Mr Sam Yasen
Contents

- Historical overview
- Review issues with polytraumatised patients
- What is damage control orthopaedics (DCO)
- What is early total care (ETC)
- When to use DCO vs ETC
  - Patient selections / specific injuries
- Summary
Early C20th: Multiply injured patients deemed too ill to undergo surgical treatment

1950’s: Standardised surgical treatment of fractures developed (the AO approach)

1960-1970’s: Application of early operative fixation of fractures noted to reduce the incidence of pulmonary and other post-op complications

Bose et al, J Trauma, 2006, 37:20-8
Historical Overview (2)

- **1980’s**: Application of early operative fixation of fractures in all patients – *early total care*
  - Subgroups of patients with severe thoracic / abd injuries and high injury severity scores did poorly


- ‘*Damage control orthopaedics*’ : introduced to orthopaedic literature over the past 6-7 yrs
Trauma

→ Systemic Inflammatory Response

→ Host defence response

→ Host defence failure

→ Damage / Death

Physiological

Pathophysiological

Reversible

Irreversible
Trauma

Systemic Inflammatory Response

Host defence response

Host defence failure

Damage / Death

Pathophysiologicaal

Physiological

Reversible

Irreversible
Polytraumatised patients are more likely to die from metabolic than operative failure...
Two Hit Hypothesis

First Hit
- Tissue injury & shock

Second Hit
- Vulnerable
  - Late MOF
  - Recovery

SIRS
- Can not resuscitate
  - Early MOF
Two Hit Hypothesis
Aim to restore physiology rather than anatomy
Damage Control Orthopaedics (DCO)

Principles

- Control haemorrhage
- Management of soft tissues
- Achieve provisional fracture stability
- Prevent contamination
- Avoid further injury
IL-6 and HLA-DR class II molecules accurately predict the clinical course after trauma

- Neither is practical in an acute situation

Injury scoring systems...

...But there is no score that assists in decision making in the acute resuscitation phase
Patient Selection

- Stable → Definitive surgery
- Borderline → DCO vs ETC
- Unstable → Resuscitate / DCO
- In extremis → Life saving surgery

‘Borderline’ Patient (1)

- Difficult to define
- Thoracic injuries have a major role

Hanover Criteria

- Polytrauma + injury severity score of >20 points and additional thoracic trauma (abbreviated injury score >2)
- Polytrauma with abdominal / pelvic trauma (Moore score >3 points) and haemorrhagic shock (initial BP <90mmHg)
- Injury severity score >40 points in the absence of thoracic trauma
- Radiographic findings of bilateral lung contusions
- Initial mean pulmonary artery pressure of >24mmHg
- Increase of >6mmHg in pulmonary artery pressure during IM nailing
Louisville criteria

- pH < 7.24
- Temp <35°C
- Coagulopathy
- Operative time > 90 mins
- Transfusion > 10 units rbcs
- Geriatric patients

Roberts et al, JBJS (Am), 2005, 87:434-49
Pelvic Fractures

Pelvic ring injuries with exsanguinating haemorrhage are ideally dealt with by DCO

Options
- Pelvic binder
- External fixator
- Pelvic C-clamp

Consider angiography & embolisation if not responding but stable, or packing if unstable
Femoral Fractures (1)

- Delay of >24hrs in the stabilisation of major femoral fractures has x5 incidence of ARDS
- Exfix (DCO) vs IM nailing (ETC)
- IM nailing causes larger ‘2nd hit’
  - Longer operative procedure
  - Fat embolism from instrumentation of medullary canal

*Johnson et al, J Trauma, 1985, 25:375-84*
Early IM nailing in patients with severe thoracic trauma did poorly and ↑risk of ARDS¹

Retrospective study² of polytrauma patients with femoral shaft #’s: 42 ETC vs 55 DCO

- No difference in ARDS, lung scores, MOF, ITU LOS, hospital LOS
- DCO: significantly shorter operative time (22 vs 125 mins) & less estimated blood loss

DCO in Limb Surgery

DCO principles can be applied to a single severely injured extremity

- High energy tibial plateau fractures
- Tibial plafond fractures
- Grade III B & C open fractures
- Mangled extremities
General Indications for DCO

- Physiological criteria: lethal triad
- Complex pattern of severe injuries: expecting major blood loss and/or prolonged procedure in an unstable patient
- Other:
  - Limited experience or resources of the surgical team in dealing with complex injuries
  - Fatigued / overwhelmed surgical team
<table>
<thead>
<tr>
<th>Physiological Status</th>
<th>Surgical Intervention</th>
<th>Timing (Days)</th>
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<tbody>
<tr>
<td><strong>Response to resuscitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>Life saving surgery</td>
<td></td>
</tr>
<tr>
<td>Borderline</td>
<td>Damage control orthopaedics</td>
<td>1</td>
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<tr>
<td>Good</td>
<td>Early total care</td>
<td></td>
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<tr>
<td><strong>Hyper-inflammation / SIRS</strong></td>
<td>‘Second look’ - <strong>ONLY</strong></td>
<td>2-4</td>
</tr>
<tr>
<td><strong>‘Window of opportunity’</strong></td>
<td>Definitive surgery</td>
<td>5-10</td>
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<tr>
<td><strong>Immunosuppression</strong></td>
<td>NO SURGERY</td>
<td>11-21</td>
</tr>
<tr>
<td>Recovery</td>
<td>Secondary reconstructive surgery</td>
<td>&gt;21</td>
</tr>
</tbody>
</table>
Summary

- DCO should always be considered as an alternative to ETC
- DCO principles are applicable to the polytrauma patient or the severely injured single extremity
- Unresolved issues
  - What constitutes the borderline patient
  - Optimal management of femoral fractures with associated head and/or chest trauma – ongoing RCT

*Source: Rixen et al, Trials, 2009, 10(72)*
Questions?