

Pelvic Trauma Radiographs Demystified

Although we are becoming increasingly reliant on CT scans for diagnosis, plain old radiographs still have their place. This is especially true in pelvic imaging after trauma.

The most common pelvic radiograph obtained is the supine A-P view taken during trauma resuscitation. This image gives a quick and dirty look at the entire pelvis, from iliac crest to ischial tuberosity. The main areas of interest are the pubic symphysis and the SI joints, so if some of the periphery is cut off a repeat is not necessary prior to CT scan. This image helps predict the need for blood and pelvic compression devices.

If fractures are present, the orthopedic surgeons will generally request additional views in addition to the CT scan. The scan gives excellent detail, but the axial image slices are still not as good as a plain old radiograph in many cases.

Inlet and outlet views are used to get a better look at the pelvic ring. The inlet view opens the ring up into a big circle (or oval) and allows identification of fractures of the sacrum or displacement of the SI joints, as

TRAUMA CALENDAR OF EVENTS

ROCKY MOUNTAIN ORTHOPEDIC TRAUMA CONFERENCE

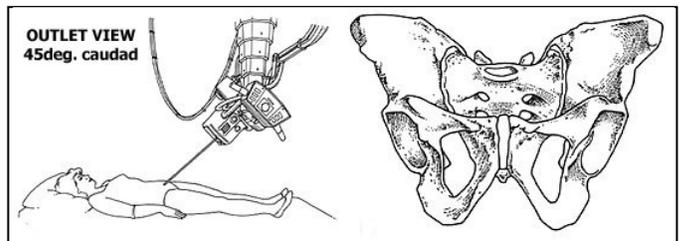
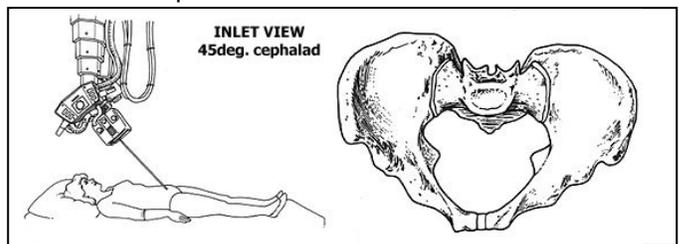
PLACE: RITZ CARLTON, BACHELOR GULCH
BEAVER CREEK, CO

DATE: AUGUST 3-4, 2013

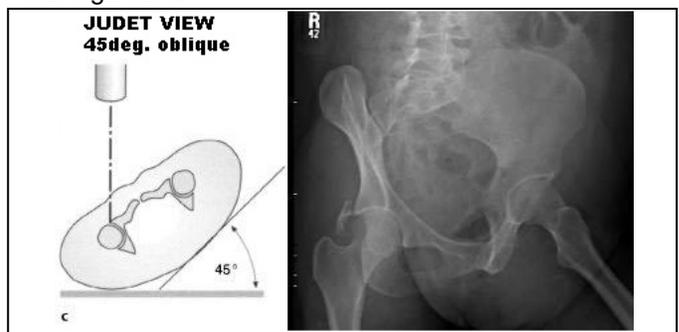
AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA

LOCATION: HILTON SAN FRANCISCO, SAN FRANCISCO, CA
DATE: SEPTEMBER 18-21, 2013

well as changes in the pubic symphysis. The outlet view shows any vertical displacements through the sacrum or SI joints well, and gives a better appreciation of some pubic fractures.



Judet views help demonstrate acetabular fractures by lining up the iliac wing with the xray tube. They can give additional information that the orthopedists use for determining operative or nonoperative management.



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Rule of thumb: For major trauma patients, obtain an A-P pelvis radiograph if indicated by mechanism of injury or physical exam. Perform CT scan of the abdomen and pelvis if indicated. If a pelvic ring fracture is identified, obtain inlet and outlet radiographs before calling your orthopedic surgeon. If an acetabular fracture is seen, obtain Judet views before calling.

Bleeding and Pelvic Fractures

Arterial bleeding from a pelvic fracture is more common than previously thought. The doctor books used to say that 10% of bleeding was arterial and 90% was venous, so angiographic techniques were seldom used unless there was clinical evidence of blood loss.

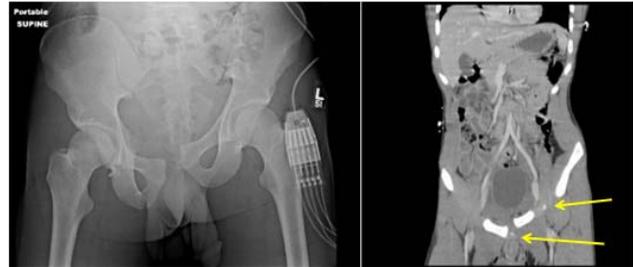
It looks like arterial bleeding occurs more frequently than we think. Here are tips that help you identify patients at risk:

- **What type of mechanism caused the fracture?** Anterior-posterior compression and vertical shear are the most common.
- **Are the vital signs stable?** If not, rule out the other four likely sources first (chest, abdomen, multiple extremity fractures, external). Then blame the pelvis.
- **Is the fracture open?** Arterial bleeding is very likely.
- **How old is the patient?** Elderly patients are more likely to have arterial bleeding, especially from gluteal artery branches.
- **What part of the pelvis is broken?** If major sacral fractures, SI joint disruption or separation of the symphysis is present, think arterial bleeding.
- **Are there CT abnormalities?** A vascular blush or large hematoma indicates significant bleeding.

The most common bleeding sites are the gluteal and pudendal arteries. The gluteal is in proximity to the SI joint, so this can be torn if the SI joint is damaged or the sacrum is fractured. The pudendal can be injured with ramus fractures, especially when the symphysis is widened.

If the patient can be reasonably stabilized, then a trip to interventional radiology is mandatory. Operative management is not very successful, so patients with blood pressure lability or controllable hypotension should go to IR. All active bleeding and arterial cutoffs should be embolized thoroughly.

Images: On the left is the portable plain image of a vertical shear pelvic fracture. The arrows on the right point to two areas of vascular blush.



Predicting Bleeding In Stable Pelvic Fractures

Bleeding is a well-recognized complication of severe pelvic fracture. Certain fracture patterns, usually with significant involvement of the posterior portions of the ring, are associated with significant bleeding. Most of these fractures are unstable to some degree.

Stable pelvic fractures (those that do not require internal or external fixation) are not generally prone to a large amount of bleeding. However, it can occur on occasion, and surgeons at the Massachusetts General Hospital have devised a simple prediction system so patients more likely to bleed can be identified and monitored more closely.

They retrospectively looked at their stable pelvic fracture population over 5+ years. A total of 391 patients with stable pelvic injury were identified. Of those, 280 never required transfusion and 111 did. Of the latter, only 15 bled from their stable pelvic fractures.

The authors found the following three significant indicators of bleeding from stable pelvic fractures:

- **Admission hematocrit < 30%**
- **Pelvic hematoma on CT**
- **Any systolic blood pressure < 90 mm Hg**

Bottom line: This is a simple, retrospective study with low numbers. However, the three indicators commonly indicate significant early bleeding in any trauma patient, so it makes sense to apply it here, too. If a patient meets one or two criteria, consider monitoring in the ICU and consider angiography. If all three or met, strongly consider appropriate intervention (angiography if good blood pressures can be maintained, or fixation and/or preperitoneal packing if not).

Reference: Predictors of bleeding from stable pelvic fractures. Arch Surg 146(4):407-411, 2010.

Posterior Hip Dislocation

Although posterior hip dislocation is an uncommon injury, the consequences of delayed recognition or treatment can be dire. The majority are caused by head-on car crashes, and 90% of these are posterior dislocations. The femoral head is forced across the back wall of the acetabulum, either by the knee striking the dash, or by forces moving up the leg when the knee is locked. This occurs most commonly on the right side when the driver is standing on the brake pedal, desperately trying to stop.

On exam, the patient presents with the hip flexed, internally rotated and somewhat adducted. Range of motion is limited, and increasing resistance is felt when you try to move it out of position. An AP pelvic X-ray will show the femoral head out of the socket, but it may take a lateral or Judet view to tell if it is posterior vs anterior.



These injuries need to be reduced as soon as possible to decrease the chance of avascular necrosis of the femoral head. Procedural sedation is required for all reductions, since it makes the patient much more comfortable and reduces muscle tone. The ED cart needs to be able to handle both the patient's weight and your own. I also recommend a spotter on each side of the cart.

Standing on the cart near the patient's feet, begin to apply traction to the femur and slowly flex the hip to about 90 degrees. Then gently adduct the thigh to help jump the femoral head over the acetabular rim. You will feel a satisfying clunk as the head drops into place. Straighten the leg and keep it adducted. If you are unsuccessful after two tries, there is probably a bony fragment keeping the head out of the socket.

Regardless of success, consult your orthopedic sur-

geon for further instructions. And be sure to thoroughly evaluate the rest of the patient. It takes a lot of energy to cause this injury, and it is flowing through the rest of the patient, breaking other things as well.

Captain Morgan Hip Reduction Technique

I described the "standard" technique for posteriorly dislocated hip reduction above. Emergency physicians and orthopedic surgeons at UCSF-Fresno recently published their experience with a reduction technique called the Captain Morgan.

Named after the pose of the trademark pirate for Captain Morgan rum, this technique simplifies the task of pulling the hip back into position. One of the disadvantages of the standard technique is that it takes a fair amount of strength (and patient sedation) to reduce the hip. If the physician is small or the patient is big, the technique may fail.



In the Captain Morgan technique, the patient is left in their usual supine position and the pelvis is fixed to the table using a strap (call your OR to find one). The dislocated hip and the knee are both flexed to 90 degrees. The physician places their foot on the table with their knee behind the patient's knee. Gentle downward force is placed on the patient's ankle to keep the knee in flexion, and the physician then pushes down with their own foot, raising their calf. Gentle rotation of the patient's hip while applying this upward traction behind the patient's knee usually results in reduction.

Some orthopedic surgeons use a similar technique, but apply downward force on the patient's ankle, using the leverage across their own knee to develop the reduction force needed. The Captain Morgan technique uses the upward lift from their own leg to develop the reduction force. This may be gentler on the patient's knee.

The authors report a series of 13 reductions, and all

but one were successful. The failure occurred due to an intra-articular fragment, and that hip had to be reduced in the operating room.

*Reference: The Captain Morgan technique for the reduction of the dislocated hip. Ann Emerg Med (in press)
doi:10.16/j.annemergmed.2011.07.010, 2011.*

The Open Fracture 8-Hour Rule: We're So Over That

For decades, the standard of care for irrigation and debridement (I&D) of open fractures has been within 8 hours of injury. There is a growing body of orthopedic literature that says this isn't necessarily so.

A paper being presented at the AAST meeting in Chicago next week retrospectively looked at their experience with early (<8hrs) vs late I&D in a series of 248 patients. They looked at infection rates stratified by time and upper vs lower extremity.

They found that the infection rates overall were not significantly different. However, when subgrouped by extremity and higher Gustilo type \geq III, they noted that both delayed I&D and Gustilo type correlated with infection risk. For the upper extremity, only Gustilo type \geq III correlated with a higher infection rate.

The authors concluded that all lower extremity open fractures should be dealt with in the 8 hour time frame, whereas upper extremity fractures can be delayed for lower Gustilo classes.

Bottom line: I don't necessarily buy into all the results from this small study. The orthopedic literature has already refined this concept. At Regions Hospital, we allow up to 16 hours to I&D for open fractures up to and including Gustilo class IIIA. Above that, the 8 hour rule is followed. We periodically review our registry data on all open fracture patients to make sure that the extended time frame patients are not experiencing an increase in wound complications. And they haven't in our 9 year experience in handling them this way.

Refresher on the Gustilo classification system:

- Class I - open fracture, clean wound, <1cm laceration
- Class II - clean wound, laceration >1cm with minimal soft tissue damage

- Class IIIA - clean wound, more extensive soft tissue damage or laceration, periosteum intact, minimal contamination
- Class IIIB - extensive soft tissue damage with periosteal stripping or bone damage, significant contamination
- Class IIIC - arterial injury without regard for degree soft tissue injury

Reference: Open extremity fractures: does delay in operative debridement and irrigation impact infection rates? AAST 2011 Annual Meeting, Paper 22.

Yes, Smoking Is Bad!

Everybody knows that smoking is bad. But how often have you stopped by to see one of your trauma patients and have been told "they're out smoking?" Well, it turns out it's bad for their injuries as well.

A German group looked at the effects of smoking on healing of a "simple" tibial fracture. They looked at 103 patients who underwent treatment for an isolated tibial shaft fracture at a trauma center. Patients with more complicated problems like extension into a joint, open fracture (Gustilo III), or significant soft tissue injury were excluded.

Patients were divided into non-smokers and smokers (including previous smokers). A total of 85 patients were studied, and there were roughly half in each group. The nonsmoking group experienced no delayed or non-unions of their fractures. The smoking group reported 9 delayed unions and 9 non-unions in 46 patients! As expected, time off work and eventual functional outcome was worse as well.

Bottom line: The exact mechanism for impairment of fracture healing by smoking is unclear. It may be due to physiologic effects of inhaled tobacco components on blood flow, blood vessels, transforming growth factor levels or collagen formation. It could also be a secondary effect of socioeconomic variables, patient compliance, or a host of other factors. Regardless, it's bad. Smoking should be forbidden while in hospital, and should be strongly discouraged after discharge.

Reference: Cigarette smoking influences the clinical and occupational outcome of patients with tibial shaft fractures. Injury 42:1435-1442, 2011.



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