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Orthopaedic Trauma  
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### Management of the femur fracture

**Swiss Trauma Day 2014, Bern**

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### Disclosures



**Zimmer Motion lock abtitsen**  
**AO: 2 decades of service**  
**Stryker: I use their nails**

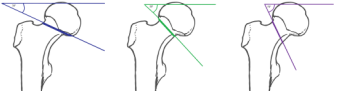





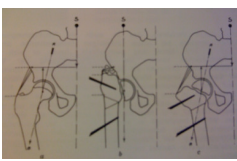

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F. Pauwels


Pauwels fracture classification

Osteotomy for femoral neck nonunions


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## Principles

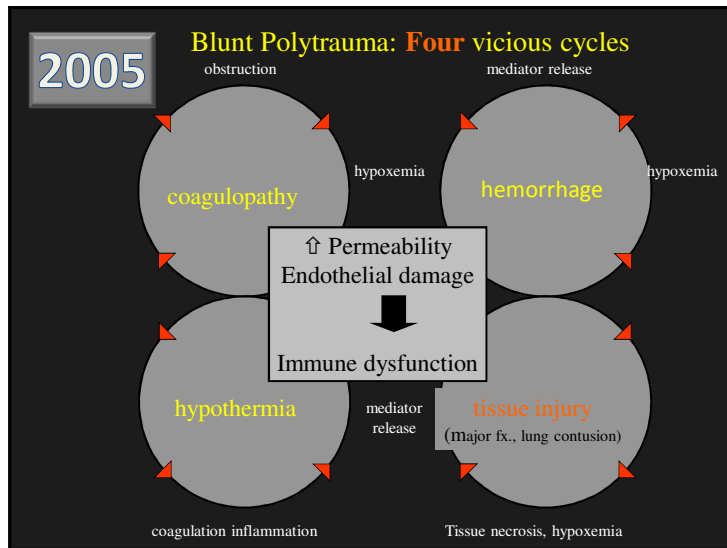
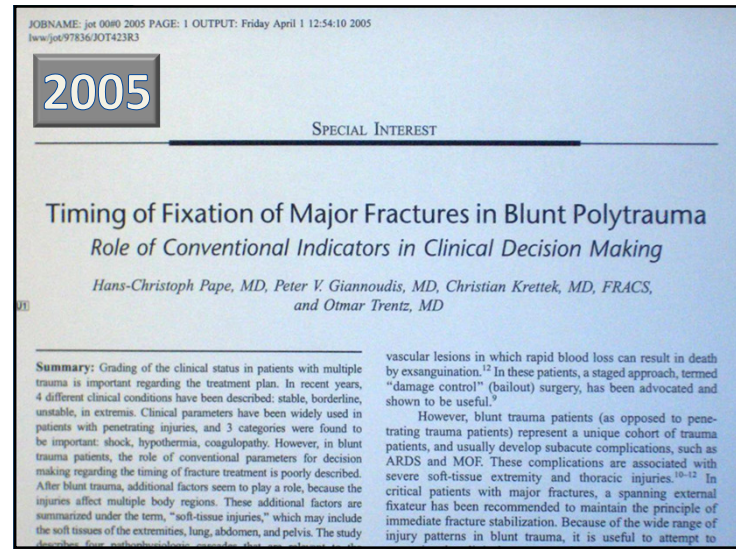
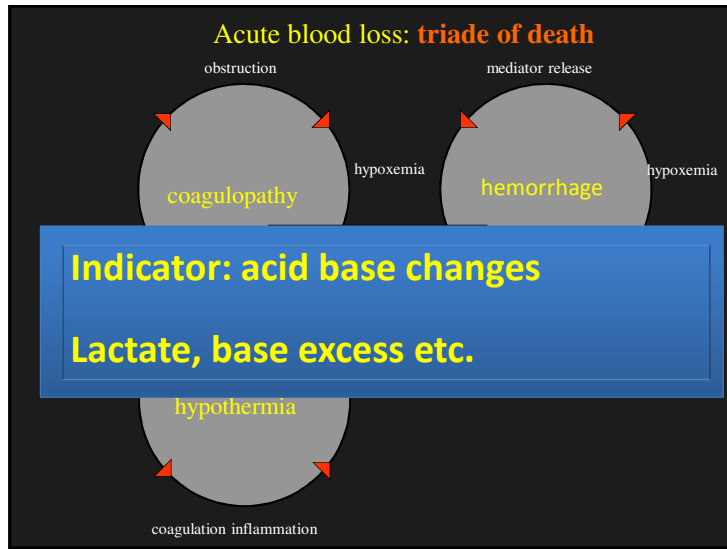
1. Assess the patient
2. Early fixation if possible  
Pelvis, femur, spine

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## Major fx.: Femur = example

1. Assess the patient  
**what parameter, when ?**
2. Early fixation if possible  
Pelvis, femur, spine  
**what method of fixation ?**



**2005**

**Initial parameters:  
look at 4 vicious cycles**

- LUNG:** Pulmonary dysfunction (PaO<sub>2</sub>/FiO<sub>2</sub> < 250)
- TEMP:** Hypothermia (< 32 °C)
- HEMOSTASIS:** Platelet count (< 95.000), signs of DIC
- SHOCK:** Lactate, BE, unresp. to therapy >10 blood units/6 hrs. (urine output < 50 mL/30 min.)

**2005**

stable patient

Borderline

unstable patient

patient in extremis

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**2005**

**Evidence level III to IV**

**Not a score, unvalidated!**

Shock	- 60				
Coagulation	re acidosis	8	000		
Temperature	2 or less				
Soft tissue injuries	0	3 or more			
	> III	rush, rollover			
	h, rollover	em.			
Surgical strategy	Damage control (DCO) or Definitive surgery (ETC)	ETC	DCO if uncertain ETC if stable	DCO	DCO

**What has changed in the meantime ?**

**1980** **2013**

mortality

> 50 %

15 - 20 %...

ICU care and Surgical strategy

of survivors

> 45...


app. 25

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**2013**

**New definition of the borderline patient**


- Nation wide trauma registry
- N = 74.000
- 95 % blunt
- General ARDS incidence 2.4 %
- Mortality rate 3.5 %
- Mortality in ISS > 16 patients: 13.1 %



### Trauma Registry Cohort 2013 (German registry)

2013



<b>Number of patients</b>	11,436
<b>Age (years)</b>	42.9 ± 18.8
<b>Male patients (%)</b>	8.297 (73.0%)
<b>Blunt trauma (%)</b>	95.6%
<b>ISS</b>	22.7 ± 11.2
<b>NISS</b>	27.1 ± 11.9
<b>Admitted to ICU (%)</b>	10.415 (91.1%)
<b>Duration of Ventilation (days)</b>	5.6 ± 10.5
<b>LOS in ICU (days)</b>	10.0 ± 13.3
<b>Total LOS in hospital (days)</b>	31.9 ± 27.2
<b>Hospital mortality (%)</b>	834 (7.3%)



### Parameters for borderline condition

2013

Variable	Pathological change		
	Low risk (%)	Intermediate risk (%)	High risk (%)
<b>SBP</b>			
Target mortality rate	~ 5%	~ 15%	~ 40%
Systolic Blood Pressure (SBP) n=10,629			
category	≥91	75 - 90	≤75
no. of patients (n)	9,059	987	582
patients (%)	85%	9%	5%
mortality (n)	387	149	235
mortality rate (%)	4.3%	15.0%	40.0%
<b>BE</b>			
Base Deficit n=6,510			
category	≤-8	8 - 10	>10
no. of patients (n)	5,562	396	442
patients (%)	86%	6%	7%
mortality (n)	269	42	174
mortality rate	4.8%	10.7%	39.4%
<b>Coag</b>			
INR n=10,211			
category	≤1.4	1.4 - 2.0	>2.0
no. of patients (n)	8,308	1,339	565
patients (%)	81%	13%	5%
mortality (n)	456	259	231
mortality rate (%)	5.5%	19.5%	40.9%
<b>Temp.</b>			
Temperature n=4,365			
category	≥35.0 °C	<35.0 °C	-
no. of patients (n)	2,725	631	-
patients (%)	60%	14%	-
mortality (n)	134	69	-
mortality rate (%)	5.2%	10.8%	-
<b>NISS</b>			
New ISS n=11,455			
category	0 - 14	15 - 25	26 - 75
no. of patients (n)	9,355	1,824	747
patients (%)	82%	16%	6%
mortality (n)	382	205	251
mortality rate (%)	4.1%	11.3%	33.6%
<b>Platelets</b>			
Platelets n=10,445			
category	≥150,000	<150,000	-
no. of patients (n)	8,252	2,193	-
patients (%)	79%	21%	-
mortality (n)	271	159	-
mortality rate (%)	3.3%	7.2%	-
<b>Blood</b>			
pRBCs n=11,406			
category	0 - 2	3 - 14	≥15
no. of patients (n)	8,501	2,369	562
patients (%)	74%	21%	5%
mortality (n)	277	309	218
mortality rate (%)	3.3%	13.1%	40.7%





### Criteria to define pathological conditions

Low risk:                      5 % mortality

Intermediate risk: 15 % mortality

High risk:                      40 % mortality



### Stable vs borderline vs critical

2013

Parameter	Clinical condition Stable (%)	Clinical condition Borderline (%)	Clinical condition Unstable (%)
<b>Number of patients (%)</b>	6.620 (66%)	2.765 (27%)	684 (7%)
<b>Age (years)</b>	43.6 ± 18.2	45.2 ± 19.3	44.9 ± 18.5
<b>Male patients (%)</b>	73.6%	71.2%	69.8%
<b>Blunt trauma (%)</b>	95.8%	94.9%	93.5%
<b>ISS</b>	21.8 ± 7.2	31.4 ± 10.3	40.8 ± 13.7
<b>NISS</b>	25.5 ± 7.9	37.3 ± 11.7	47.8 ± 14.5
<b>Admitted to ICU (%)</b>	95%	96%	75%
<b>Duration of Ventilation [days]</b>	4.9 ± 8.8	11.1 ± 13.9	10.5 ± 14.5
<b>LOS on ICU (days)</b>	9.2 ± 11.0	16.6 ± 16.2	14.1 ± 18.1
<b>LOS in Hospital (days)</b>	24.7 ± 19.9	34.9 ± 29.7	26.3 ± 34.7
<b>Hospital mortality</b>	2.5%	13.4%	51.3%

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### Stable vs borderline vs critical

2013

Parameter	Clinical condition		
	Stable	Borderline	Critical
<b>AIS head ≥3</b> (number [%]) n=11,436	1490 16.5%	419 22.9%	154 26.9%
<b>AIS chest ≥3</b> (number [%]) n=11,436	3775 41.8%	1257 68.7%	446 78.0%
<b>AIS abdomen ≥3</b> (number [%]) n=11,436	1640 18.2%	711 38.8%	328 57.3%
<b>AIS extremities ≥3</b> (number [%]) n=11,436	7432 82.3%	1553 84.8%	530 92.7%
<b>Shock (RR≥90)</b> (number [%]) n=10,629	412 4.9%	730 42.1%	432 78.3%
<b>MOF</b> (number [%]) n=10,226	1217 15.0%	800 48.0%	308 72.8%
<b>Sepsis</b> (number [%]) n=10,321	530 6.4%	307 18.4%	109 9.2%

Patients in extremis excluded!

### Intermediate risk group: Borderline

Hospital Mortality

1.7 34 70.2

Low H 3 >3 H

borderline Patients  
n=2.765 (27%)

Evidence level II

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## Principles

1. Assess the patient
2. Early fixation if possible  
Pelvis, femur, spine

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1980 ies

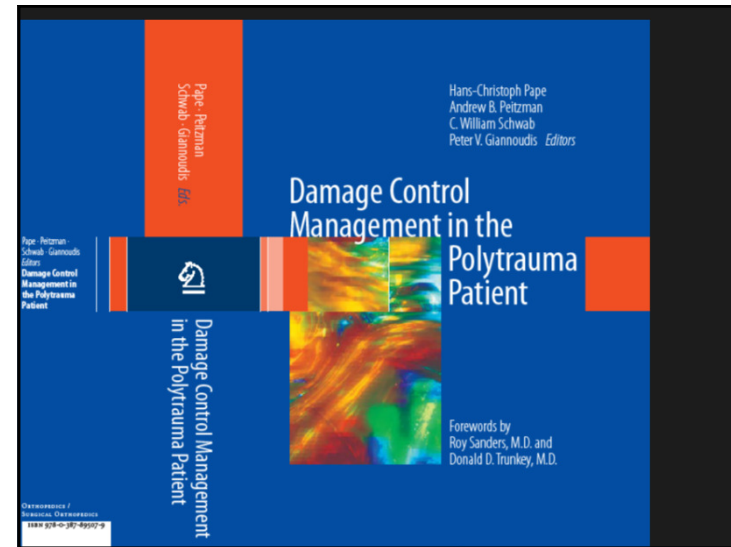
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L. Bone

Early fixation of fractures !  
PRIOR TO BONE 's ERA:  
10 DAYS TRACTION

### Major fractures - multiple injuries

<1940	Böhler	non - operative
>1980	Early Total Care	IM-nailing
>2000	Early Total care, if patient stable or can be resuscitated adequately (60-80%)	
	Damage control Orthopaedics	I° ex.fix. II° nailing



Initial parameters:  
look at 4 vicious cycles

SBP	<b>Evidence level II</b>	( $< 250$ )
BE		
Coag		
Temp.		
NISS		lood units/6 hrs.
Platelets		
Blood		

### Major fractures - multiple injuries

<1940	Böhler	non - operative
>1980	Early Total Care	IM-nailing
>2000	Early Total care versus Damage control	IMN or Ex.fix.

## Major fractures - multiple injuries

<1940	Böhler	non - operative
>1980	Early Total Care	IM-nailing
>2000	Early Total care versus Damage control	IMN or Ex.fix.
>2010	Safe Definitive Surgery	

## Major fractures - multiple injuries

< 1940	Böhler	non - operative
> 1980	Early Total Care	IM-nailing
> 2000	Early Total care or Damage control	

Safe definitive surgery (SDS)

## Safe definitive surgery (SDS)

Initial parameters:  
look at 4 vicious cycles  
(level II evidence)

1. NISS: >16
2. TEMP: Hypothermia (< 32 °C)
3. HEMOSTASIS: Platelet count (< 95.000), signs of DIC
4. SHOCK: SBP< 90, Lactate, BE, unresp. to therapy >10 blood units/6 hrs.  
(urine output < 50 mL/30 min.)



## Safe definitive surgery (SDS)


stable patient

Borderline

unstable patient

patient in extremis    Lactate  
Vasopressors    ICU






**Safe definitive surgery (SDS)**

stable patient      ISS<16, isol. Fx.  
IM nailing

Borderline


unstable patient



**Safe definitive surgery (SDS)**

Borderline

unstable patient      Damage control



**Safe definitive surgery (SDS)**

responsive to resuscitation      SDS


Borderline

unresponsive to resuscitation      Damage control

Safe definitive Surgery      Damage control

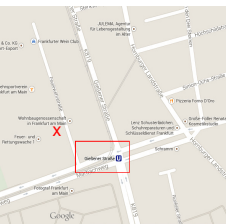
**> 80 %**      **< 20 %**

Borderline patients 2014:  
Evidence based definition !



**Course location**

Feuerwehr- und Rettungs-Training-Center (FRTC) Feuerwehrstraße 1, 60435 Frankfurt am Main Germany  
Subway Station: *Gießener Straße*




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**In cooperation with:**






**Polytrauma Management -beyond ATLS-**

**May 24<sup>th</sup>-25<sup>th</sup>, 2014**




**Polytrauma Course**



**Aachen University Medical Center**  
 Department of Orthopaedic Trauma (Director: H.-C. Pape, FACS)

In Cooperation with:  
 St. James's University Hospital, Leeds, UK, P. Giannoudis, FRCS  
 Med. Hochschule Hannover, Germany, C. Krettek, FRACS  
 University of Pittsburgh, Med. Ctr., USA, A. Peltzman, FACS

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Thank you

