الجمعية الجزائرية لجراحة العظام و المفاصل

Société Algérienne de Chirurgie Orthopédique & Traumatologique

Trauma Care in Germany :

Dispatch Triage, Resuscitation Area Treatment and Spine Injury Management

Philipp Störmann

Notfall-, Intensivmedizin und Schwerverletztenversorgung

Sektion NIS

Deutsche Gesellschaft für Orthopädie und Unfallchirurgie

Background Severe multiple Trauma Germany

- 33,000 – 38,000 patients per year
- in-hospital mortality 12.5 – 13.5%
- 73 % male, 58 % traffic accidents
- 94 % blunt trauma mechanism
- mean age 43 years
- main cause of death in patients younger than 45 years of age

Background Severe multiple Trauma Germany

DEUTSCHE GESELLSCHAFT FÜR UNFALLCHIRURGIE

Weißbuch Schwerverletztenversorgung

AWMF-Register-Nr.: 187-023

publiziert bei: AWMF online Das Portal der wissenschaftlichen Medizin

Polytrauma/Schwerverletzten-Behandlung

S3-Leitlinie

der

Deutschen Gesellschaft für Unfallchirurgie e.V.

und

Deutsche Arbeitsgemeinschaft Krankenhaus-Einsatzplanung (DAKEP)
Deutsche Gesellschaft der Plastischen, Rekonstruktiven und Ästhetischen Chirurgen e.V. (DGPRÄC)
Deutsche Gesellschaft für Allgemein- und Viszeral Chirurgie e.V. (DGAV)
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Deutsche Interdisziplinäre Vereinigung für Intensiv- und Notfallmedizin e.V. (DIVI)
Deutsche Röntgengesellschaft e.V. (DRG)
Deutscher Berufsverband Rettungsdienst e.V. (DBRD)
Gesellschaft für Mund-, Kiefer- und Gesichtschirurgie e.V. (DGMKG)
Sektion Pflege der Deutsche Interdisziplinären Vereinigung für Intensiv- und Notfallmedizin e.V. (DIVI)

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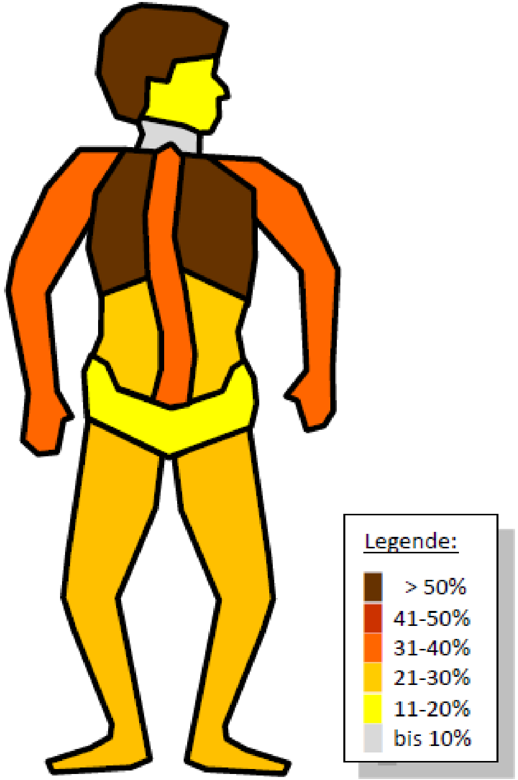
DEUTSCHE GESELLSCHAFT FÜR UNFALLCHIRURGIE

DGOU Deutsche Gesellschaft für Orthopädie und Unfallchirurgie

Injury pattern

- severe injuries in multiple trauma:
  - head 54,9%
  - chest 52,9%
  - abdomen 15,8%
  - extremities 29,8%



S3 guideline Polytrauma

- first version published 2011

- 3rd version published February 2023
  - 24 medical societies involved
  - 332 key recommendations
    - 82 with highest level of evidence

- Structured in 3 phases
  - pre-hospital care
  - resuscitation area
  - initial operative treatment / phase

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Translation published in 2018

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https://doi.org/10.1007/s00068-018-0922-y

GUIDELINE

CrossMark

Level 3 guideline on the treatment of patients with severe/multiple injuries

AWMF Register-Nr. 012/019

Polytrauma Guideline Update Group

© DGU (Deutsche Gesellschaft für Unfallchirurgie e.V.) 2018

Structural requirements

Interdisciplinary work

Standard trauma team

standard

Trauma	resident	1
	attending	1
	nurse	2
Anaesthesia	resdent	1
	attending	1
	nurse	1
radiology	consultant	1
	technical assist	1

dokumentation, ICU,
Laboratory, blood bank, transportation

optional

	neurosurgery	
	abdominal surgery	
	face/plastic surgery	
	chest surgery	
	pediatrics	
OR	tech. assist	2

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Dispatch - Trauma team activation

- former recommendations: strong increase of overtriage, mainly due to mechanistic criteria

- working group “NIS” – scientific re-evaluation of TTA

- mechanistic criteria are reduced

- physiological indications re-defined

Parallel work / flow chart

	t = 0 - 2 min	t = 2 - 15 min	t = 15 – 25 min	t = 25 min – Schockraum Ende
Anästhesie	Übergabe durch RD / NA	• Pupillenkontrolle • Beurteilung und Sicherung Atemweg • Narkose • adäquate Zugänge	• Zentrale Zugänge • ReAsses • Kreislaufstabilisierung	• Vorberitung Transport • endg. Stabilisierung
Trauma		• Primary Survey • FAST / FEEL • Stabilisierung Becken / Extr. • Thoraxdrainage	• Organisation OP • Organisation ICU • Gesamtbild Verletzungs-schwere	• Secondary Survey • endgültige Info OP • im Konsens: Therapiekonzept
Radiologie		• Röntgen Thorax • Röntgen Becken	• Traumascan	• Röntgen Extremitäten • ggf. Zusatz – Diagn.
Pflege		• Entkleiden • Peripherer Zugang • Blutentnahme / BGA • Kreuzblut		

TTA 2023 – physiological parameters

A / B: - $SpO_2 < 90\%$, mechanical ventilation necessary
- breathing frequency < 10 or > 29

C: - SBP < 90mmHg
- frequency > 120 bpm
- shock index > 0.9
- eFAST: positive

D: - GCS ≤ 12

E: - hypothermia < 35.0° C

TTA 2023: mechanism

- Fall from > 3m

- MVC with ejection from car or fracture of 2 long bones

- Burn injuries > 20% body surface and at least grade 2b

TTA 2023 injury pattern

- flail chest
- instable pelvic ring fracture
- penetrating injuries neck and torso
- spinal injures
- pre-hospital intervention

Severe trauma in the elderly

2.2.8	Empfehlung	Neu 2022
Empfehlungsgrad **B ⇑**	Die Schockraumalarmierung bei geriatrischen Patienten sollte großzügig erfolgen.	
Literatur, Evidenzgrad	[55] Hranjec 2012: LoE 2b [45] Werman 2011: LoE 3b↓	
	Konsensstärke: 81%	

2.2.9	Empfehlung	Neu 2022
Empfehlungsgrad **B ⇑**	Die Schockraumalarmierung bei geriatrischen Patienten nach relevantem Trauma sollte zusätzlich bei einem der folgenden Parametern erfolgen: • RRsys <100mmHg • bekanntes oder vermutetes Schädel-Hirn-Trauma und GCS ≤14 • 2 oder mehr verletzte Körperregionen • Fraktur eines oder mehrerer langer Röhrenknochen nach Verkehrsunfall	

- TTA in the elderly with increased importance
- “relevant trauma” +
  - RRsys < 100mmHg
  - suspected TBI and GCS < 15
  - 2 or more injured body regions

Causes of death in severe multiple trauma

Asphyxia
Rupture of major blood vessels
Massive brain destruction
Cervical paraplegia

Intracranial haemorrhage
Haemoto-/pneumothorax
Liver-/Spleen injury
Pelvic injury
Amputations

Sepsis
Multi-Organ Failure

Seconds – Minutes

Minutes – Hours

Days – Weeks

Time

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Time-related problems after multiple trauma

Days	Weeks	Months
Critical Survival	Systemic Inflammation	Rehabilitation
Hemorrhage	**Organ Failure**	**Psychological**
TBI	**Sepsis**	**Social Problems**
Organ Trauma	**MOF**	

Evolvment of surgical treatment

1990‘s	2000‘s	2015	2015 - 2020
Early toral care	*Damage Control Orthopedics*	*Early Appropriate Care*	*Safe definitive surgery / PRISM*
	DCO	EAC	

– treatment changes from apodictic principles

– individual concepts based on injury pattern and patient‘s condition

Safe Definitive Surgery (SDS)

- dynamic concept for fracture fixation in polytrauma patients

- 3 (4) (after begin of resuscitation) groups based on primary trauma assessment

- based on e.g.: blood pressure, transfusion requirement, lactate levels, base deficit, urine output, temperature coagulation

- stable patient: definitive surgical care

Injury, Int. J. Care Injured 46 (2015) 1–3

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

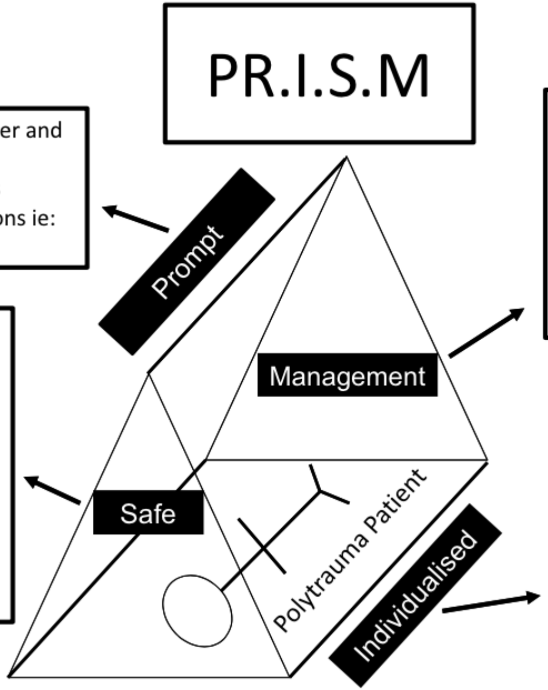
Editorial

Safe definitive orthopaedic surgery (SDS): Repeated assessment for tapered application of Early Definitive Care and Damage Control?

An inclusive view of recent advances in polytrauma management

Pape HC, Pfeifer R. Safe definitive orthopaedic surgery (SDS): repeated assessment for tapered application of Early Definitive Care and Damage Control?: an inclusive view of recent advances in polytrauma management. In

Prompt individualized safe management



-Consider local man power and resources
-Proceed without delays
-Do not set time limitations ie: 8,24,36hrs..

Assess with great detail:

-Injury mechanism?
-Distribution of injuries?
-ATLS
-Physiological state?
-Use of Conventional markers?
-Use of biomarkers?
-Early Diagnostics (CT)

-Ongoing response to resuscitation?
-Interventional radiology?
-ETC?
-DCO?
-EAC?
-Ongoing evaluation?

Consider:

- Patient symptoms and needs?
-Age?
-Sex?
-Pregnancy?
-Patient comorbidities?
-Appropriate type of resuscitation?

ELSEVIER
Injury
Volume 48, Issue 7, July 2017, Pages 1279-1282
Injury

Editorial

Time to think outside the box: 'Prompt-Individualised-Safe Management' (PR.I.S.M.) should prevail in patients with multiple injuries ☆

P.V. Giannoudis, Vasileios P. Giannoudis, Daniel S. Horwitz

Clinical Challenge – Patient identification

eligibility for ETC

- long bone fracture (isolated)
- no relevant concomitant injuries
- Injury Severity Score (ISS) < 17 (<25)
- no signs of hyperinflammation
- no signs of major coagulopathy, acidosis, hypothermia

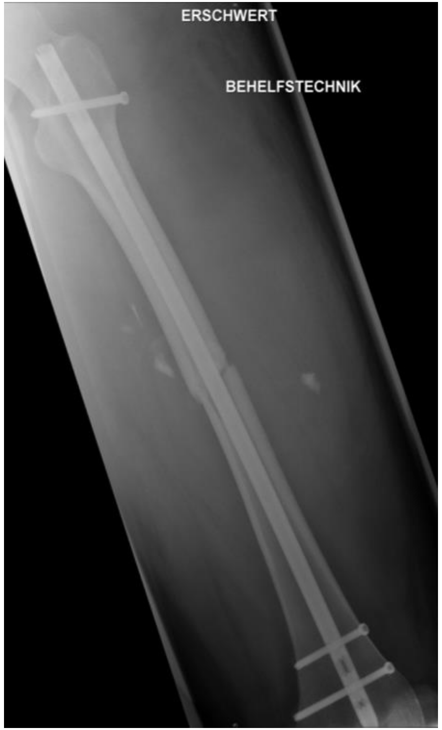
Case ETC

- 22-year old male
- high velocity injury as driver
- femoral shaft fracture left side
- distal fracture of ulna left side
- fracture of dorsal acetabulum left side
- no chest or brain injury

Case - ETC

- Immediate definitive intramedullary nailing left femur
- ORIF by plate left ulna
- 1 day ICU, afterwards normal ward
- overall hospitalization 14 days
- No complications
- → young patient, no relevant co-injuries

ETC



Damage Control (Orthopedics) - Indications

- ISS ≥ 16 and Chest Trauma (AIS ≥ 3)
- ISS ≥ 25
- Severe TBI (AIS_{head} ≥ 3)
- Instable pelvic fracture
- Multiple fractures of long bones
- Hemondynamic unstable patients (RR_{syst} < 90mmHg)
- Bleeding (e.g. Hb < 6 g/dl, masstransfusion)
- Hypothermia (< 34° C)
- pH < 7,2

Pro Damage Control Orthopedics

- Hb < 6 g/dl
- Quick < 60 % or INR > 1.6
- Base Excess < -6 mmol/l
- Thrombocytes < 60,000/µl
- age > 60 yrs
- accident – start of surgery > 6 hours

Bouillon Unfallchirurg 2009

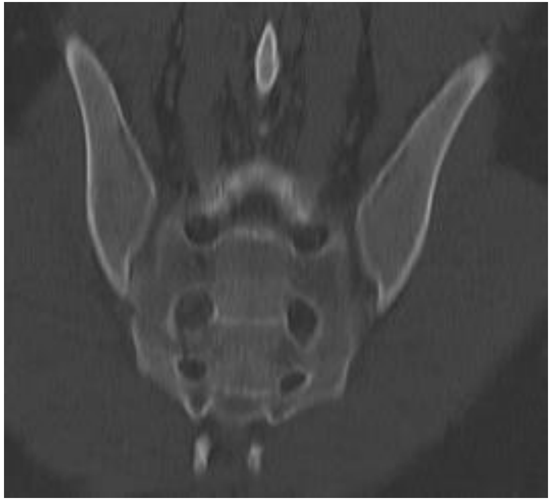
Case 2 - DCO – 21y, ♂, Suicide 11th Floor

Initial GCS 15

Diagnoses:

- pneumothorax right (chest tube)
- subtrochanteric Femur fracture
- acetabular fracture right
- sacrum fracture
- lower Leg Fractures both sides
- elbow luxation fracture right

How to procede ?



Damage Control Orthopedics

- treatment of femoral fractures by external stabilization , EF elbow

- ICU treatment to normalize

  - Hypthermia
  - Acidosis
  - Coagulation
  - Systemic inflammation

- definitive surgical procedure (e.g. nailing) after stabilization

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Day one surgery

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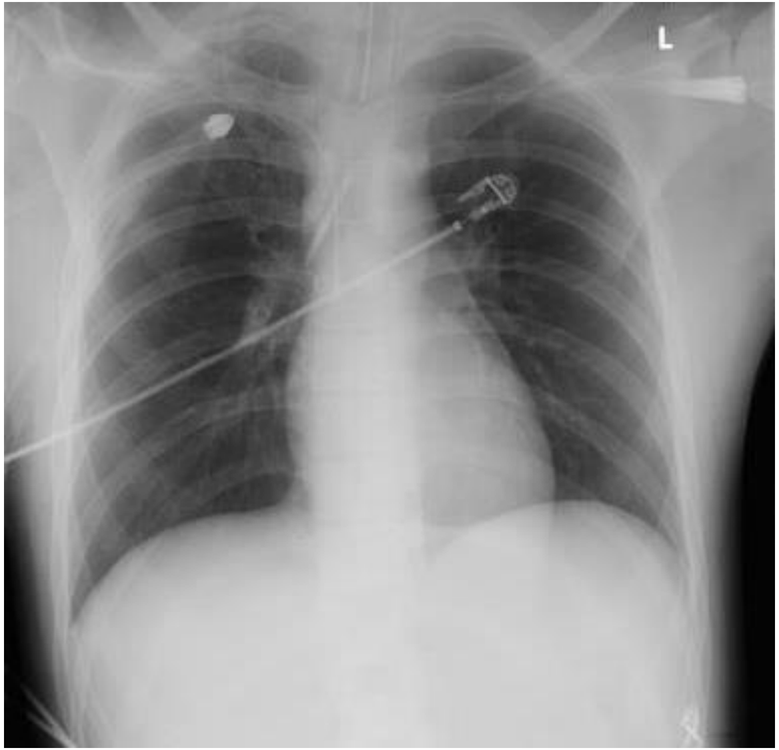
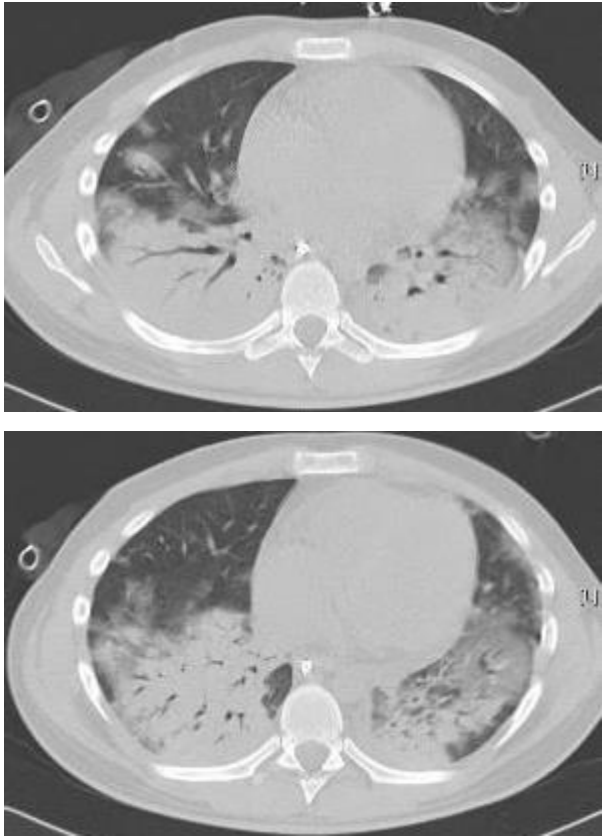
ICU

ARDS



Day 1 after Trauma



Day 9 after Trauma

Severe pulmonary dysfunction (ARDS)

d1-d5: continuous lateral rotational therapy (60° /60° , PEEP 15, PPS 0/0)

d9: fulminant ARDS, PEEP up to 20, Jet-Ventilation 180/min, FiO2 1,0; prone positioning

d27: successful Decanulation

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Definitive orthopedic Surgery

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Spine Injury Managment

Our Concept

- emergency surgery in fractures Type A3.3, B and C with existing or imminent neurologic deficit

- fast stabilization and decompression if necessary

- emergency setting: open surgery, no MIS-procedures

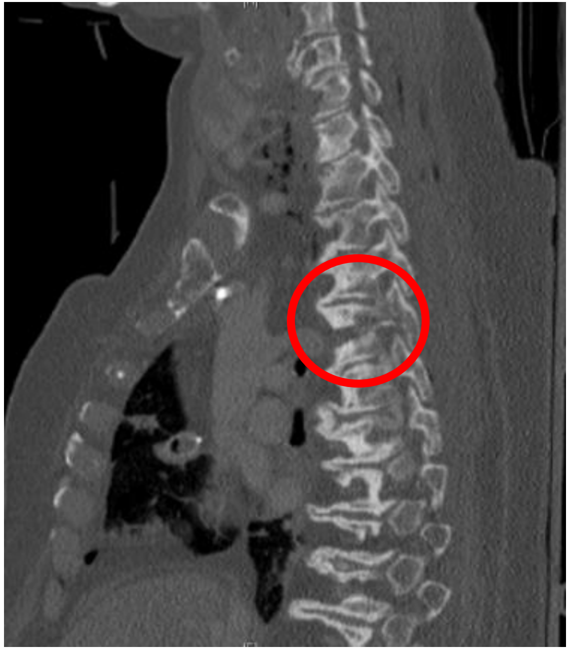
- continous lateral rotational therapy (spine /chest trauma) on ICU

- anterior column-reconstruction by vertebral body replacement after 6 to 10 days (damage control)

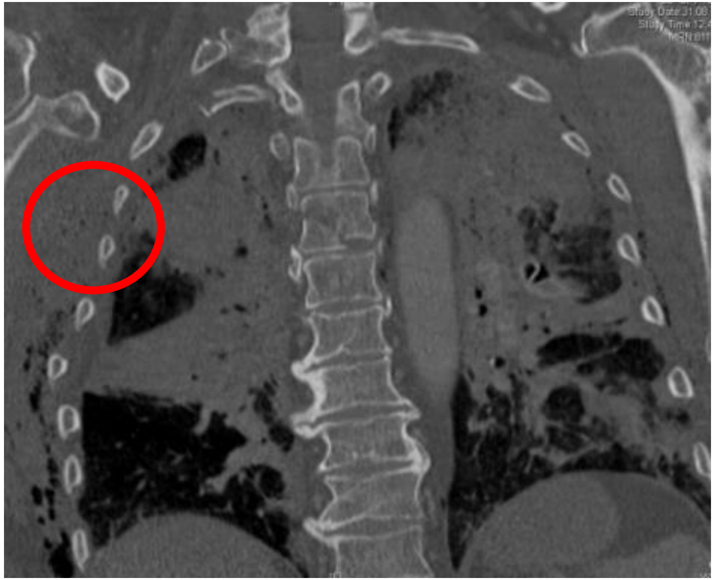
Case 3: 74 y.o., female, motor vehicle accident

- Run over by vehicle
- multiple trauma
  - Fracture of vertebra T4 with suspected incomplete spinal cord injury
  - CPR on scene and during transportation
  - Severe chest trauma, lung contusion, rib fractures
  - Sternal fracture
  - Liver injury Moore I°
  - Pelvic fracture (AO type B 2.1)
  - Open fracture left humerus with pulselessness
- ISS: 50, blood hemoglobin 6.5mg/dl
- 10 PRBC, 6 PLT, 4 g Fibrinogen, 3000 IE PPSB

Initial CT-scan

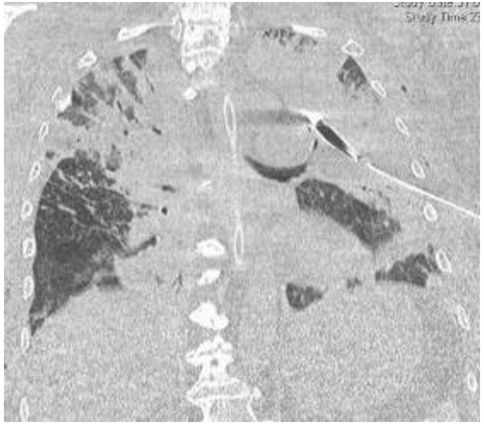



Initial CT-scan



- Vertebral fracture T4

- severe pulmonary contusion



Immediate surgical interventions

- laparotomy due to suspected liver trauma and hemodynamic instability: liver hemangioma, no relevant trauma

- chest tube insertion

- ORIF proximal humerus fracture left, reestablished pulse

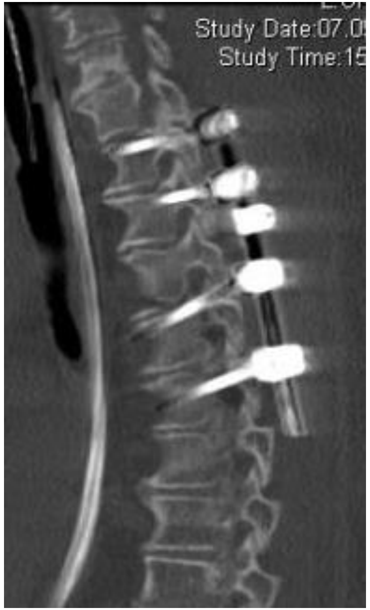
- Intensive care and CLRT, damage control

- no emergency spinal stabilization in hemodynamically instable patient

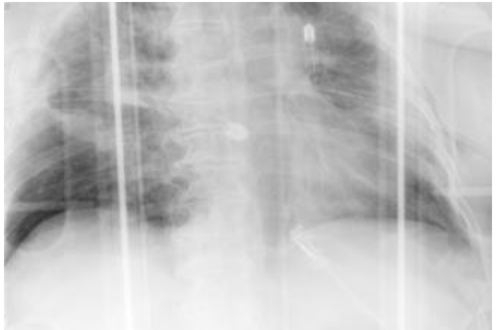
second surgical intervention day 3

- Chance fracture of the 4th thoracic vertebra with rupture of the ventral longitudinal ligament, AO Type B

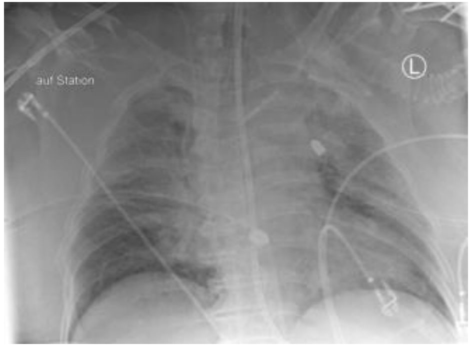
=> indication for early posterior stabilisation of T4-Fracture (T2 – T6)



Lung contusion: Chest xrays



day 1



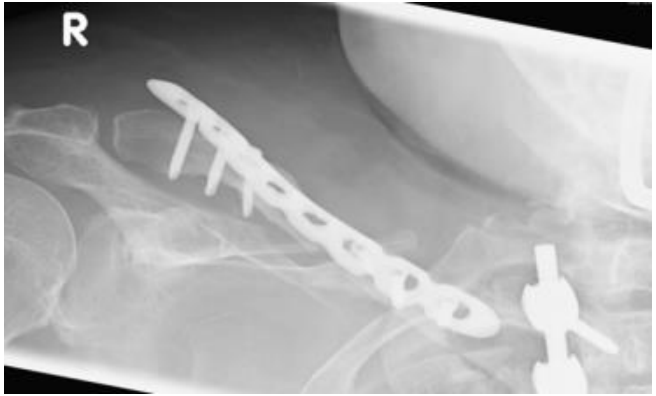
day 2

day 3

day 4

third surgical intervention Day 14

- ORIF and double plate osteosynthesis distal humerus
- ORIF of the left collarbone
- discharge to rehab 3 weeks post trauma



Background

European Journal of Trauma and Emergency Surgery
https://doi.org/10.1007/s00068-023-02247-3

GUIDELINE

ESTES recommendation on thoracolumbar spine fractures

January 2023

Klaus Wendt[1] · Christoph Nau[2] · Marko Jug[3] · Hans Christoph Pape[4] · Richard Kdolsky[5] · Sam Thomas[6] · Frank Bloemers[7] · Radko Komadina[8]

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Prehospital and Emergency Room Management

- Full in-line spinal **immobilization** in suspicion of spine injury
- Transport to a hospital where **definitive spinal care can be achieved**
  - ➢ In case of **life-threatening** injuries transport to the **nearest hospital**

- Use of **corticosteroids** of **high- dose corticosteroids is not recommended**

- Whole-body **CT Angiography scan**
  - ➢ Conventional X-rax only in case of low energy trauma

- **MRI** can provide **additional information** about discoligamentous injuries, occult fractures and spinal cord injuries

Non-Operative Treatment

- Based on:
  - Biological age
  - Bone quality
  - Activity level
  - Individual requirements
  - **Stability of the fracture** as most important criterion

Non-Operative Treatment

- According to the German Society of Orthopaedics and Trauma (DGOU), four **morphological modifiers (MM)** were introduced in addition to the AO Spine Classification:
- **MM 1:** Deviation from the physiological profile of the spine

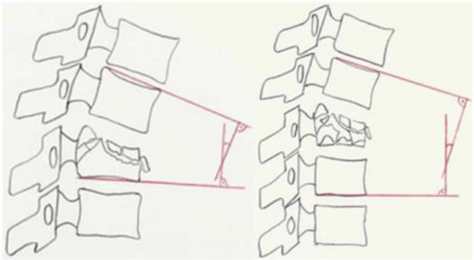


Fig. 5 Morphological modifier 1 (MM 1): Disorder in the physiological alignment of the vertebral column: monosegmental and bisegmental endplate angle (EPA) (Spine Section DGOU [51])

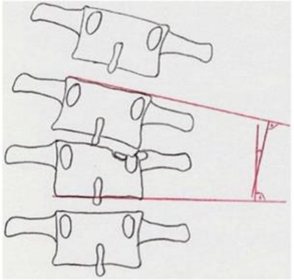


Fig. 6 Morphological modifier 1 (MM 1): Disorder in the physiological alignment of the vertebral column: scoliosis angle (Spine Section DGOU [51])

- δ-EPA < 15–20° and the posterior column is intact
  - ➢ functional therapy
- scoliosis angle<10°
  - ➢ functional therapy

Non-Operative Treatment

- **MM2**: Destruction of the vertebral body:

Fig. 7 Morphological Modifier II (MM II): Comminution of the vertebral body (Spine Section DGOU [51])

- **MM 3:** Stenosis of the spinal canal:

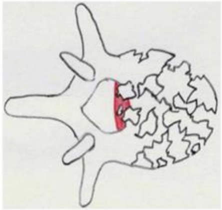


Fig. 8 Morphological Modifier III (MM III): Stenosis of the spinal canal (Spine Section DGOU [51])

- **MM 4:** Extent of disc injury: No spontaneous healing tendency

Non-Operative Treatment

- A0 – minor, non-structural fracture
- A1 – wedge compression, EPA <15-20°
- A2 – split (MM2, MM4)
- A3 – incomplete burst (MM1, MM2, MM3, MM4)
- A4 – complete burst (MM1, MM2, MM3, MM4)

➢ Pain therapy, physiotherapy, X-rax controls (1, 3, 6, 12 weeks)

Surgical Treatment

- **No strong evidence** for surgery regarding treatment (conservative vs operative), and type of surgery (posterior, anterior or combined)

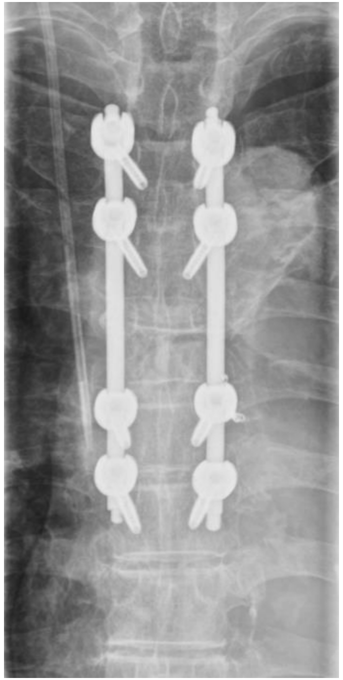
- Fractures type **AO B and C** and those with neurological deficits profit from surgery

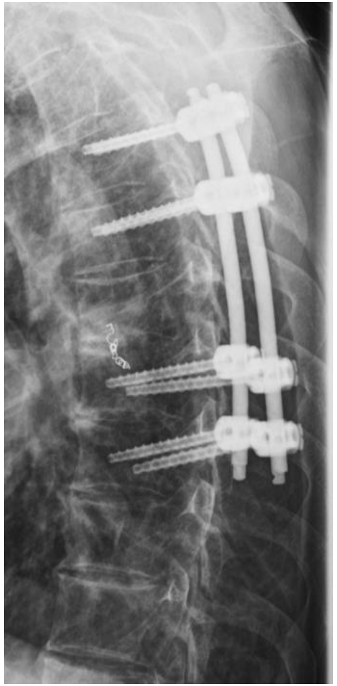
- Goal of stabilization can be **instrumentation or fusion** (spondylodesis)

Surgical Treatment

- Long segmental instrumentation should be used above TH 10

- Dorsal stabilisation by fixation of the noninjured vertebra cranial and caudal of the index fracture is standard.





Surgical Treatment

- Patients >70y, those with neurological deficits and decompression/ osteoporotic disease long instrumentation is advisable

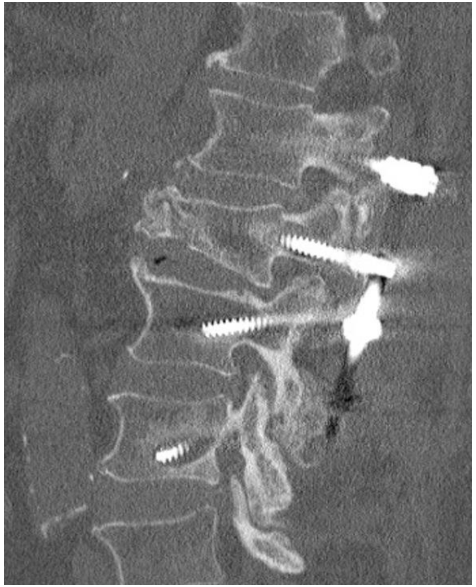
- Diameter of the screws is more important than length of the screw

Surgical Treatment

- Cement augmentation with PMMA (polymethyl methacrylate) useful in patients with reduced bone quality.

Surgical Treatment

- Placement of pedicle screws in the noninjured part of the index fracture in short segment stabilisation



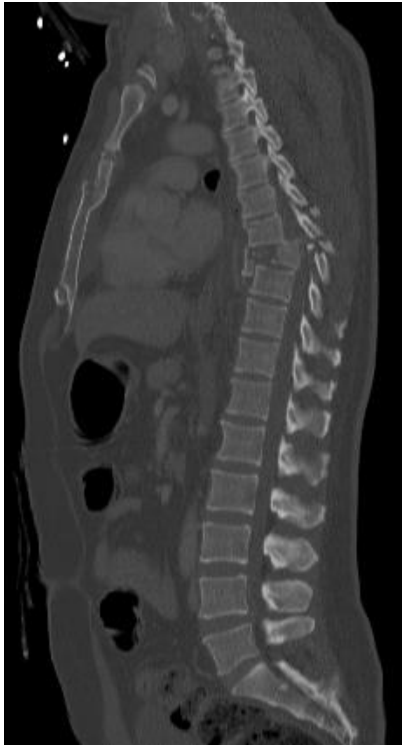
Surgical Treatment

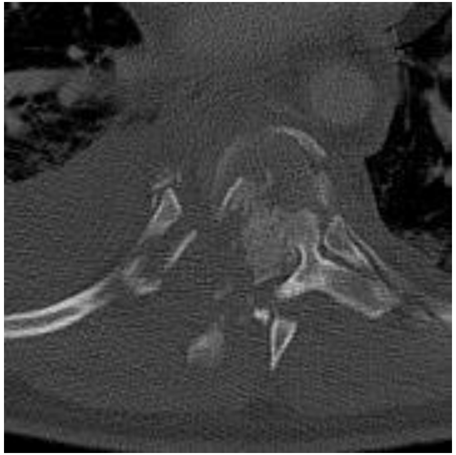
- In cases with unfavourable morphological modifiers anterior stabilization can be considered

Timing of Surgery

- Unstable thoracic fractures should undergo early (within 72 h) stabilisation

- Neurological deficits caused by traumatic spinal canal stenosis should be treated as an emergency
  - ➢ Surgical decompression within 24 h is associated with improved sensormotoric recovery





Summary

- Multiple trauma treatment is an interdisciplinary approach
- Treatment follows ATLS – concepts and german S3-guideline

Spine:

- If a spinal injury is suspected, the patient must be immobilized and transferred directly to a specialized centre.
- Adequate imaging is essential for further treatment.
- Operative treatment can prevent further deterioration and allows early mobilization in unstable fractures.
- Early decompression is essential for recovery from spinal cord injuries.

Thank you very much !