

Principles of Damage Control in Orthopaedic: Multiple fractures

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History

Naval military concept:

Save the ship

Limit damage

Repair and
accomplish the
mission



Goals

- keep someone alive that would be dead without our intervention
- Prioritize treatment
- Patient to return to functional life

Hit phenomenon

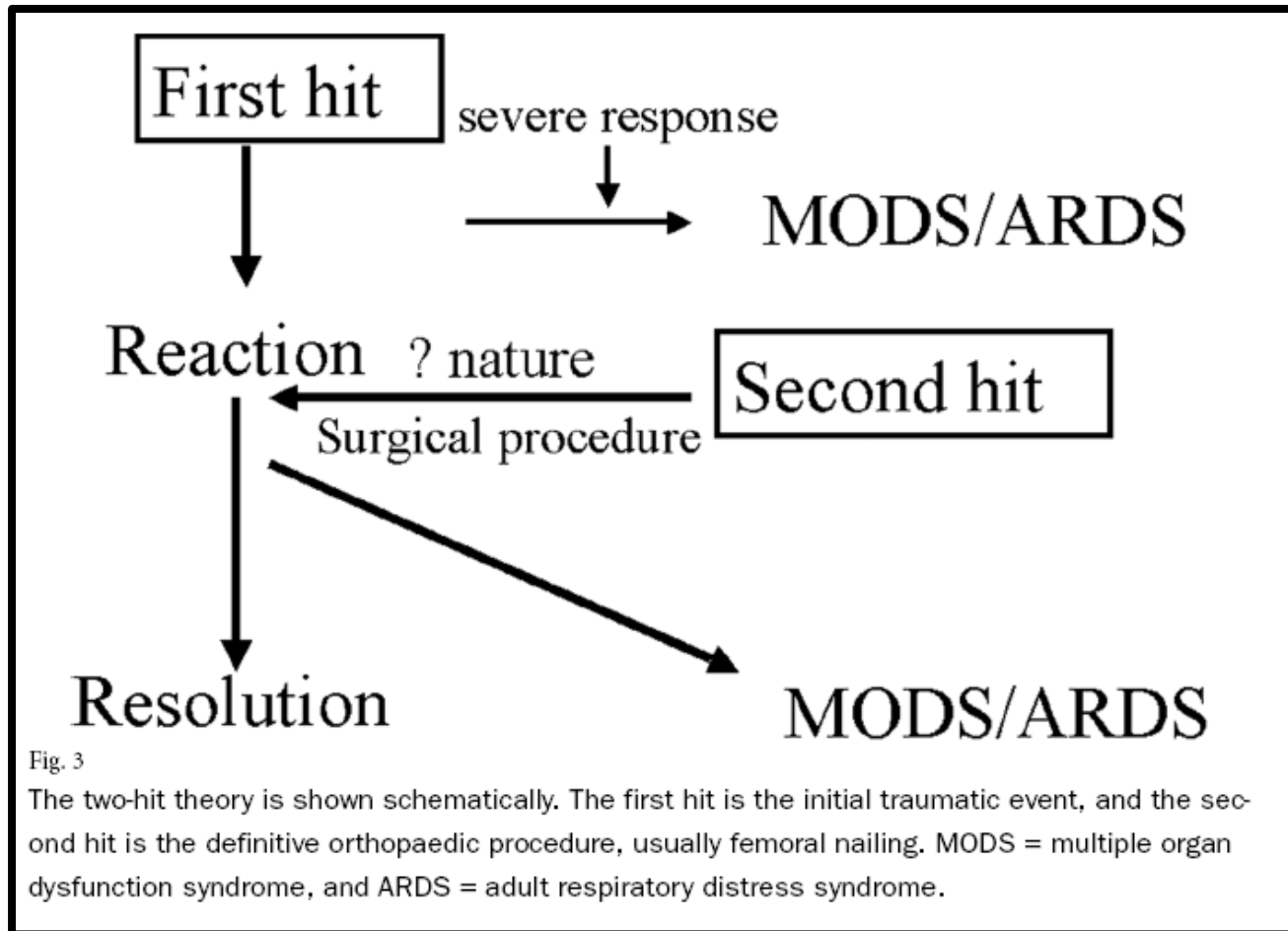


Fig. 3

The two-hit theory is shown schematically. The first hit is the initial traumatic event, and the second hit is the definitive orthopaedic procedure, usually femoral nailing. MODS = multiple organ dysfunction syndrome, and ARDS = adult respiratory distress syndrome.

Benefits of resuscitation

- Uncompensated shock: gross sign of circulatory deficiency
- Compensated shock: suboptimal tissue perfusion
- Fully resuscitated: tissue acidosis eliminated and aerobic metabolism restored

NO DEBATE

Urgent extremity issues

- Control external bleeding and asses vascularity
- Rule out compartment syndrome
- Major dislocation
- Basic wound management
- Splint the extremity

Benefits of early fractures stabilization

- Reduce continued marrow emboli to the lungs
- Improves pain control
- Protects surrounding soft tissue
- Facilitates nursing care

Primary IMN femur in MTP with associated lung contusion

Pape et al 1993

- 106 patients with ISS>18
- In patients with chest trauma nailing within 1st 24 hours led to
 - ↑ARDS (33 vs 7,7%)
 - ↑Mortality (21 vs 4%)

IN CHEST TRAUMA EARLY IMN IS BAD

IMN of long bones has systemic effect

- Robinson et al JBJS 2001
- Trans oesophageal echo & invasive monitoring during IMN
 - ≈ ↑ pulmonary arterial pressure
 - ≈ ↓ arterial oxygen partial pressure
 - ≈ systemic change in markers of coagulation

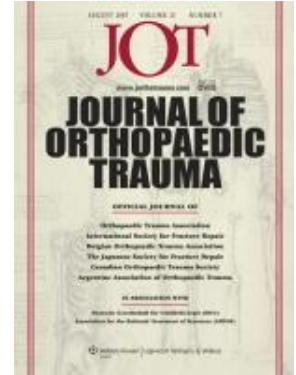
Systemic effects of IMnailing

- Brundage et al Journal of Trauma 2002
- 1362 patients over 12 years
- Femur fixation within 24 hours improved outcome even with severe chest and head injuries

“Resuscitation & hemodynamic normalization are essential part of our protocol”

- Only 65% of pt were physiological ready <24 hours
- Highest incidence of ARDS in group fixed 2-5 days

Pro inflammatory response is ↑ by primary IMN



- Pape et al 2003
- Prospective study =35patients
- The systemic inflammatory response measured by IL-6 was ↑55 to 254 pg/dl
- Ex –fix and secondary IMN IL-6 fairly remain same (71 pre-surgery and 68 post)

How to identify patients at risk for systemic effects of IMN

- Injury factors: high ISS, pulmonary injury, abdominal injury, bilateral femur
- Physiological factors: difficult resus, multiple transfusion, coagulopathy
- Genetic and Biochemical markers

Damage control principles

Avoid 2nd hit phenomenon

- External fixation
- Easy to apply
- Two surgeons working simultaneously
- Versatile
- Fracture stability without ↑ inflammatory response

Conversion of ex-fix to IMN

- Bhandari et al JOT 2005
- Easy to do
- Problem : pin drainage
- Best done in <2weeks
- Average infection rate 3.6%

Clinical case

- GSW thigh
- What is the surgical sequence?
 1. repair > fixation
 2. fixation > repair
 3. shunt > fixate > repair



Unstable fracture with vascular injury what is the surgical sequence?

- JT 2002 McHenry ,Retrospective review
 - 27 pt over 10 years
 - 5 fracture fixation first but 4 required fasciotomies
 - 13 temporary shunt
 - 9 definitive vascular repair
- 8 fasciotomies

Revascularization before fracture fixation did not
results in repair disruption

Damage Control Orthopaedic

- Prevent 2nd hit
- Hb <8
- Base deficit >5
- Body temperature <32
- INR >1.5 (>2-50% mortality)

If all corrected fix the femur and tibia within 1st
48hours

2-5 days worse time to operate

Summary

- Trauma to the extremity most common injury pattern
- DCO optimizes resuscitation of patient
- 2nd hit is regulated
- Patient selection important
- The ideal method of stabilization should be easier, quicker and less harmful to the patient