Complex Pelvic Fractures

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AUSTRALIA
B-2 Lateral Compression

- Associated injuries:
  - Pelvic viscera

Bleeding risk +/-
Classification

Tile C
Significance

• 35% mortality in Australasian Major Centres
  » Verbeek et al. World J Surgery in press

• Most frequent preventable bleeding-related hospital trauma deaths
  » Brenneman et al. J Trauma 2006

• Level of evidence is low

• We can make a difference
  » Biffi et al Ann Surg 2001
  » Balogh et al J Trauma 2005
MANAGEMENT

“Multidisciplinary Approach”

= Nobody does anything

- General surgeon
- Orthopaedic surgeon
- Interventional Radiology
- Urology
BACKGROUND

- Haemodynamically unstable patients with Pelvic #:

  - 32% mortality
  - Only 55% had abdominal diagnostics
  - Only 28% had pelvic binding
  - 27% had angiography
  - 49% non-therapeutic laparotomy rate

Verbeek et al. World J Surg in press
BACKGROUND

• Primary intervention:
  – Angiography 18% mortality (58y, ISS 42)
  – Laparotomy 29% mortality*** (56y, ISS 40)
  – Pelvic fixation 10% mortality (39y, ISS 18)

Verbeek et al. World J Surg in press
Hemorrhagic Shock

22% on arrival to ED

SBP: 98±11 mmHg

BD: -13±2 mmHg

Transfusions: 11±2 U PRBC

62% related to pelvis

Balogh et al. J Trauma in press
SBP <90 mmHg

45% had no shock

46% shock patient had normal SBP

Balogh et al. J Trauma in press
COMPLEX PELVIC FX

- Requiring major surgical reconstruction
- Haemodynamic instability
- Open Fracture
- Associated injuries: Urethra and/or Rectum
Cause of Exsanguination (%)

Pre-hospital

- Extremity: 7%
- Abdomen: 14%
- Combined: 10%
- Pelvis: 23%
- Aorta: 23%
- Chest: 23%

Balogh et al. J Trauma in press
Cause of Exsanguination (%)

In-Hospital

- Externity: 11%
- Combined: 0%
- Abdomen: 11%
- Pelvis: 32%
- Aorta: 23%
- Chest: 23%
Anterior Ring – Pelvic Floor
Posterior Ring – Gluteal and Sacral vessel
Probability

- 1.5/100,000/year in Australia
- 5% of all pelvic fractures
- 10% of all high energy pelvic fractures

Balogh et al. J Trauma in press
Probabilities: High Energy Fractures

- Only 15% has abdominal injury requiring intervention
- Only 7% requiring immediate abdominal haemorrhage control
- 5% urethral injury
- 3% rectal injuries

Balogh et al. J Trauma in press
“Religions”

- Embolisers
- C-clampers / ex-fix-ers
- Packers
- Ligators
- Too concerned to do anything
Analysis of the literature on haemodynamically unstable pelvic #

Level of evidence

Number of articles
Steps 1.

- Base Deficit is worse than 6

- (Blood Transfusion in ED)

- Other sources are excluded
Pelvic binding < 10 min

~ venous bleeding
Pre and Post Binding
Angiography
Minimally invasive pelvic fixation <24 hours
WHAT NEXT?

- ?More ED resuscitation
- ?CT
- ?OT
- ?ICU
- ?Angio Suite
Diversion selectively based on localization of the perineal wounds (Faringer 1994.)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Need for colostomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone I.</td>
<td>Most of the cases</td>
</tr>
<tr>
<td>Zone II.</td>
<td>If long bedrest or faecal incontinence anticipated</td>
</tr>
<tr>
<td>Zone III.</td>
<td>Rarely</td>
</tr>
</tbody>
</table>
Haemodynamically Unstable Patient with a Pelvic #

CXR, PXR

DPA and/or FAST

Negative

Aim to transfer out of Resus room within 45 minutes

Stabilise pelvis in Resus

Angiography

Haemodynamics unstable - Repeat FAST positive

Laparotomy

Haemodynamics unstable - Big pelvic haematoma

Angiography

Positive

Stop external blood loss
Assess long bones
Deal with haemo/pneumothorax first

Laparotomy

Stabilise pelvis in OT
Classification

Tile A
• General surgical consult:
  - Distended abdomen
  - Tender lower abdomen
  - NEEDS LAPAROTOMY

• Orthopaedic surgical consult:
  - “Too unstable” to operate
  - May put an ex-fix when general surgery finished if stable enough
CT scan???

- Contrast blush on angio: Very specific to arterial bleeding
- Only 60% sensitivity!
Mortality

35\% - 40\% \implies 10\%
The Solution

1. Prehospital information
2. Preparation, communication
The Solution

3. Fix Airway and Breathing
The Solution

4. Find the source of the bleeding

<table>
<thead>
<tr>
<th>Site</th>
<th>Tool to Investigate</th>
<th>Time (minutes)</th>
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</thead>
<tbody>
<tr>
<td>External</td>
<td>Eyes</td>
<td>1</td>
</tr>
<tr>
<td>Long Bones</td>
<td>Eyes</td>
<td>3</td>
</tr>
<tr>
<td>Chest</td>
<td>CXR</td>
<td>10</td>
</tr>
<tr>
<td>Abdomen</td>
<td>DPA-FAST</td>
<td>10</td>
</tr>
<tr>
<td>Pelvis</td>
<td>Palpation, PXR</td>
<td>1-15</td>
</tr>
</tbody>
</table>
4. External stabilisation technique
METHODS

Prospective data collection

18m pre guidelines retrospective evaluation

18m post guidelines prospective evaluation

Univariate statistical analysis *p<0.05
METHODS

Inclusion criteria:
High-energy trauma with pelvic #
ISS > 15
BD > 6 mEq/L
PRBC > 6U/12hr

Exclusion criteria:
Non-pelvis related bleeding
GCS < 9
RESULTS

Pre-guidelines: 18m ending Dec 2001
(n=17)

Post-guidelines: 18m after Dec 2001
(n=14)
### RESULTS

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (yrs)</th>
<th>Male %</th>
<th>ISS (mEq/L)</th>
<th>BD (mEq/L)</th>
<th>SBP (mmHg)</th>
<th>GCS</th>
<th>PRBC (U/12hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-PG</td>
<td>40±4</td>
<td>71</td>
<td>39±3</td>
<td>9±1</td>
<td>116±7</td>
<td>12±1</td>
<td>9±2</td>
</tr>
<tr>
<td>Post-PG</td>
<td>42±6</td>
<td>71</td>
<td>37±4</td>
<td>10±1</td>
<td>112±6</td>
<td>12±1</td>
<td>9±2</td>
</tr>
</tbody>
</table>
Adherence to Practice Guidelines

- Abdominal Clearance <15min
- Pelvic Binding <15min
- Angiography <90 min
- Minimally invasive Pelvic Fixation <24hrs

* p<0.05

Pre-PG

Post-PG
OUTCOMES

*\( p < 0.05 \)

- ICU LOS (days)
- 24hr PRBC (U)
- Mortality (%)

**Pre-PG** vs **Post-PG**
Recombinant Factor VIIa
• DAY 1 CT SPINE: #
  T7/T9/RIGHT RIB 6/7/12

• DAY 2 RE-
  EXPLORATION,
  IRRIGATION,
  CLOSURE OF
  ABDOMEN/FIXATION
  OF PELVIC SCREWS
CT: - head – Multiple contusions
   - Chest – pulmonary contusion, expanded lungs
   - Abdomen – negative

Hemodynamically unstable
Contrary to transfusion of 4 units packed cells

Figure of “H” fracture of the sacrum
Contrast extravasation
Angiography - Embolization

External iliac artery

EXTRAVASATION

EMBOLISED

Internal iliac arteries

HAEMODYNAMICALLY UNSTABLE

CONTRARY TO TRANSFUSION OF 6 U PACKED CELLS
STENTING INSERTION

External iliac artery stent
The bleeding stopped

EMBOLISED Internal iliacs

HAEMODYNAMICALLY STABLE
TRANSFUSION: Ø
Traps

- Non-therapeutic laparotomy
- Missed rectal injury
- Insignificant fractures in elderly
- Underestimation of pelvic displacement because of early binding
Classification

Tile B