SEVERELY INJURED PATIENTS

Presenter:
Dr Laszlo G Nöt

SEVERELY INJURED PATIENTS - EPIDEMIOLOGY

- **Hypovolemia shock** is a major contributor in nearly half of 150.000 trauma-related deaths per year in the United States.

- **Injuries** claim the lives of 235.000 European Union citizens annually.

- The **multiple organ dysfunction syndrome (MODS)** has a high incidence and especially **high mortality rate ~30-50%**.

- Despite the advances in traffic and occupational safety, trauma remains the **major cause of death in people younger than 35 years.**

- **Early deaths** after injuries are caused by **severe hemorrhage** and **central nervous system** injuries, whereas **late** deaths are related to **septic complications** and **multiple organ dysfunction syndrome**.

DEFINITION

Polytrauma: *Combination of injuries with the involvement of at least one of the body cavities whereas any of the injuries itself or the combination of them - by aggravating the effect of each others - results in an immediate life-threatening condition.*

Examples: **- injury of two body cavities or,**
- injury of a body cavity and two long bone fractures

Important: ***Spine injury with neurological deficit or complex pelvic fracture equals with a cavity injury !!***

Please, be aware that definition of polytrauma or severely injured patients may vary, depending on the country / region where you will be practicing!

UK & USA:

Severely Injured Patient: **ISS ≥ 16** (ISS = Injury Severity Score)

DEFINITION

IMPORTANT TO NOTE THE DIFFERENCES:

Multitrauma: *Combination of injuries without the involvement of of the body cavities whereas neither the injuries themselves, nor the combination of them are life-threatening.*

Monotrauma: *Single, isolated injury of one of the extremities.*

Advanced Trauma Life Support© (ATLS) - HISTORY

ADVANCED TRAUMA LIFE SUPPORT©

- ATLS has its origins in the United States in 1976, when James K. Styner, an orthopedic surgeon his plane into a field in Nebraska. Dissatisfied with the efficacy of emergency management, then he decided to create a protocol to improve the early trauma care.

- In 1980, the American College of Surgeons Committee on Trauma adopted ATLS and began US and international dissemination of the course.

- ATLS has become the standard for trauma care in American emergency departments and advanced paramedical services.

American College of Surgeons
Trauma Programs

Textbook: http://www.snath.org/download/ATLS_Dr.pdf

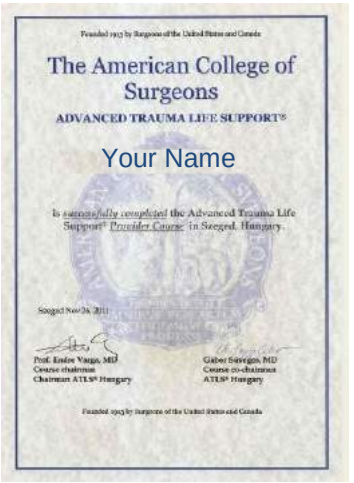
Advanced Trauma Life Support© (ATLS) - HISTORY

ADVANCED TRAUMA LIFE SUPPORT©

• Since then, emergency physicians, paramedics and other advanced practitioners use ATLS as their model for trauma care worldwide.

> Trauma Programs Home > ATLS

Advanced Trauma Life Support


The American College of Surgeons
ADVANCED TRAUMA LIFE SUPPORT®
Your Name

Textbook: http://www.snath.org/download/ATLS_Dr.pdf

ADVANCED TRAUMA LIFE SUPPORT©

AT THE SCENE OF AN ACCIDENT:

DON'T PANIC – KEEP IT ON YOUR MIND:

WHATEVER YOU DO *IS BETTER* THAN DOING NOTHING !!

FIRST THING TO DO - CALL FOR HELP !!!

112

112 / 911

POLYTRAUMA – *PRINCIPLES OF THE SUCCESSFUL MANAGEMENT*

- To identify the priorities of life saving, limb saving, and disability-limiting surgery.
- To outline the general and local factors affecting decision-making.
- To recognize the importance of teamwork.

POLYTRAUMA – *KEY FACTORS OF THE MANAGEMENT*

Injury

- Fracture
- Vascular injury
- Compartment syndrome
- Open wound
- Crush injury
- Nerves

Patient

- Previous Condition
  - Age (physiologic)
  - Diagnoses
  - Medications!
- Other injuries
- Physiologic response
- Expectations/needs

Care Team

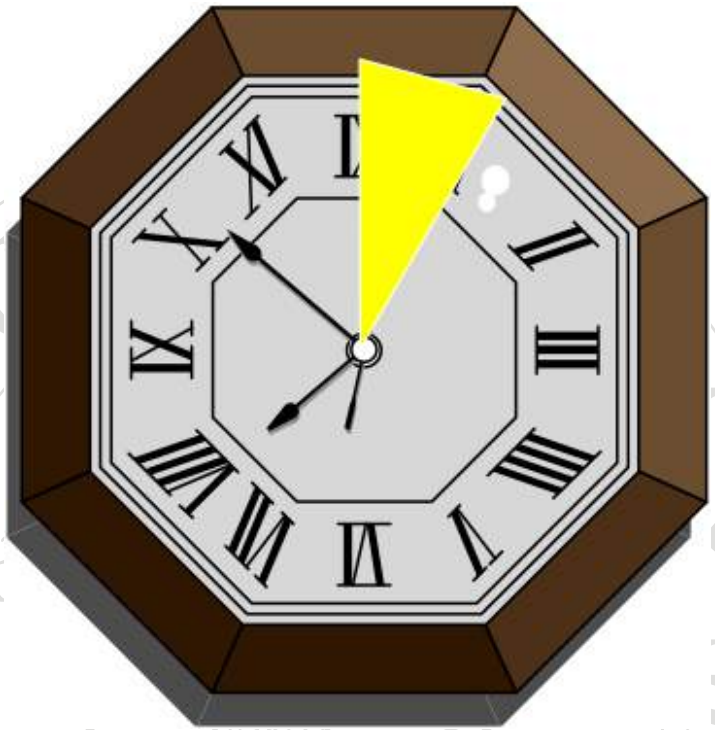
- Surgeon
- Assistants
- Anesthesia
- Other specialties
- OR nurses
- Postoperative
- Rehabilitation
- Social supports

Resources

- OR
- Instruments
- Implants
- Imaging
- ICU
- (Other Patients)

The first 60 minutes after the accident:

‘golden-hour’

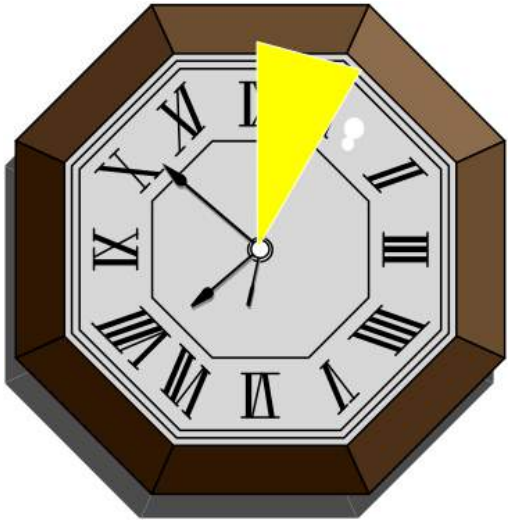


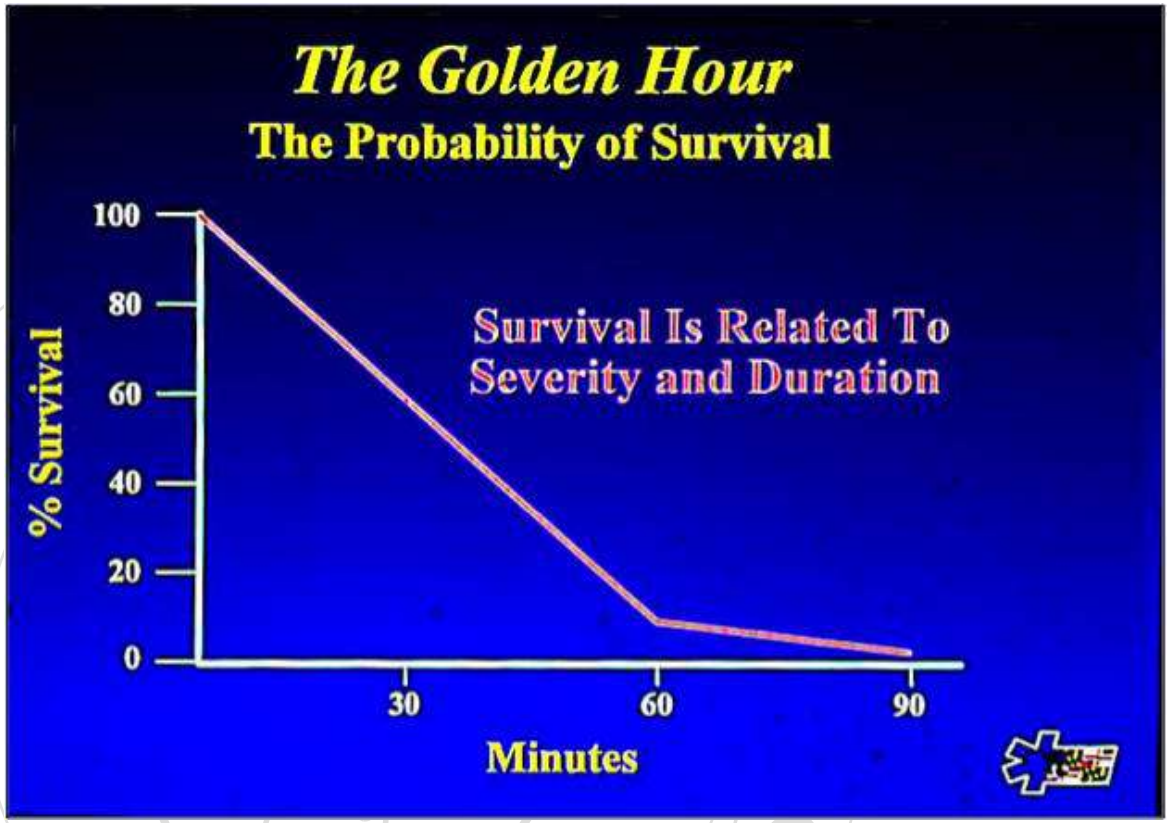
The first 10 minutes following accident:

‘platinum ten-minutes’

THE ‘GOLDEN-HOUR’ OF SHOCK

Saving TIME – Saves LIVES





ATLS - ALGORITHM

1. Preparation & Triage
2. Primary Survey
3. Resuscitation
4. Adjuncts to Primary Survey and Resuscitation
5. Secondary Survey
6. Adjuncts to Secondary Survey
7. Post Resuscitation Monitoring and Re-evaluation
8. Definitive care

1. Preparation & Triage

• An *effective trauma system* needs the teamwork of EMS, emergency medicine, trauma surgery, and surgery subspecialists.

• Trauma roles
  - *Trauma captain*
  - Interventionalists
  - Nurses
  - Recorder

• Triage
  - Experienced trauma surgeon
  - Score system

EVALUATION – SCORE SYSTEMS

Revised Trauma Score (RTS): physiologic scoring system, designed for use in based on the initial vital signs of a patient: GCS + Systolic Blood Pressure + Respiratory Rate

APACHE II (Acute Physiology and Chronic Health Evaluation II): monitoring 12 physiological parameters

SAPS II (Simplified Acute Physiology Score) physiologic scoring system, similarly to APACHE II

TRISS: Trauma - Injury Severity Score, calculating survival probability, based on RTS, ISS and age.

AIS / ISS score: Injury Severity Score: anatomy based evaluation

GCS: Glasgow Coma Scale, neurological deficit

ISS – INJURY SEVERITY SCORE

I. Abbreviated Injury Scale (AIS)

- Severity of injury is graded for
  non-fatal lesions from 0 (no injury)
  to 5 (critical) in 5 body areas.

II. Injury Severity Score (ISS)

- Total amount of squares of the 3 highest AIS values obtained for one patient.
- The maximum value is 75
- Polytrauma: ISS ≥ 16

TRAUMA.ORG
CARE OF THE INJURED

Score calculators: http://www.trauma.org/index.php/main/article/383/

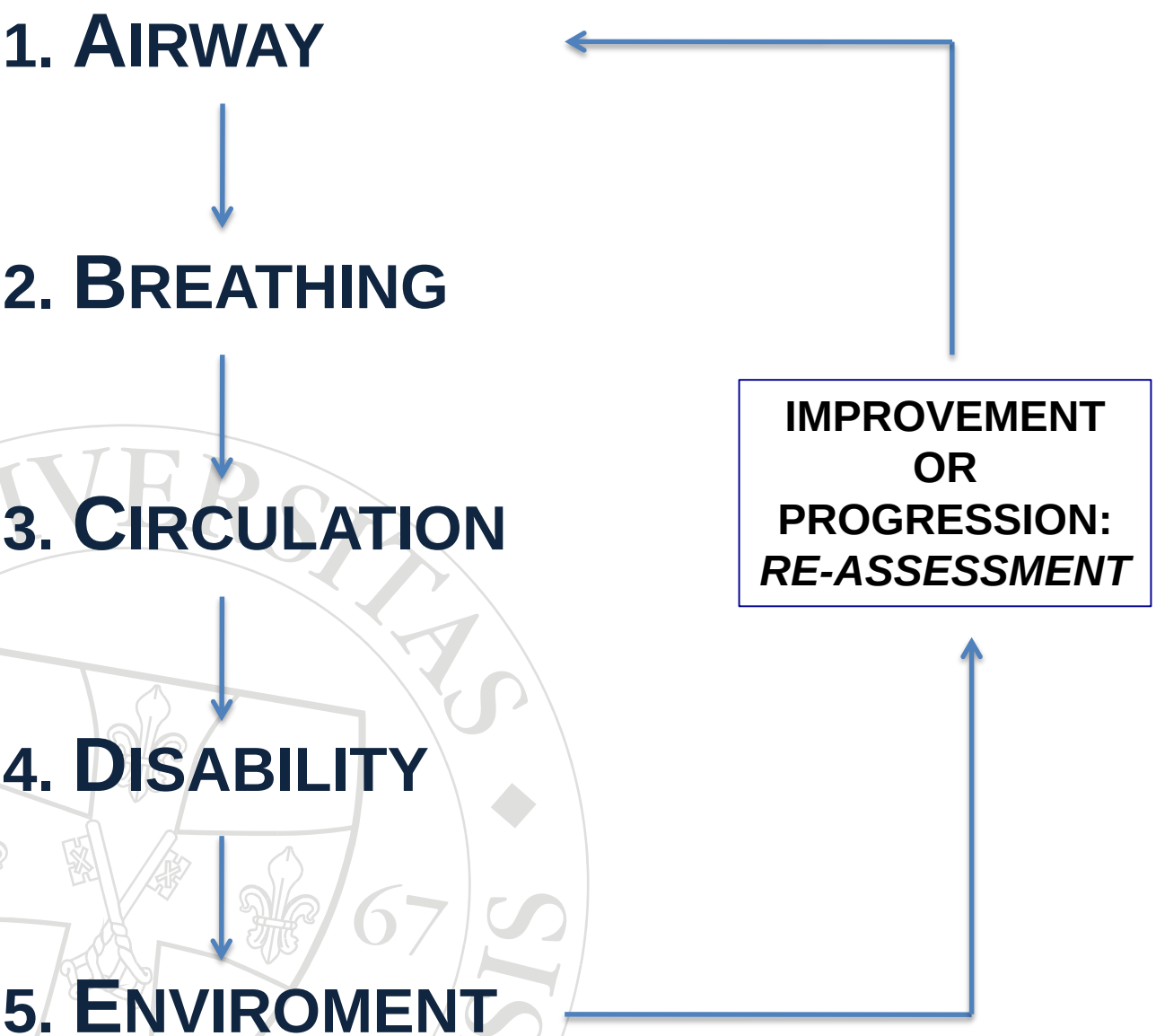
2. Primary Survey

• Patients are assessed and treatment priorities established based on their injuries, vital signs, and injury mechanisms

• ABCDEs of Trauma Care

- **A:** Airway and c-spine protection
- **B:** Breathing and ventilation
- **C:** Circulation with hemorrhage control
- **D:** Disability/Neurologic status
- **E:** Exposure/Environmental control

‘ABCD’ - PROTOCOL



3. Resuscitation

- Oxygenation and ventilation

- Shock management, intravenous lines, warmed Ringer's lactate solution (NS, HES, etc)

- Management of life-threatening problems identified in the primary survey is continued

3. Resuscitation

4. Adjuncts to Primary Survey and Resuscitation

- Blood pressure, pulse oximetry, ECG
- X-rays and other diagnostic studies
  - conventional X-rays: a, chest
    b, C-spine
    c, pelvis
  - DPL (diagnostic peritoneal lavage) or
  - FAST (focused abdominal sonography)
- Urinary and gastric catheters
- Monitoring
- ABG / lactate analysis (metabolic and respiratory acidosis) and respiratory rate
- End-tidal carbon dioxide

5. Secondary Survey

- **AMPLE history**:
  - Allergies
  - Medications
  - Past Medical History
  - Last Meal
  - Events (prior to accident)

  Mechanism of injury: blunt / penetrating / thermal

- **Physical exam from head to toe**, including rectal exam

- **Frequent reassessment** of vitals

5. Secondary Survey

- Head
- Chest
- Abdomen
- Spine
- Neurological examination
- Limbs

6. Adjuncts to Secondary Survey

- Hemodynamic status
- Contrast CT-scan / MRI-scan
- Extremity X-rays
- Endoscopy and ultrasonography

7. Post Resuscitation Monitoring and Reevaluation

- reevaluation for new findings or overlooked
- continuous monitoring of vital signs
- urinary output /0.5 ml/kg/hr - 1 ml/kg/hr/
- ABG , ECG , pulse oximetry – effective analgesia

8. Definitive care

- **Definitive care** – after identifying the patient's injuries and managing life-threatening problems
- **Obtaining special studies**

- **Transfer**

If the patient's injuries exceed the institution's treatment capabilities

PHASES OF SHOCK

1. **Compensated:** circulatory redistribution blood pressure is maintained, capillary refill time >2sec, oligo-anuria, tachycardia, confused.

2. **Decompensated:** dropping blood pressure, pale, tachycardia, anuria, coagulopathy, met. acidosis, respiratory insufficiency, loss of consciousness.

3. **Irreversible:** collapsing circulation, progressive cell death.

RESPONSE TO INITIAL FLUID THERAPY

2000mL crystalloid fluid iv:

- **Fast response:** 10-20% blood loss,

- **Transitory response:** 20-40% blood loss, op, aggressive fluid administration

- **No relevant effect:** severe blood loss >40% , transfusion, emergency op

THERAPEUTIC APPROACHES

EARLY TOTAL CARE
(life-saving op + definitive care)

?

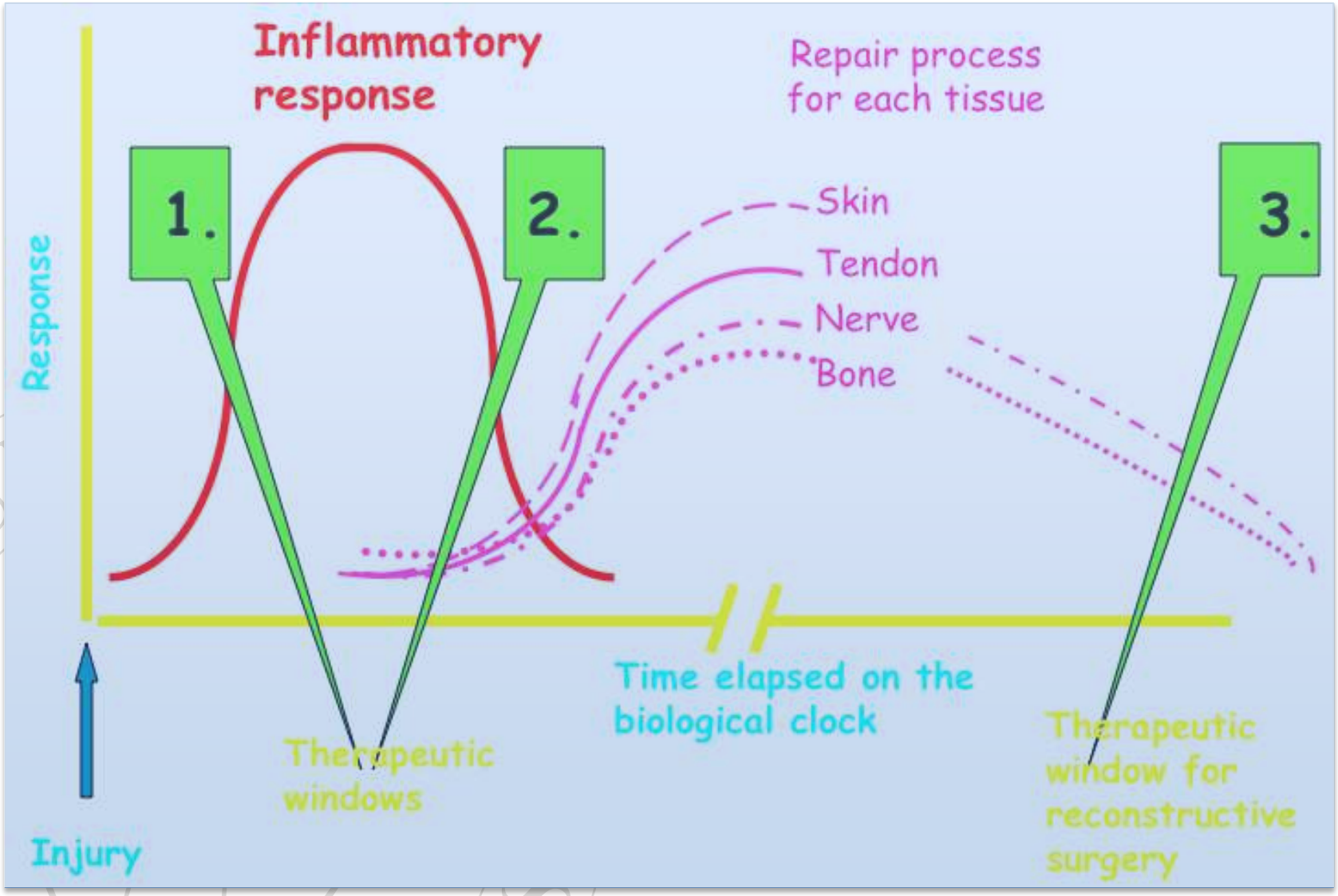
DAMAGE CONTROL
(life-saving op + temporary solution: external fixation, pelvic clamp..

- No high-level evidence-based study available to support any of the methods as a sole, preferable approach for the management of severely injured patients.

→ **Consensus (AO – Advanced Course, December 2013):**

- **Early Total Care:** hemodynamically stable patient
- **Damage Control:** hemodynamically unstable patient (compensated or decompensated hemorrhagic shock)

THERAPEUTIC WINDOWS TO STAGE PRIMARY, SECONDARY AND RECONSTRUCTIVE SURGERIES



THERAPEUTIC WINDOWS TO STAGE PRIMARY, SECONDARY AND RECONSTRUCTIVE SURGERIES

I.A. Lifesaving urgent operations (tensile PTX, bleeding from great vessels, pericardiac tamponade, bleeding in chest or abdomen, bleeding from sinus in the skull, intracranial pressure increase)

I.B. Lifesaving urgent other interventions – stabilization (ventilation, anti-shock therapy, treatment of the metabolic disturbances)

II. Diagnostic investigations /spiral CT scan of chest, abdomen, spine, pelvis, ultrasonography, laboratory…./

THERAPEUTIC WINDOWS TO STAGE PRIMARY, SECONDARY AND RECONSTRUCTIVE SURGERIES

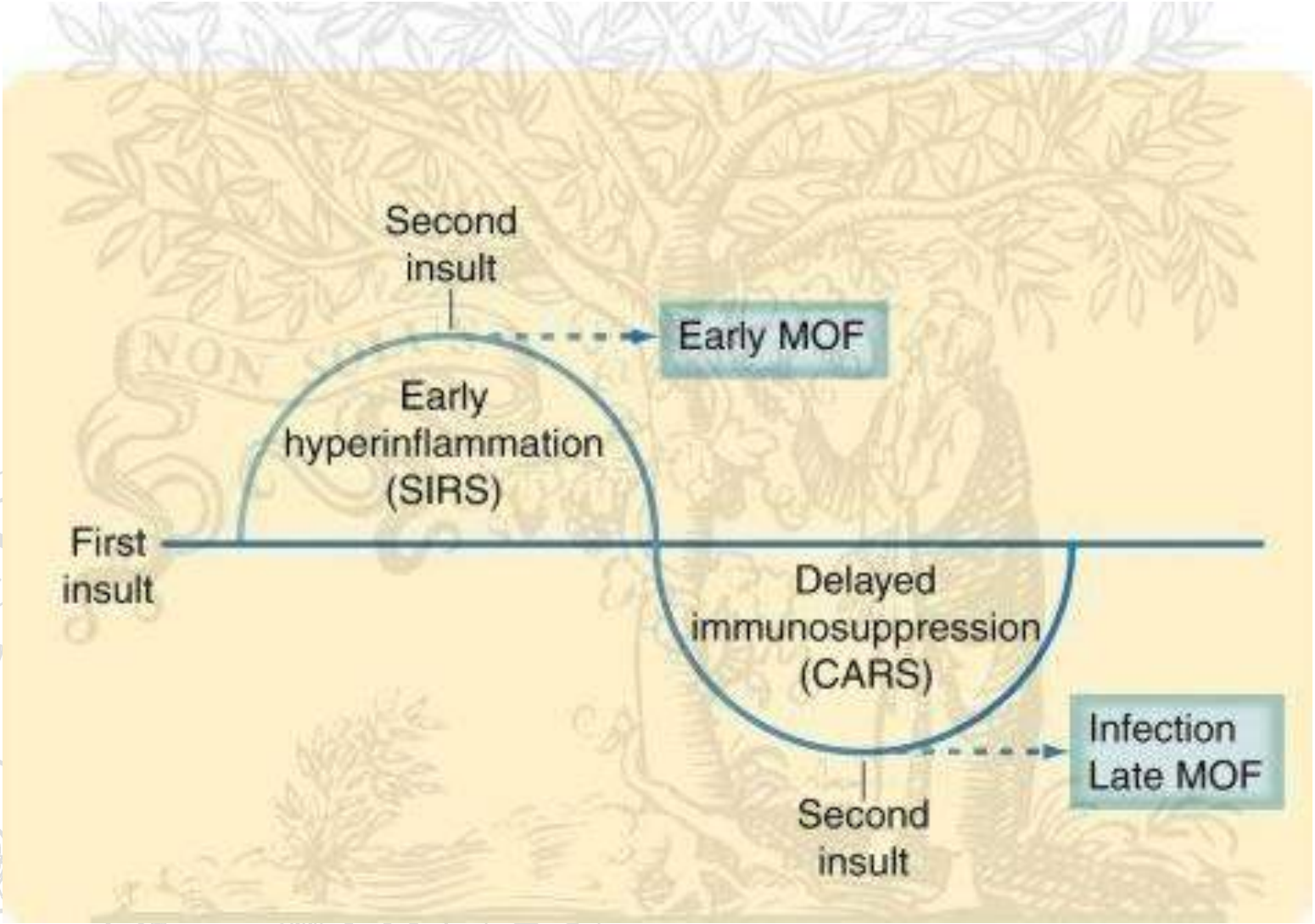
III. Second operative phase (urgent, but not lifesaving: postponed primary operations due to thoraco-abdominal injuries, 3rd grade open fractures, traumatic amputations, serious hand injuries, fractures of the femur)

IV. Observation on ICU (prevent sepsis, ARDS, embolism)

V. Third operative phase (treatment of closed fractures, frx. of the pelvis, upper extremity, leg, knee, ankle)

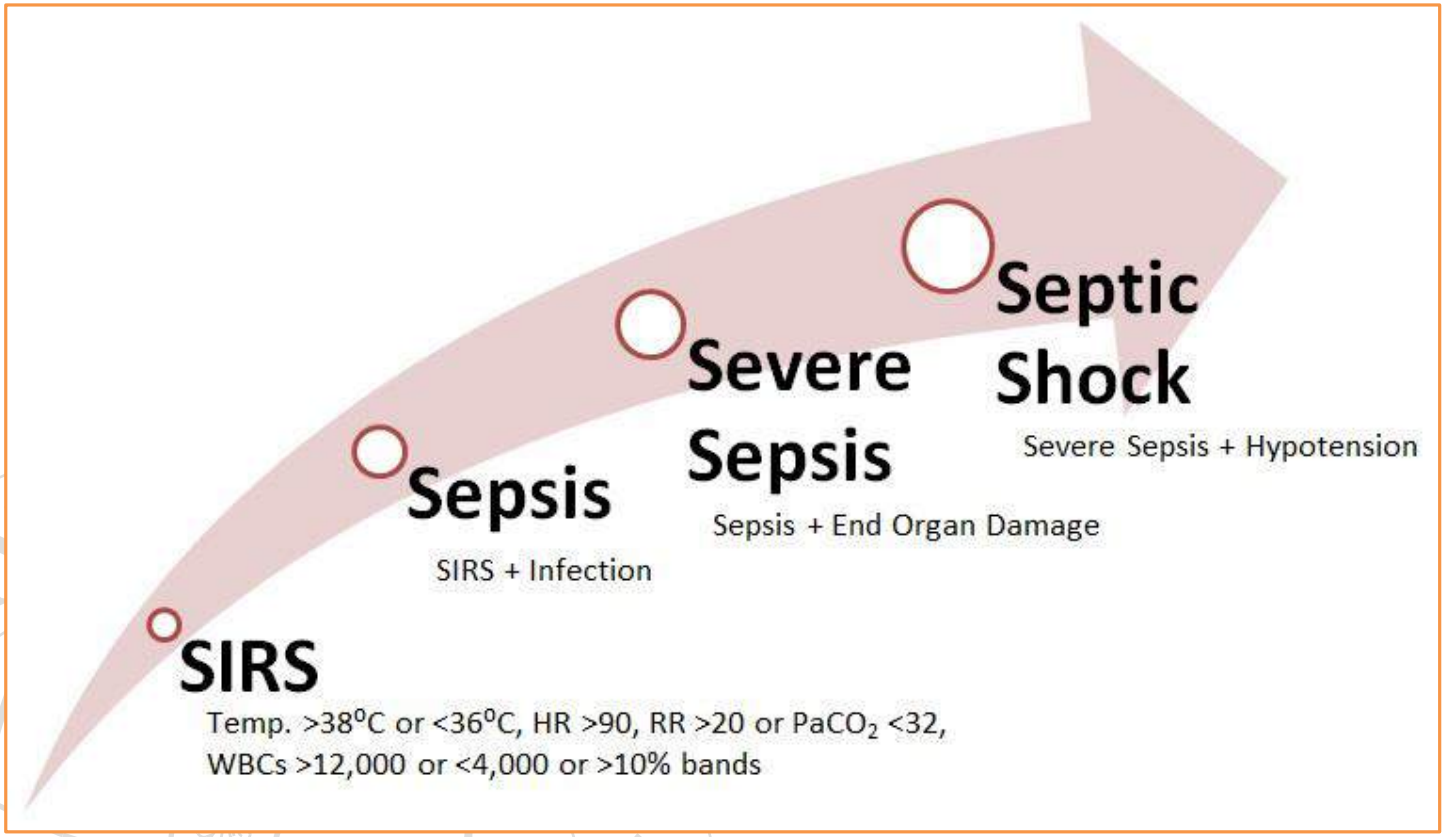
VI. Rehabilitation (progressive mobilization, complex physiotherapy, balneotherapy, etc..)

PATHOPHYSIOLOGY OF SIRS / MODS



THE 'TWO-HIT' THEORY

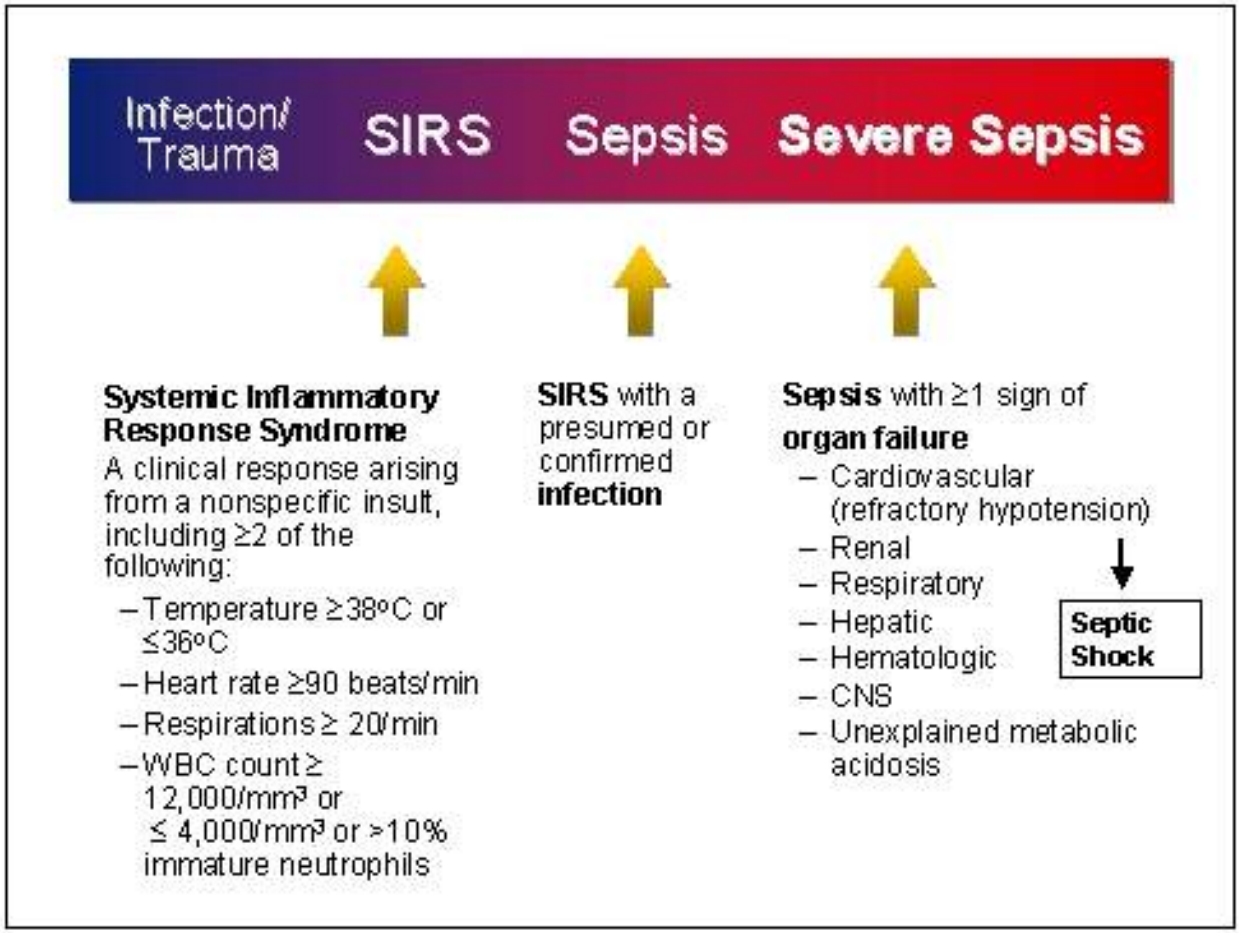
DEVELOPMENT OF COMPLICATIONS AFTER INJURY



SIRS (Systemic Inflammatory Response Syndrome)

MODS (Multiple Organ Dysfunction Syndrome)

COMPLICATIONS: PROGRESSION from SIRS to MODS



SIRS (Systemic Inflammatory Response Syndrome)

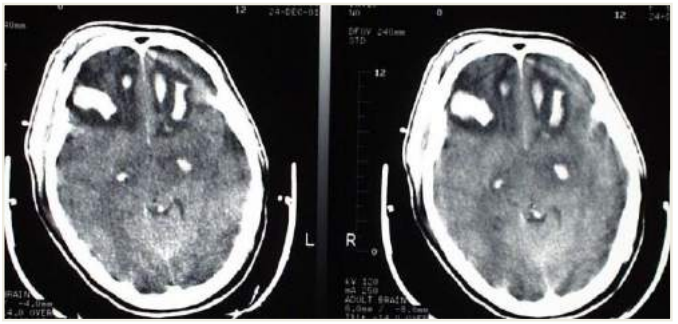
MODS (Multiple Organ Dysfunction Syndrome)

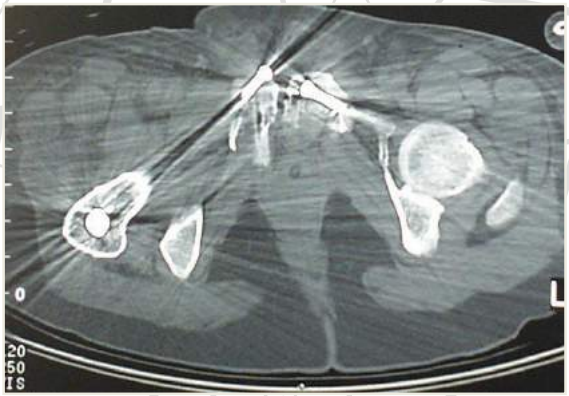
MANAGEMENT OF COMPLICATIONS

- complex ICU therapy
- hemodynamic parameters, inotropes
- monitor and/or respiratory support
- fluid balance
- careful wound and fracture management
- wide-spectrum antibiotics

CASE REPORTS

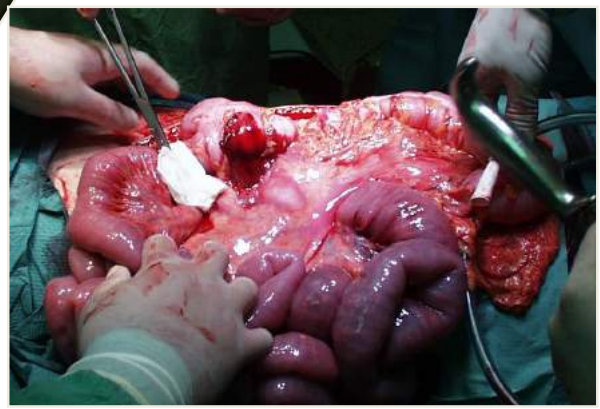
Patient 1.



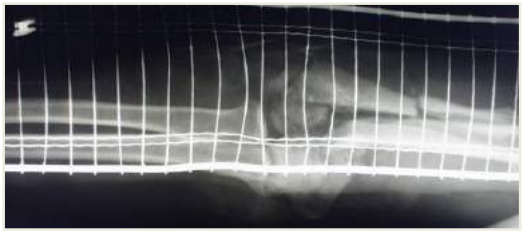


Young lady injured at a traffic accident. Unstable pelvic fracture, liver rupture, intracranial hemorrhage. Despite of urgent operations an ARDS occured and finally she died.

Patient 2.

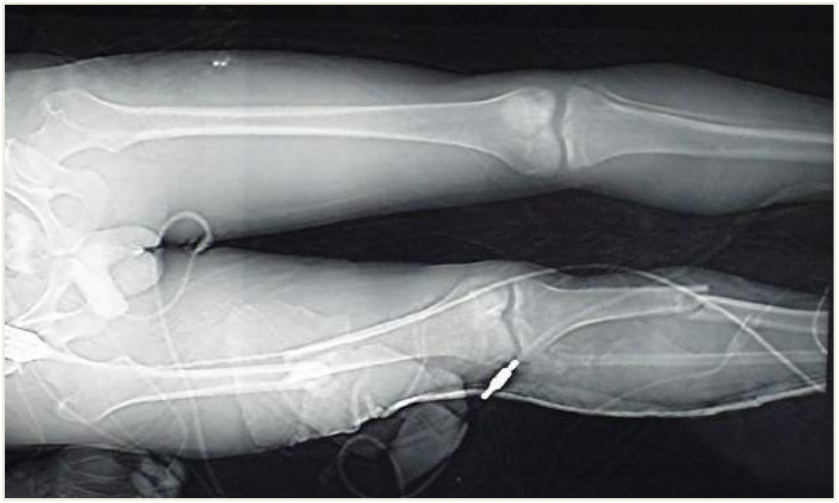


Young man, run by a car. Open pelvic fracture with injury of the rectum. Rupture of the Mesenterium.

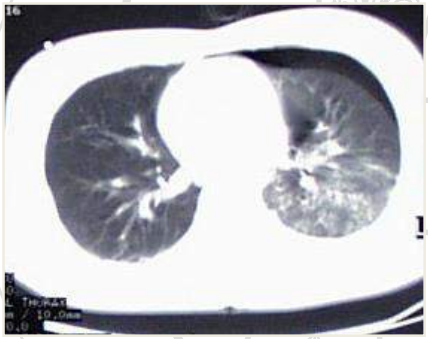


Fracture on the skull-base.
Open fracture of olecranon and distal part of humerus.

Patient 3.



Ipsilateral midshaft fracture of the femur and leg.
Serious cuntusion of the lung.
Pneumothorax, hemothorax.

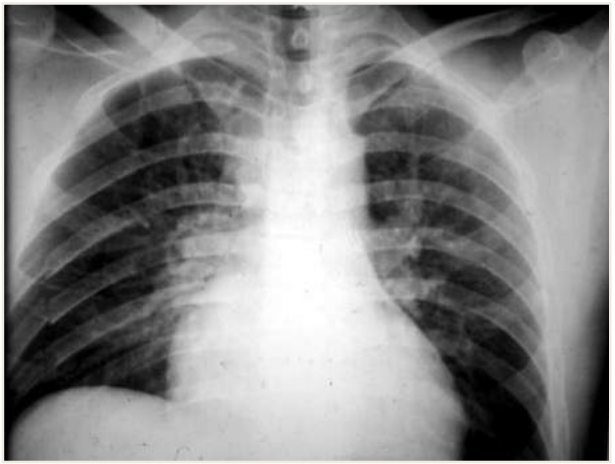


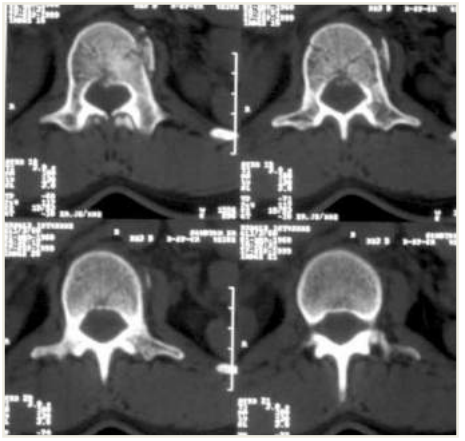
Despite of urgent operations and intensive care,
owing to serious cerebral and thoracal injuries he died within one week.

Patient 4.

Horizontally unstable pelvic fracture(B3), retroperitoneal hematoma, rupture of left kidney.

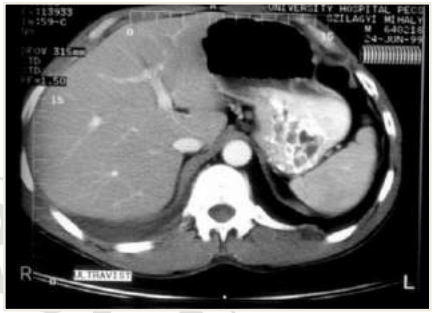
Primary laparotomy, suture of ruptured kidney, temporary stabilisation of pelvis with external fixator, later definitive fixation with Herbert screws. He survived with a good recovery.



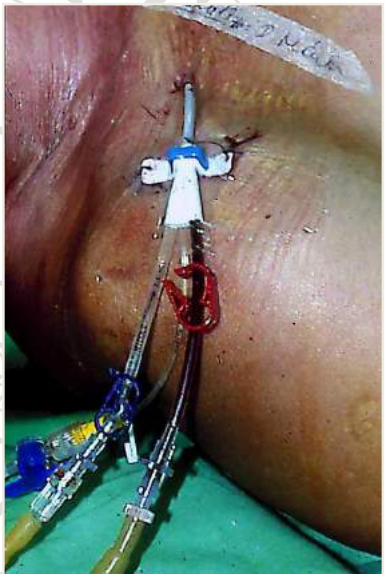


Patient 5.

Serial rib fractures and pneumothorax On the left side. Fracture of 3rd lumbar vertebrae, treated conservatively.



He survived with a good recovery.



SUMMARY

'Take home messages'

- First response - call for help !!
- Immediate Transport to Trauma Centers
- ATLS and 'ABCD'
- Primary and Secondary Surveys
- Early Total Care Vs Damage Control
- Complications: SIRS, ARDS, MODS
- Epidemiology - Importance of Prevention

SUMMARY

If you are interested in, please, check the following links for further information:

1. AO / ASIF AO Foundation Transforming Surgery–Changing Lives
www.aotrauma.org: AO Surgery Reference & Online Education

2. Orthopaedic Trauma Association (OTA)
http://ota.org/about/

3. trauma.org
http://www.trauma.org/archive/traumabank.html

4. AAOS: www.aaos.org AAOS American Academy of Orthopaedic Surgeons / American Association of Orthopaedic Surgeons

5. ATLS: http://www.facs.org/trauma/atls/ American College of Surgeons Trauma Programs

THANKS FOR YOUR ATTENTION!