SUBJECT: Acute Pelvic Fracture Management Guideline

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RECOMMENDATION(S): Dr. J Margolick **APPROVAL:** 12/17/2020

CONCURRENCE(S): Trauma & Ortho Faculty **EFFECTIVE:** 12/17/2020

PURPOSE:
To provide an evidence-based approach to acute management and hemorrhage control of these complex injuries. These guidelines apply to any patient presenting with an acute pelvic ring injury. This includes acetabular fractures but excludes femoral neck fractures.

BACKGROUND:
There are varied approaches to acute management of trauma patients with pelvic fractures. The proper care of these complex injuries is multidisciplinary and often dependent on local resources. Two key factors must be recognized early: patients can hemorrhage to death from acute arterial and/or venous retroperitoneal bleeding and the impact required to incur pelvic ring injury leads to high likelihood of associated life-threatening injuries. Some of those associated injuries may have competing therapeutic priorities (eg., TBI, SCI) and present a particular challenge to trauma teams. Mortality from pelvic ring injury remains as high as 40%[1].

Early recognition of pelvic trauma, prompt cessation of hemorrhage and aggressive resuscitation are critical to reducing mortality and limiting the sequelae of hemorrhagic shock such as delayed multi-organ failure.

This guideline is designed to be used immediately upon the arrival of a trauma patient in the ED. The guideline prioritizes rapid cessation of bleeding, early recognition of associated abdominal trauma and balanced resuscitation. Patients are evaluated in the trauma bay then, depending on their condition and presence of other injuries, are shunted rapidly to either the Operating Room (OR), Interventional Radiology Suite (IR) or CT scanner followed by admission to the Surgical Intensive Care Unit (SICU).

This guideline is meant to encompass all patients with pelvic ring injuries because fracture pattern on X ray does not predict mortality, hemorrhage or need the for IR[2,3,4]. This guideline includes acetabular fractures because these patients are just as likely to require hemorrhage control2 but excludes patients with femoral neck fractures.

GUIDELINE
EVALUATION:

The evaluation of potential pelvic trauma patients begins with pre-hospital history. Providers should anticipate, and prepare accordingly for a pelvic fracture under the following circumstances:

1. Blunt trauma with hemodynamic instability
2. Fall from significant height
3. Pedestrian/Cyclist struck by vehicle
4. High speed MVC or MCA
5. MVC with ejection
6. Unable to ambulate at scene

7. Obvious unstable pelvis, leg length discrepancy at scene
8. Bowel/bladder incontinence
9. Rectal or vaginal hemorrhage
10. Elderly blunt trauma patients

If any above situations are met:

- Place Temporary Binder (TPP) as soon as possible after perineal exam.[1,4,7]
    - Place cautiously in pregnant and elderly patients[1]
    - TPP should be placed regardless of fracture pattern
        - TPP may be less effective for vertical shear fractures but have not been shown to exacerbate bleeding[1,4,7]
- TPP must be placed at the level of greater trochanters'.
    - 40% of binders are placed too high[5].
- Evaluate for unstable pelvis during the primary survey as part of "Circulation".
    - Compress bilateral iliac wings together
    - Examine only once
- To facilitate femoral venous and/or arterial access do not remove binder, Instead, cut a "wedge" out of the material to expose puncture site. Keep the binder on during operative or IR interventions whenever possible.

Hemodynamic and Time goals:

- Maintain permissive hypotension when able.
    - SBP < 90 so long as patient is alert and lucid, making adequate urine, and does not have other signs of end-organ hypoperfusion (cold, mottled extremities, decreasing LOC, rising base deficit/lactate).
    - Contraindications to permissive hypotension: TBI and SCI.
- Trauma bay to CT scan → 10 min
- Trauma bay to OR → 15 - 20 min
- Trauma bay to IR → 30 min
- Surgical fixation within 24 hours.
- DVT chemoprophylaxis (Enoxaparin BID) within 6 hours of injury if hemostasis achieved.
- Remove pelvic binder within 24 hours.

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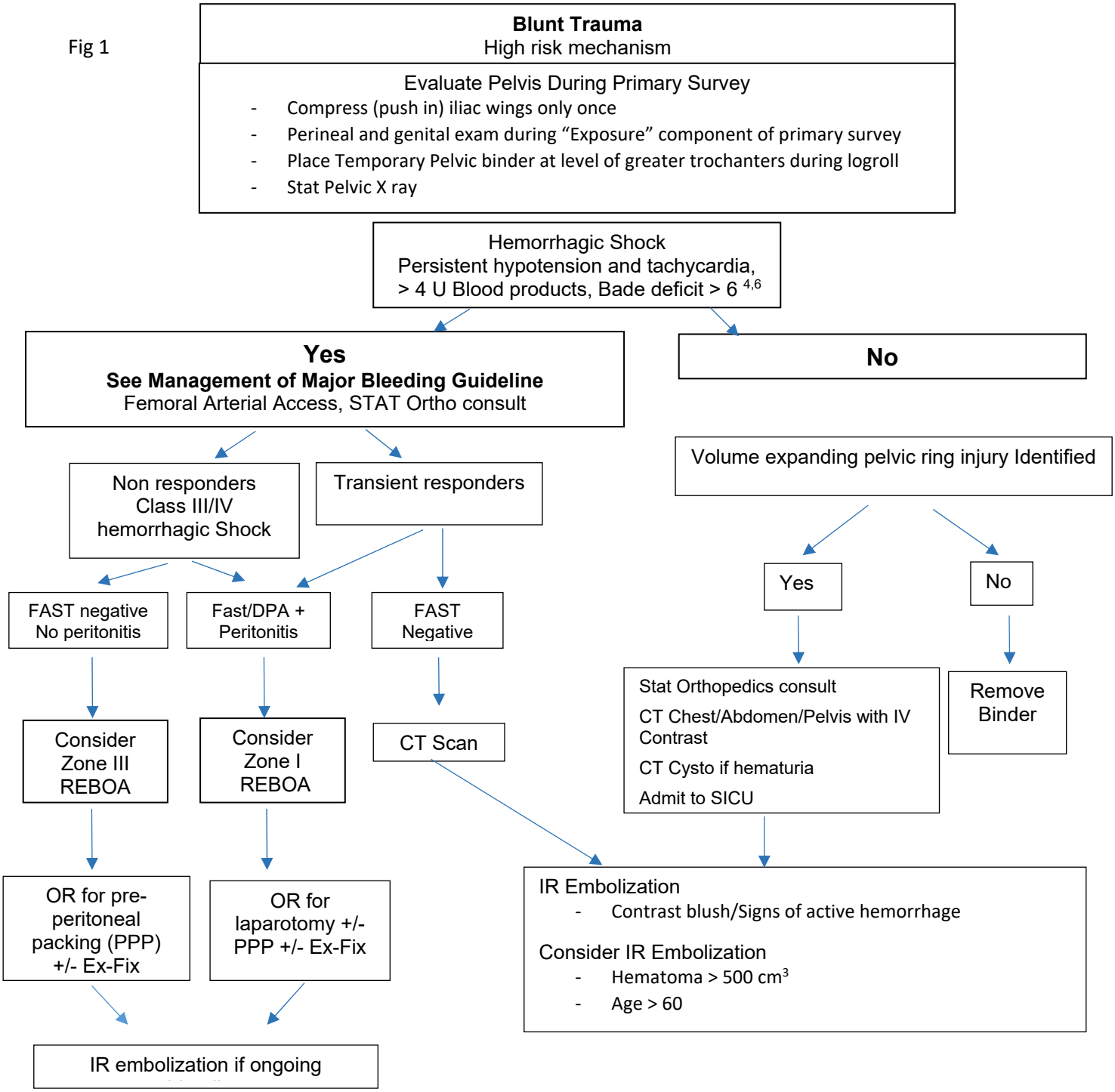
Fig 1



Pre-Peritoneal Packing versus IR Embolization

Angioembolization

- Angioembolization is a safe and effective technique to control pelvic hemorrhage. However, the source of hemodynamic instability in patients with pelvic ring disruptions is venous 80-90% of the time[1].
- When arterial bleeding is identified, angioembolization is effective in controlling the hemorrhage 85-97% of the time.[4] However, some patients will still bleed because the likelihood of concomitant venous bleeding is nearly 100%[1].
- The safety of angioembolization is well established. Femoral artery injury or renal artery embolization is very rare. Bilateral internal iliac artery embolization is safe with minimal reports of gluteal muscle ischemia.[4] Sexual function in males does not seem to be affected by bilateral internal iliac embolization.[15] Other complications such as nerve injury, bowel injury, claudication and deep space infections have been reported.[16]
- Retrospective evidence has suggested that angioembolization is associated with a significant risk of deep surgical site infection requiring operative management (58% vs 14%, $p < 0.05$) in patients with acetabular fractures. [17] Newer, larger retrospective studies have refuted this data and shown that concerns for higher rates of infection after pelvic embolization are not substantiated. [18] These studies are retrospective, and whether angioembolization truly increases risk of deep surgical site infection remains an area of ongoing investigation.
- Large hematomas (> 500 cc^3) may have an increased risk of arterial injury requiring angioembolization.[4]
- Elderly patients have been shown to require angioembolization more frequently regardless of hemodynamics and fracture pattern. Therefore, angiography should be considered in these patients even if suspicion for arterial bleeding is low.[1]

Pre-Peritoneal Packing

- Studies have reported that only 5-15% of hemodynamically unstable patients with pelvic fractures have a target to embolize, [1,4,9,10] Therefore, angioembolization does not addresses potentially lethal bleeding in 85-95% of patients hemorrhaging from their pelvic fracture.
- PPP is an effective measure for early hemorrhage control in hypotensive patients with bleeding secondary to pelvic ring disruptions.[1,4,8,10,11]
- PPP can be done in less than 20 minutes and is effective in APC, LC and VS type fractures.[9,11]
- Some studies have shown no difference in mortality or ICU length of stay between PPP and angioembolization. However, there is overall increased delay to hemostatic therapy and hemorrhage control with angioembolization, especially when an interventional radiologist is not in house.[1,8,9,10]
- PPP is not a ubiquitously applied technique in North America. However, years of experience and not-inferior outcomes from Europe can reasonably be extrapolated to our patient population.

- There is some evidence for increased survival with PPP + external fixation compared to angioembolization.[11] These findings have largely been single institution studies. For example, increased survival was shown at a Level I trauma center in Denver when PPP was combined with external fixation.[11, 12] PPP has also been identified as an independent predictor of 24-hour survival when combined with external fixation.[13]

Choosing between PPP and Angioembolization

- Both approaches are reasonable first line hemorrhage management strategies in patients with pelvic fractures.
- PPP in the operating room provides the advantage of allowing the surgeon to extend his or her operating domain to cavities if necessary. PPP is easy, fast and effective at controlling bleeding. It is however, more invasive than angioembolization and prone to standard surgical complications such as wound infection.
- If a patient continues to bleed after one strategy is used it is reasonable to try the other.
- Eastern Association of Trauma, Western Trauma Association and World Society of Emergency Surgery all advocate PPP as an effective tool. However, direct comparative studies are lacking and therefore one technique is not recommended over the other. WEST Trauma Association recommends either PPP or angioembolization as first line therapy in hemodynamically unstable patients with pelvic trauma.[14]

Recommendations for Pre-Peritoneal Packing

- Consider emergent PPP in hemodynamically unstable patients with pelvic fractures
- Consider PPP in patients who continue to bleed after angioembolization.
- Pelvic binder should remain during and after PPP. Consider concurrent external fixation or traction pin placement.
- Remove pelvic packing 24 – 48 hours after physiologic restoration, reversal of coagulopathy and acidosis.
- Avoid re-packing the pelvis for ongoing bleeding due to pelvic space infection risk. If continued bleeding occurs after coagulopathy is corrected, proceed to angioembolization.

Recommendations for REBOA Placement

- A REBOA can be considered as a bridge to definitive treatment in the following circumstances:
    - Patients with pelvic fractures as the source of hemorrhagic shock and who are non-responders to blood products.
    - Zone I placement can be considered an alternative to Aortic Cross clamping for patients with massive intra-abdominal hemorrhage and pelvic fracture.
    - Consider intermittent REBOA to limit ischemia-reperfusion time.

    - Consider re-deploying a Zone I REBOA to Zone III if no massive abdominal hemorrhage or intra-abdominal bleeding is controlled.
- Common Femoral Arterial access for the REBOA should be obtained under US guidance or cut-down by an attending, fellow or senior (PGY 4/5) resident.

Admission to SICU Criteria

- Any patient with hemodynamic instability, metabolic acidosis and/or coagulopathy.
- Patient requiring IR or surgical intervention for hemorrhage control.
- Vascular compromise
- Unstable pelvic fractures: LC 2, 3, APC 2,3 and VS fractures.

Additional Management Recommendations

- Perineal, digital rectal exam (DRE) and genitalia exam is mandatory in patients with pelvic trauma.
- Double glove when performing DRE as bone fragments can be sharp.
- If blood or bony fragments are identified on DRE, proceed with rigid or flex sigmoidoscopy when patient stabilizes.
- If an open pelvic fracture is suspected, administer Ceftriaxone 2 grams and Metronidazole 500 mg within 30 min of ED arrival.
- If blood is identified at urethral meatus, do not insert Foley. Instead perform a Retrograde Urethrogram (RUG) using the following steps.
        - Perform RUG *after* CT scan if applicable.
        - Insert tip of Foley catheter 1-2 cm into urethra
        - Inflate Foley balloon with 2 cm of sterile NS
        - Inject 60 ml of water-soluble contrast
        - Immediately obtain KUB X ray in both the AP and Lateral positions
    - If evidence of urethral disruptions, emergently consult urology.
- If a Foley is placed and hematuria is seen, obtain a CT Cystogram if patient is going to scanner.
- It patient presents with an EMS placed TPP, remove binder to facilitate pelvis and perineal examination. If there is evidence of pelvic ring disruption immediately place the binder back on.

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