Update on the Early Management of the Fractured Pelvis

Robert C. Mackersie, M.D., FACS
Department of Surgery
San Francisco General Hospital
> 90% will have other injuries

- Index for intraabdominal injury (9-11%)
- Index for bladder injury (4-6%)
- Index for renal injury (1-2%)
- Index for urethral injury (2-3%)
- Other: TBI, chest, aorta
IT’S THE BLEEDING… STUPID!!

- arterial
- venous
- bone

OPEN FX. (recto-vag. inj)

COMPLEX FRACTURES (ortho)

Why this is such a problem II:

- complications
- ARDS
- death

Why this is such a problem II:
Critical Decisions:

- Will immediate external compression be necessary?
- Does patient require immediate assessment of abdomen & possible laparotomy?
- Will patient require pelvic A/G for diagnosis & control of hemorrhage?
- Will the patient need pelvic ex-fix & when?
- Routing: OR? CT? A/G? ICU? (particularly tough w/ combined injuries)
Recognition of risk:

- deformity
- suprapubic, scrotal, perineal hematomas
- open fracture bleeding
- “pelvic rock” unreliable & potentially dangerous!
- plain radiographs
  - shock, obtundation, (+) physical exam, hematuria
Recognition of risk:

- Hemodynamics (VS, base deficit)
- Transfusion requirements
- ED cystogram
- Pelvic radiographs
  - Pelvic fracture type
  - Number of fracture sites
  - Posterior element involvement
  - Degree of displacement of hemipelvis

OVERALL PREDICTIVE POWER IS POOR
Airway control (intubation)

- Low threshold for intubation
  - shock, transfusion requirements
  - elderly
  - associated chest injuries
  - associated CNS injury
  - most patients requiring external compression (belts, MAST, etc.)
Monitoring for major pelvic fx.

- central venous pressure, arterial lines
- thermistor foley or core temperature monitor
- serial arterial base deficit
- Intraabdominal compartment syndr.
- ICP & coags where approp.
- Role of the anesthesiology service!!
‘Vortex’ Control: warm & out of shock

- MASSIVE TRANSFUSION PROTOCOL
  - Activated by surgeon / anesthesiologist
  - MTP coordinator
  - 4-6 FFP: 4-8u PRBCs available at all times
  - Platelets to stay > 50 x 10^9/ l.
  - ‘Hemostatic’ resuscitation: (tailored to case)
    - 1:1:1 (FFP, PRBC, non-apheresis platelets)
    - cryo for fibrinogen < 100 mg% after FFP
Pelvic fracture hemorrhage control:

- (LAPAROTOMY first - PRN for abd inj)
- Pro-coagulants (MTP, PCC, rFVIIa…)
- External compression (MAST, belts)
- Pelvic packing – selected patients
- ARTERIOGRAPHY (dx. & rx.)
- PELVIC FIXATION
Pro-coagulants

- blood components, MTP
- Pro-thrombin complex complex concentrate (PCC)
- rFVIIa
- other agents
  - DDAVP
  - aprotonin
  - anti-fibrinolytic agents
Pelvic compression (sheets, belts)

- Very simply & rapidly applied
- Re-conforms displaced pelvis
- May help tamponade hemorrhage
- Much less respiratory or constrictive problems
- Allows arterial access
- Limited data available...
External circumferential pelvic compression
Pelvic (anterior) external fixation:

- Will NOT definitively control major arterial hemorrhage!
- No good controlled reports of comparative efficacy
- Takes time – not good with severe injuries
- May displace posterior injuries & worsen bleed
- Giving way to formal pelvic ORIF
Clinical use of pelvic binders
Krieg et al. J. Trauma 2005

- External rotation fx.
- Internal rotation fx.
CT useful to ID patients likely to benefit
definitive rx. for arterial hemorrhage
effective in 87 - 99% of cases
may fail w/ coag, PVD, severe shock
repeat embolization may be required
complications = ischemia, impotence, emboli, arterial injury
14 patients in severe shock or in extremis underwent lap + pelvic packing. 5/14 developed IACS. 33.2 U transfusion / first 12 hrs. NO A/G, EMBOLIZATION. Mortality 25%

- Lap + pelvic packing to control venous & arterial hemorrhage
- For dx/rx of other intraabdominal injuries & large vessel injuries
Totterman et al. J. Trauma 2007: 18 patients with retroperitoneal pelvic packing. Time from injury to ED arrival = 98 minutes! Mean total transfusion requirement = 59 U, with ave. of 12 U prior to packing & 17 U in 24 hrs following packing.

- 15 patients had A/G, embolization following packing with 80% positive for arterial injury.
- Mortality overall = 28% 1 death from ongoing pelvic hemorrhage, contributory in 4/5 non-survivors
- Used for patients “who would not otherwise survive transferal to the angio suite.”
Pelvic EP packing
Needed: Protocol driven approach

- Immediate I.D. of ‘at-risk’ patients
- Airway control
- Early reduction of pelvic displacement
- ‘Vortex’ control & tight physiological management
  - blood & products
  - prevent hypothermia
  - monitoring for adequacy of resuscitation
- Early management of abdominal injury
- Control of pelvic fracture hemorrhage
Clinical pathway for unstable pelvic fractures

- Total mortality
- Death due to bleeding
- Death due to MOF
- 24-hour mortality

Comparison before and after implementation of the clinical pathway.
Clinical pathway for unstable pelvic fractures
Balogh. al. J. Trauma 2005
Pelvis fracture (A)

- Resuscitate, AP XRay, FAST or DPA (B)
  - Pelvic binder (G)
  - Unstable
    - OR for exploration (+/- external fixator) (L)

- Stabilizes (C)
  - Abdominal / Pelvic CT

- CT +
  - OR for viscous injury
  - Operate for ongoing bleeding

- CT -
  - Pelvic blush (E)
  - Angiography / Embolization (F)
  - OR/Exploration Preperitoneal Packing (K)

- ICU Finish evaluation, Resuscitation (D)

- ICU, finish evaluation (I)
  - Preperitoneal Packing (M)
  - Angiography / Embolization (H)

- Consider Repeat Angiography (J)

WTA protocol (JW Davis MD)
Clinical review: Initial management of blunt pelvic trauma patients with haemodynamic instability

Thomas Geeraerts¹, Vibol Chhor¹, Gaëlle Cheisson¹, Laurent Martin¹, Bertrand Bessou², Augustin Ozanne³ and Jacques Duranteau¹

- Pelvic Fracture
  - Unstable haemodynamic status
    - Eliminate other causes of haemorrhage (Thorax, head, limbs)
    - FAST
      - Free intraperitoneal fluid?
        - YES
          - Laparotomy
            - ± Pelvic Packing
            - ± Pelvic Clamp or
              - or External fixation
              - CT scan if not performed before
        - NO
          - CT scan if possible
          - Angiography
            - ± Pelvic Clamp or
              - External fixation
            - External fixation
              - Stable haemodynamic status?
                - YES
                  - ICU
                - NO
                  - Consider Surgical bleeding control or repeated angiography
  - Stable or stabilised haemodynamic status
    - FAST and CT scan + contrast (TAP)
    - Arterial causes of haemorrhage
    - Stable haemodynamic status?
SFGH algorithm
On-line.

Management Algorithm for Hemorrhage Associated with Pelvic Fractures

- **Blunt trauma patient, major mechanism => Prioritize management of airway, breathing, & fluid resuscitation**

- **Question:** Blunted response to pain? Any evidence of shock? Major associated injury?
  - **Answer:** NO
  - **Steps:**
    - Plan AP pelvic radiograph (usually in conjunction w/ CXR)
    - Presence of major pelvic fx?
      - **Pos.**
        - Major pelvic fracture & evidence of hemorrhagic shock, major drop in Hct or requiring blood transfusions in ED?
          - **Yes**
            - Immediate eval. for source of hemorrhage: FAST exam for patient in shock (compartmentalized or decompensated)
          - **No**
            - IMMOBILIZE: Orthopedic consult
              - Continue resusc per routine protocol
              - CT abdomen => AG + embolization for evidence of extrinsic CT

  - **Answer:** NO
  - **Steps:**
    - Additional pelvic exams are usually not necessary. Equivocal injuries may be further evaluated by CT.
    - Continue resusc per routine protocol
    - Cerebral monitoring for hemorrhage

- **Answer:** (+) FAST
  - **Steps:**
    - Pelvic binder application as needed.
    - To the OR for exploratory laparotomy, thoracotomy as indicated.
    - Embolization + pelvic ligation post-op if indicated

- **(-) FAST**
  - **Steps:**
    - Presumed source of major hemorrhage = pelvic fx
    - APPLY PELVIC BINDER for transport, pre-CT or enroute (seiz postop)
    - ESTABLISH MONITORING: Set up for immediate AG => Head CT as indicated, OR for head if indicated
    - ANESTHESIOLOGY CONSULT
    - MAJOR TRANSUSION protocol
    - PROCORRIGENTS, hypothermic precautions

- **Poor response**
  - **Steps:**
    - Consider major associated vascular injury (lacer, injury)
    - Likely
      - To the OR for control/repair pelvic packing prior to AG
    - Not likely
      - **Steps:**
        - Consider pelvic packing prior to AG
        - PELVIC AG + EMBOLOGIZATION
        - MAST (milking anti-shock tourniquet)
        - MAY be applied in selected patients with recurrent/persistent hypotension, and fx, NOT responding to binder immobilization

- To ICU for monitoring & correction of deficits. Complete diagnostic evaluation
  - **Steps:**
    - Consider application of conventional anterior external fixator for unstable injuries. Complete dx evaluation.
Protocolized Management

- Protocols (PMGs) reduce undesirable practice variability
- Protocols also have the potential for limiting better-than-average practice variability
- One size does not fit all – careful analysis of stratifying factors is essential
- PMGs must be tailored to institutional expertise & resources
- PMG must involve careful assessment of stratification factors (physiological, demographic, resources, etc.) in order to promote “good” decisions
- Institutional PMGs should be constantly re-analyzed & modified based on ongoing case experience
Pelvic fx: Top ten points…

1) It's the bleeding, stupid!! (and don’t forget abd injury)
2) Avoid the vortex: warming, monitoring & massive transfusion protocols
3) Old boy scout (girl scout) trick: pressure stop bleeding (binder, packing)
4) Watch out for the elderly (physiologic fragility, pelvic space compliance)
5) The CT scanner is (mostly) your friend (screening for angio)
6) Anesthesia is definitely your friend (cooperative management)
7) Embolization - more is not always better
8) The benefits of skeletal alignment (ex-fix)
9) Beware of occult problems: (rectal, vaginal, GU complications)
10) Know where you're going: Protocol-driven approach
Current Management of Pelvic Fractures

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