Management of Bleeding Pelvic Fractures

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No Disclosures.
Pelvic Fractures & Mortality

- Majority of pelvic fractures are stable / low energy mechanism.

- Subgroup of 8-10% with HD instability
  - Mortality rates 30-50% in modern series

Costantini et al. *J Trauma* 2016
Tesoriero et al. *J Trauma* 2017
Gaski et al. *J Trauma* 2016
KEY POINT

Stop the bleeding.....
Stop the Bleeding....

- Despite prompt angiography...
- Despite hemostatic resuscitation...
- Despite protocol driven management...

Patients were still dying due to pelvic fracture related hemorrhage.
In 2004.....Pelvic Packing

• Described in Europe
  – rapid transport to OR
  – external bony fixation
  – packing of retroperitoneum

• Rationale:
  – addresses venous/bony bleeding
  – additional procedures as indicated

Pohlemann et al.  OTA Ann Mtg 2000
Ertel et al.  J Orthop Trauma 2001
Pelvic Packing

Pelvic fixation first:
KEY POINT

Be aware of bar location during ex-fix placement.
Modified European technique:

- 6-8 cm suprapubic incision
- divide midline fascia
KEY POINT

Incision should be away from a laparotomy incision – keep the spaces separate!
You will encounter the hematoma!
Pelvic Packing

- Packing the pelvis:
  - 3 lap pads on either side of bladder
  - 1st one is all the way down to presacral space
  - Use a ringed forceps or Cobb elevator
  - Done blindly

(at unpacking)
Pelvic Packing

- Typically 6 packs for adults, 4 for children.
- Inverted U around the bladder.

(at unpacking)
• **Suprapubic catheters** – must be placed at first operation.
PITFALLS

Separate incision for SP tube.
Pelvic Packing

- Close fascia and skin
KEY POINT

Pelvic packing may be used in children.

Burlew et al. *J Trauma Acute Care Surg* 2017
Chao et al. *J Pediatr Surg* 2012
Unstable Pelvic Fracture Algorithm

**FAST Exam**
- Positive
  - Operating Room: Exploratory Laparotomy
    - HD Unstable
    - HD Stable
  - Resuscitate in the SICU + CT scans
- Negative
  - 2 units RBCs/ED trauma bay
    - HD Stable
    - HD Unstable

**If Pelvic Hematoma Evident**: Pelvic Fixation and Pelvic Packing

**Operating Room**: Pelvic Fixation and Pelvic Packing
Re-ultrasound Abdomen
Pelvic Packing

- 11 years – 2293 pelvic fx patients
- 128 (6%) patients = PPP/EF
  - 70% men  Age = 44 ± 2 yrs  ISS = 48 ± 1
- ED vitals: SBP 74 ± 2  HR 120 ± 2
- Pelvic fx classification:
  - APC III (29)  LC II (26)  LC III (20)
  - APC II (20)  LC I (13)  APC I (4)
  - vertical shear (14)  CM (2)

Burlew et al.  J Trauma Acute Care Surg  2017
Packing: Hemorrhage Control

- Time to OR: 44 minutes
- RBCs: 4 ± 0.4 units in ED
- Pre-SICU vs. subsequent 24°
  - 8 units vs. 3 units
- FFP:RBC ratio was 1:2
Packing and Concurrent Procedures

- 85% of pts underwent 3 ± 0.2 procedures
  - Laparotomy
  - Urologic procedures
  - Extremity vascular
  - Neurosurgical/spine
  - Thoracotomy
  - Ex fix of fractures
  - I&D wounds/fasciotomy
Open Pelvic Fractures

“Packing doesn’t work for open fractures.”
Unstable Pelvic Fracture Algorithm

- **FAST Exam**
  - Positive
    - HD Stable
    - HD Unstable
  - Negative
    - 2 units RBCs/ED trauma bay
    - Resuscitate in the SICU + CT scans
- **Operating Room**
  - Exploratory Laparotomy
  - Pelvic Fixation and Pelvic Packing
  - Re-ultrasound Abdomen
- **If Pelvic Hematoma Evident → Pelvic Fixation and Pelvic Packing**
- **HD Stable**
- **HD Unstable**
Unstable Pelvic Fracture Algorithm

Operating Room:
Pelvic Fixation and Pelvic Packing
Re-ultrasound Abdomen

Remain HD Unstable

Arterial Bleeding from Pelvis?  Hemoperitoneum?  Abdominal Compartment Syndrome?
Unstable Pelvic Fracture Algorithm

What is the role of angio??
Angiography After Packing

- Minority required AE
  - 13% of patients
- Time to resuscitate/transfer
  - need for angio = avg of 10 hrs
- Fx classification:
  - LC I (4)
  - LC II (4)
  - APC III (2)
  - APC II (2)
  - LC III (2)
  - VS (2)
Who Needs Angiography?

• Can’t predict by:
  age, ISS, presenting SBP, presenting base deficit, ED blood tx, or fracture pattern

• Patients with AE after packing:
  lower HR (105 ± 8 vs 121 ± 3)
  more RBC pre-SICU (15 ± 3 vs 9 ± 1)
  more FFP pre-SICU (9 ± 2 vs 4 ± 1)
  more RBC in SICU (7 ± 2 vs 3 ± 1)
  more FFP in SICU (6 ± 2 vs 2 ± 0.4)
Who Needs Angiography?

- **FAST Exam**
  - **Positive**
    - Operating Room: Exploratory Laparotomy
      - HD Unstable
        - HD Unstable
          - If Pelvic Hematoma Evident ➔ Pelvic Fixation and Pelvic Packing
          - HD Unstable
        - HD Stable
  - **Negative**
    - 2 units RBCs/ED trauma bay
      - HD Stable
        - HD Stable
          - HD Stable
          - HD Stable
          - HD Stable
          - HD Stable
        - HD Unstable
      - HD Unstable
        - HD Unstable
          - HD Unstable
          - HD Unstable
          - HD Unstable
          - HD Unstable

- **Operating Room: Pelvic Fixation and Pelvic Packing**
  - Re-ultrasound Abdomen
  - HD Unstable
    - HD Unstable
      - HD Unstable
      - HD Unstable
      - HD Unstable
      - HD Unstable

- **Resuscitate in the SICU + CT scans**
  - Ongoing Transfusion Requirements after Pelvic Packing? (≥4 units RBCs from pelvic source with normal coags in 12 hours)
    - **Yes**
      - Angiography
    - **No**
      - SICU
PITFALLS

Caution: Empiric Embolization.

You can send the patient for just a diagnostic angio......
Hybrid OR

If you have hybrid OR capabilities, the algorithm may change $\rightarrow$ flush angiogram of the pelvis after pelvic packing.
Pelvic Packing: Mortality

• All pelvic fx = 8%
• Mortality in high risk = 21%
  – traumatic brain injury (9)
  – multiple organ failure (4)
  – withdrawal of support (4)
  – pulmonary failure (3)
  – cardiac failure (3)
  – adverse physiology (3)
  – invasive mucormycosis (1)

Death after arrival:
  89 min
  100 min
  9 hours
Modern Day Comparison

• 21% mortality (all cause) in our study of PP

• 32% mortality in AAST multicenter study\(^1\)
  - shock defined as SBP < 90, HR > 120, BD > 6

• 41% mortality in angio only study\(^2\)
  - comparison group – >10u RBCs in first 24 hrs

• 37% mortality in hemostatic resusc study\(^3\)
  - comparison group – >5u RBCs in first 24 hrs

\(^1\)Costantini et al. J Trauma Acute Care Surg 2016
\(^2\)Tesoriero et al. J Trauma Acute Care Surg 2017
\(^3\)Gaski et al. J Trauma Acute Care Surg 2016
Unstable Pelvic Fracture Algorithm

Refactory Profound Shock (SBP < 80 mmHg)
- REBOA if available

Operating Room: Exploratory Laparotomy
- HD Unstable
- HD Stable

If Pelvic Hematoma Evident → Pelvic Fixation and Pelvic Packing
- HD Unstable
- HD Stable

Ongoing Transfusion Requirements after Pelvic Packing? (>4 units RBCs from pelvic source with normal coags in 12 hours)
- Yes → Angiography
- No → SICU

Resuscitate in the SICU + CT scans

2 units RBCs/ED trauma bay
- HD Stable
- HD Unstable

Operating Room: Pelvic Fixation and Pelvic Packing Re-ultrasound Abdomen

Positive
- HD Stable

Negative
- HD Stable
- HD Unstable
• 31 yo man, run over by a cement truck

• Large wound/open pelvic fx

• SBP 80mmHg on arrival, CXR/FAST negative
  ➢ sheet the pelvis
  ➢ Terumo sheath in CFA
  ➢ MT protocol

• Despite RBCs, SBP = 50mmHg
  ➢ REBOA, transport to OR
REBOA, Ex Fix, Pelvic Packing

- Ex-fix
- Pelvic packing
- REBOA deflated
- Catheter out = 61 min
- Patient stable
- Transfer to SICU
- CT scans
KEY POINT

You have to be ready!
PITFALLS

➢ Avoid “re-opening” the pelvis – exacerbates the bleeding.

➢ Look at the perineum – significant external blood loss.
Pelvic Trauma: Summary

- Mortality rates remain high in complex fx.
- Have an algorithm.
- Use all techniques at your disposal
  - Binders
  - External fixation
  - Pelvic packing
  - Angioembo
  - REBOA