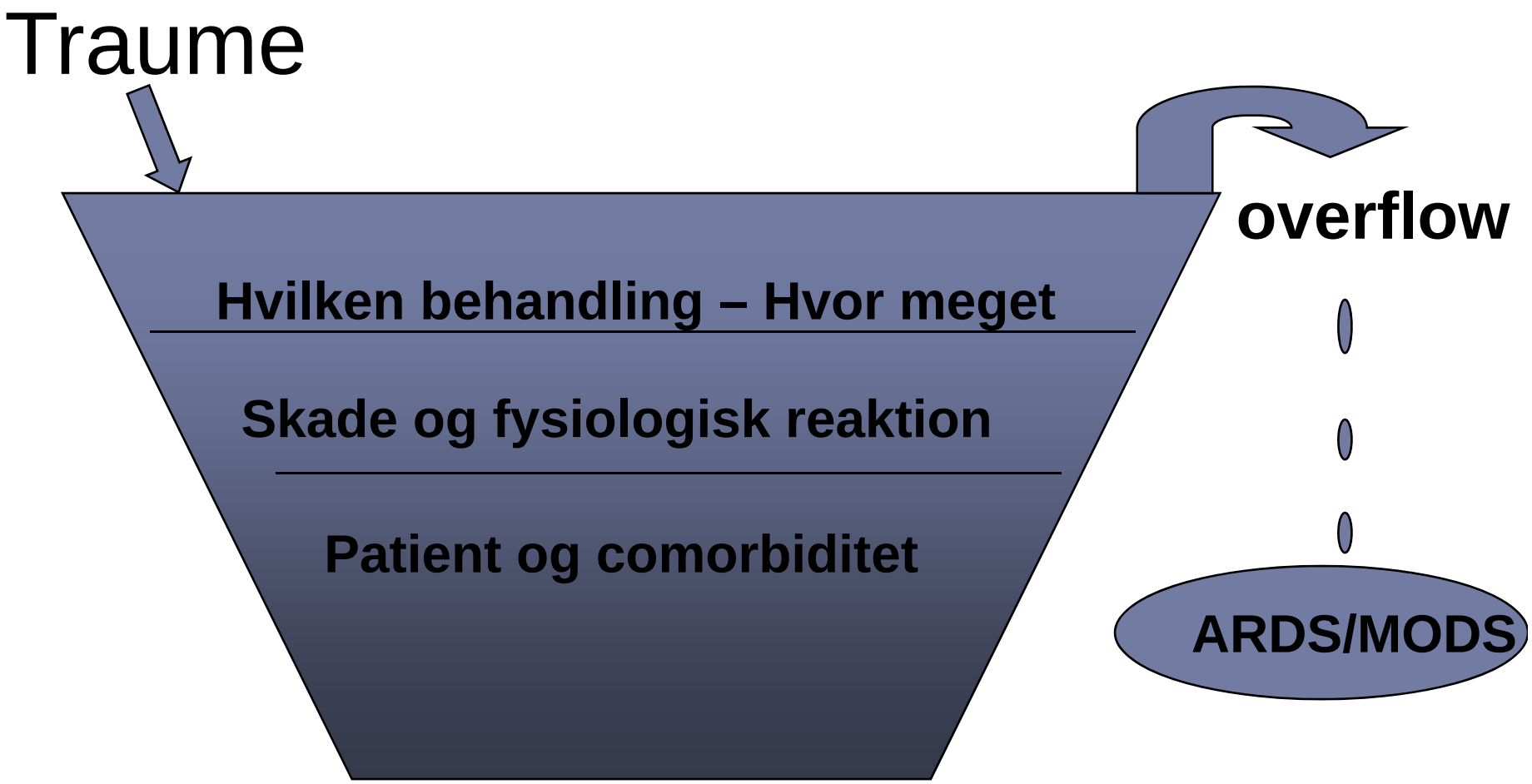


However…

- Can ETC lead to increased pulmonary complications and mortality in certain patient groups ??
  - Head and chest trauma, high ISS

Schüller W et al, 1986
Nast- Kolb D et al, 1990
Pelias ME et al, 1992
Pape HC et al, 1992, 1993
Carlson DA et al, 1998

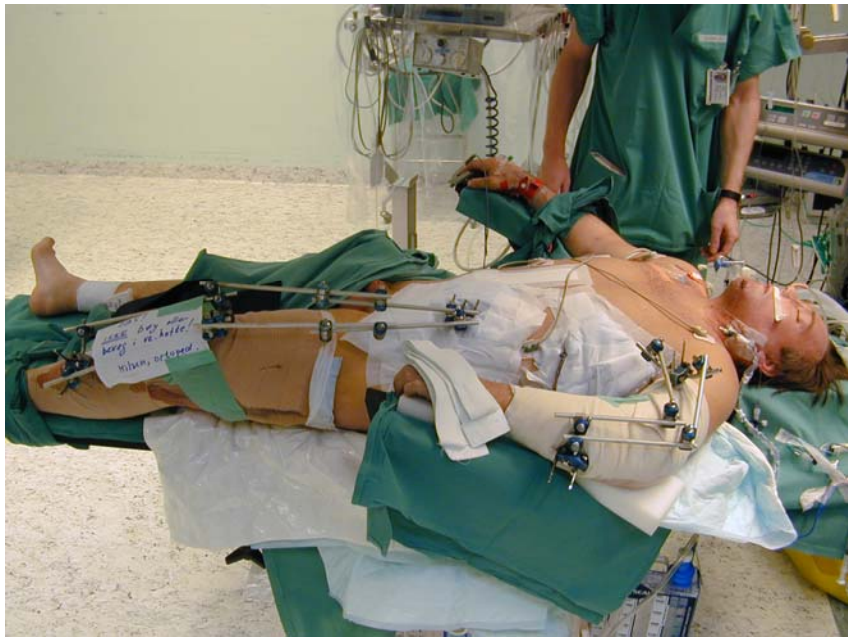
Traume bad


Traume
overflow
Hvilken behandling – Hvor meget
Skade og fysiologisk reaktion
Patient og comorbiditet
ARDS/MODS

Damage Control Orthopaedics

Scalea TM et al, 2000

- Concept developed during the 1990s
- Purpose: To reduce the impact of the second hit



You can bridge anything!

The Journal of TRAUMA® Injury, Infection, and Critical Care

Changes in the Management of Femoral Shaft Fractures in Polytrauma Patients: From Early Total Care to Damage Control Orthopedic Surgery

Hans-Christoph Pape, MD, Frank Hildebrand, MD, Stephanie Pertschy, MD, Boris Zelle, MD, Rayeed Garapati, MD, Kai Grimme, MD, and Christian Krettek, MD

- Retrospektivt studie 1993-2000
- 191 patienter med femurfraktur
- ISS – 39 (svært tilskadekomne)
- Primært marvsøm: 110
- ExFix -> marvsøm: 68

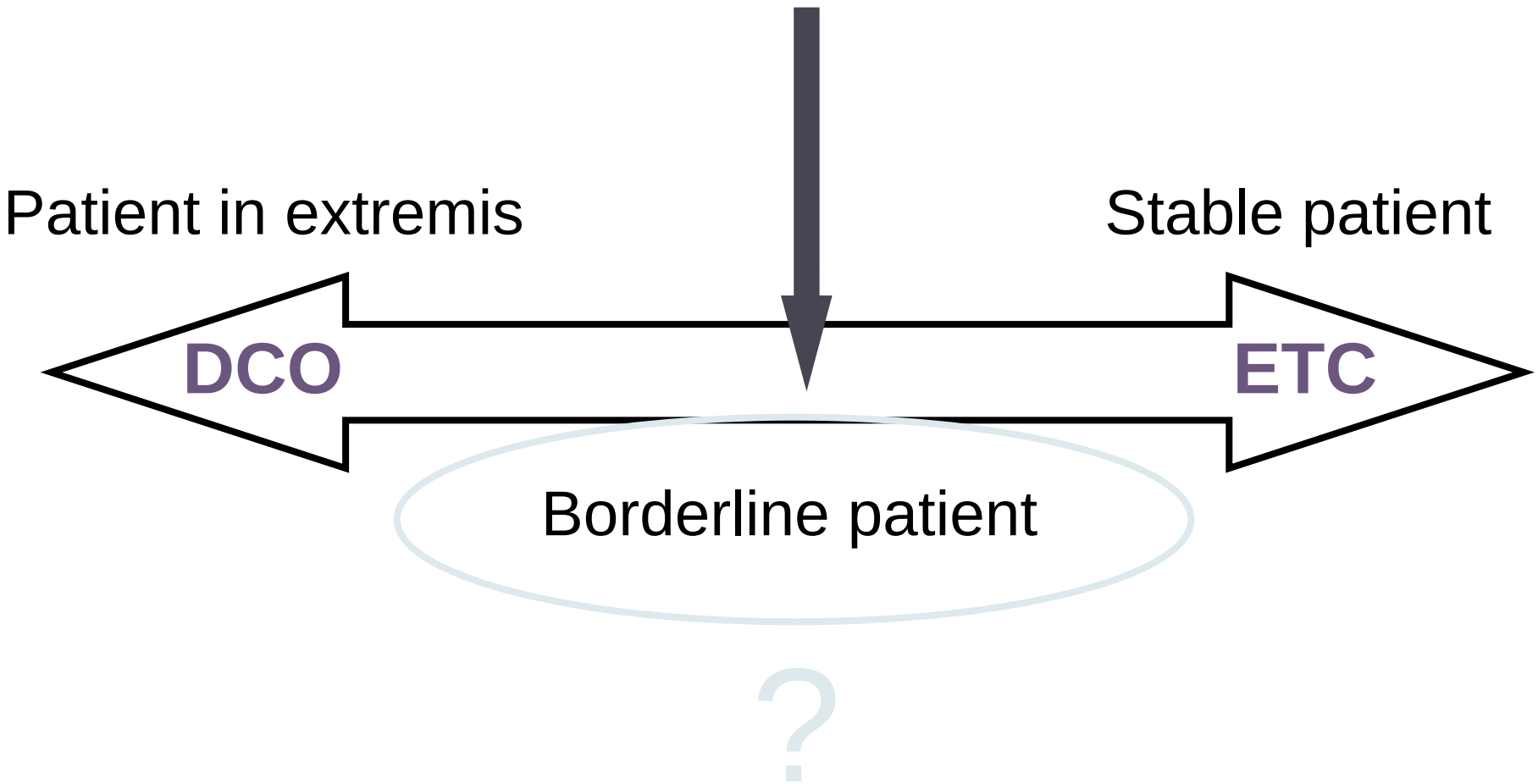
Table 7 Postoperative Course

	DCO (%)
Hospital stay	
Marvsøm	13.9 ± 4
Ekstern fix -> marvsøm	13.4 ± 3
MOF	
Marvsøm	31 (16.2)
Ekstern fix -> marvsøm	22 (11.5)
ARDS	
Marvsøm	29 (15.1)†
Ekstern fix -> marvsøm	15 (7.8)

Timing and effects of fracture surgery on the severely injured patient

- Early Total Care
- Damage Control Orthopaedics
- Priorities in fracture treatment

The controversy



How do we recognize the patient going towards SIRS/MOF

Core temperature

Coagulation

Arterial O_2

Pulmonary pressure

Lactate > 2 mmol/l

Urine output <1 ml/kg/t

ICP

Notice the trends !!!!

Clinical considerations

Consider each fracture in context of the patient and their overall condition and injuries

. . . each is different

Hvis en eller flere parametre forværres - Skift til Damage Control og få patienten på Intensiv Afdeling hurtigst muligt

Courtesy:JE Madsen, Ullevål

Early appropriate care

- J Trauma. 2011 Jul;71(1):175-85
- 750 femur fracture
- Mean Injury Severity Score (ISS) 23.7

- Early definitive stabilization in patients with multiple injuries was associated with fewer complications than delayed stabilization (18.9% vs. 42.9%, $p < 0.037$) after adjusting for patient age and ISS
- **656** was treated with early definitive stabilization

DCO RCT Ann. Surg. 2007; 246: 91-501

TABLE 4. Treatment Group Differences in Clinical Course and Complications for Patients in Stable and Borderline Condition

	Stable Condition		Regression Analyses			Borderline Condition		Regression Analyses		
Outcomes	**s-I°ExFix (n = 50)**	**s-I°IMN (n = 71)**	**HR/OR**	**95% CI**	***P***	**b-I°ExFix (n = 21)**	**b-I°IMN (n = 23)**	**HR/OR**	**95% CI**	***P***
ICU hours	212.4 ± 167.93	133.52 ± 193.49	HR = 1.06	0.84–1.86	0.290	476.95 ± 284.50	399.14 ± 404.13	IRR = 1.28	0.67–2.44	0.445
Ventilator hours	142.2 ± 121.32	66.54 ± 108.45	HR = 1.55	1.04–2.33	0.030	360.48 ± 245.47	313.81 ± 359.77	IRR = 1.36	0.74–2.53	0.325
Pneumonia	23.8%	6.5%	OR = 0.40	0.11–1.50	0.176	38.9%	45.0%	OR = 1.00	0.22–4.59	0.995
ALI	28.6%	12.9%	OR = 0.39	0.14–1.08	0.170	16.7%	52.4%	OR = 6.69	1.01–44.08	0.048
ARDS	9.5%	6.3%	OR = 0.73	0.15–3.53	0.700	11.1%	16.7%	OR = 2.01	0.13–31.91	0.618
SIRS	30.2%	30.8%	OR = 1.49	0.62–3.57	0.367	50.0%	52.6%	OR = 0.73	0.17–3.24	0.684
Sepsis	11.9%	6.3%	OR = 0.60	0.15–2.36	0.469	11.1%	36.8%	OR = 3.86	0.46–32.52	0.214
MOF	0.0%	0.0%				16.7%	22.2%	OR = 0.78	0.13–4.75	0.791

Regression analyses represent the relation between treatment condition (0 = external fixation, 1 = intramedullary nailing) and each outcome after controlling for initial treatment group differences on the revised trauma score, New Injury Severity Score, and AIS head score. Cox regression with robust standard errors was used for number of hours until release from ICU and hours until taken off the ventilator. Logistic regression with robust standard errors was used for binary outcomes.

ALI indicates acute lung injury; ARD, acute respiratory distress; SIR, systemic inflammatory response; MOF, multiple organ failure; HR, hazard ratio; OR, odds ratio; CI, confidence interval.

DCO RCT Ann. Surg. 2007; 246: 91-501

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RCT studie - Tyskland

Trials

BioMed Central

Study protocol

Open Access

Protocol for a randomized controlled trial on risk adapted damage control orthopedic surgery of femur shaft fractures in multiple trauma patients

Dieter Rixen*[1], Eva Steinhausen[1], Stefan Sauerland[2], Rolf Lefering[2], Matthias Meier[3], Marc G Maegele[1], Bertil Bouillon[1] and Edmund AM Neugebauer[2]

Logaritmisk regression

- $P_{Death} = 1/(1+e^{\{-[0,1551+0,084*BE-0,0359*Quick+0,0438*Alder-0,2067*GCS-0,0252*ISS]\}})$.

- BE er *base excess* (mmol/l)
- Quick er protrombintid (%)
- GCS er *Glasgow coma scale score*
- ISS er *injury severity score*.

Hvornår skal vi operere igen?

<u>Hannover</u> study: 42 patients ***Pape et al J Trauma 2001***

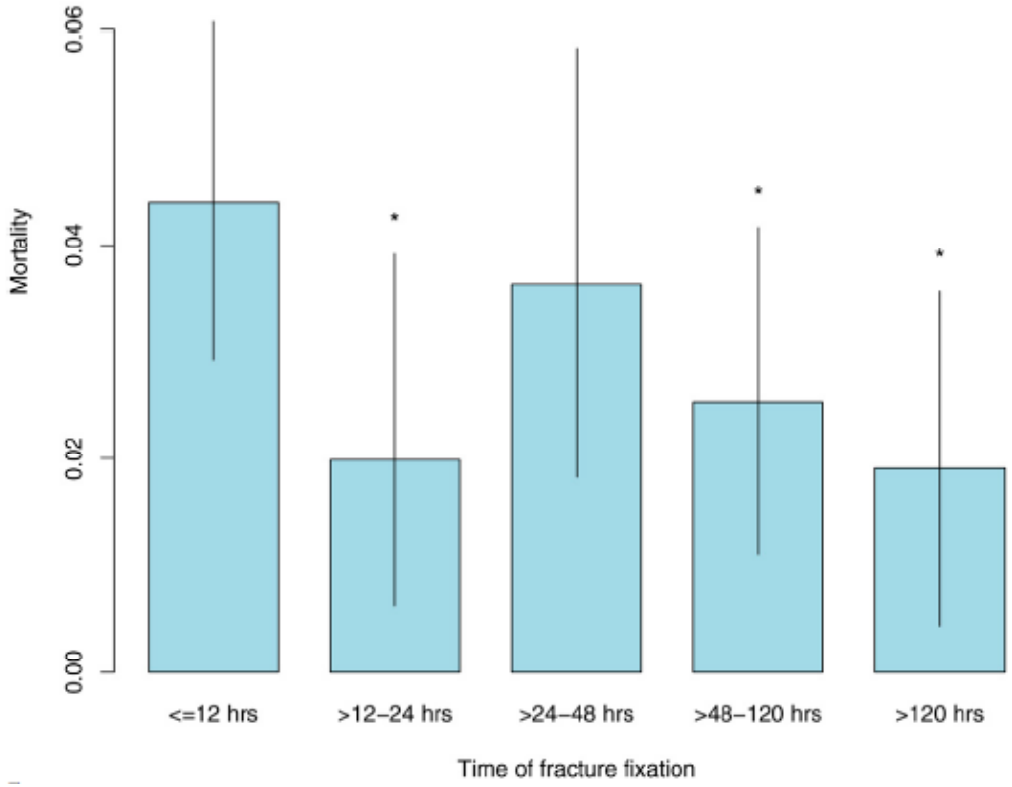
Surgery day 2 - 4: 46.5% MODS

Surgery day 5 - 8: 15.7% MODS

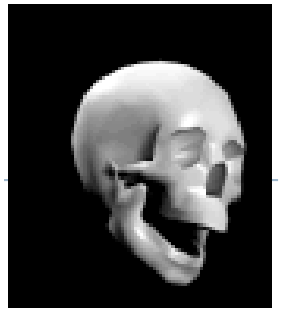
Delayed Internal Fixation of Femoral Shaft Fracture Reduces Mortality Among Patients with Multisystem Trauma

By Saam Morshed, MD, MPH, Theodore Miclau III, MD, Oliver Bembom, PhD, Mitchell Cohen, MD, M. Margaret Knudson, MD, and John M. Colford Jr., MD, PhD

3069 femurfraktur
ISS > 15



Resumé



- Anvend ABCDE ved modtagelse af multitraumatiserede patienter
- Multitraume er en systemisk sygdom
- Prioritering af frakturbehandling under hensyn til patientens fysiologiske tilstand.
  - Early Total Care – Golden standard !!!
  - Damage Control!!!