Introduction: How to Accept Gratitude
Rob Orman MD and Anand Swaminathan MD

Take Home Points

- It is important for us to accept praise and thanks from our patients rather than focusing on negative interactions.
- Set aside what you are doing and make time to talk to the patient and family.

- Scenario 1. You have taken fantastic care of a patient. On the way out, they say thank you.
- Scenario 2. You have taken fantastic care of a patient. They are irritable and think you are an idiot. They want to talk to the management.
- Which patient gets the most attention at the end of their visit and which one do you think about on the drive home? The negative gets the most attention. We need to focus on the positive.
- You are on the phone or working on a chart. The patient waves from across the room on their way out the door and says thank you. How do you respond? Give a half wave and keep on working.
- What should you do? Hold up a finger or two hands. Get off the phone. Go to the patient and move them off to the side. “You were going to tell me something. I want to make sure you have my undivided attention. What were you going to say?”
  - “Thank you so much for taking care of my mother.”
  - “You are so welcome. I enjoyed taking care of you mom. Thank you so much. It reconnects me with why I do what I do. Have a great rest of your day and I hope I never see you again.”
- Respond honestly. Pay attention and be present in the moment. This is the quickest way to feel like your practice has meaning.
- There is meaning in the small things we do, not just the dramatic resuscitation.
- Slow down to listen to their thank you. This is a wonderful thing for both of you. We talk so much about burnout. Take a few minutes to enjoy the small victories.

Pediatric Constipation
Anthony Crocco MD

Take Home Points

- Pediatric constipation may be diagnosed in the emergency department with history and use of the Rome III criteria.
- X-rays provide no additional diagnostic benefit, increase radiation exposure and may provide false reassurance resulting in failure to diagnose a more serious condition.
- Pediatric constipation is a common presentation to the emergency department.
- How do you diagnose constipation? The current standard is to use the Rome III criteria for constipation.
  - Criteria include two or fewer bowel movements in the toilet per week, at least one episode of fecal incontinence per week, history of painful or hard bowel movements, presence of a large fecal mass in the rectum or history of large caliber stools that may obstruct the toilet.
- Should you obtain x-rays? A systematic review found no additional diagnostic benefit to doing x-rays for constipation in kids.
  - The North American and European Societies of Pediatric Gastroenterology, Hepatology and Nutrition agree pediatric constipation is a clinical diagnosis.
- X-rays take time, add cost and expose children to radiation. In addition, the use of x-rays for constipation in kids was associated with an increased risk of missing a more serious diagnosis such as bowel obstruction, appendicitis and intussusception.
CASE 1
A 5 year old who presents with a history of weekly stools that are hard to pass and plug the toilet. In between bowel movements, he is incontinent to liquid stool. Is he constipated? Yes. Does he need an x-ray to prove this? No.

CASE 2
A 5 year old presents with abdominal pain 2 hours after eating 8 hot dogs. An x-ray shows lots of stool. Does this mean he is constipated? No. It just means that his bowels are processing food into stool. This is what bowels are supposed to do.

- Pediatric constipation is a clinical diagnosis. Get a good history. Do a good clinical exam. Make your diagnosis.

Should We Listen to Parents?
Al Sacchetti MD

Take Home Points
- Parents or caretakers have fairly high sensitivity and specificity (96.8% and 88.5%) for identifying serious bacterial illness when they feel there is something wrong with the child. The positive likelihood ratio is 8.4.
- Parental reports that “something is wrong” correlated with a diagnosis of sepsis or meningitis had a likelihood ratio of 30.7.
- Tachypnea, especially in an afebrile patient, indicates increased metabolic demand and should raise your suspicion for more serious illness.
- A recent EMR AFP segment described a child with intussusception whose diagnosis was delayed after the clinicians did not listen to the parents.
- Is there any evidence supporting parental concern? Sometimes patients are convinced the patient has a condition and demand tests that aren’t indicated.

- They examined multiple parameters of sick children presenting to a primary care setting. Although the study examined a primary care setting, some of the findings are applicable to emergency medicine.
- What was the sensitivity and specificity of a mother or caretaker who insisted there was something wrong with the child? The sensitivity was 96.8% and specificity of 88.5%.

This was a positive likelihood ratio of 8.4 for finding a serious bacterial illness in that child. Remember; for a likelihood ratio to be significant, it should be above 5 (or 10).
- This is pretty good compared to the sensitivity and specificity to other tests such as procalcitonin or white blood cell counts.
- If the parents stated that this illness was different than previous illnesses, the sensitivity was 93%, and specificity was 85% with a positive likelihood ratio of 7.9.
- When they looked specifically at a diagnosis of sepsis or meningitis and correlated it with the report that something was wrong, the positive likelihood ratio was 30.7. If they reported that there was something different about the illness, the positive likelihood ratio was 16.
- The negative likelihood ratios were poor if they didn’t say something was wrong or different. However, you aren’t looking for this.
- They found that when there was parental concern that something was different or unusual, the positive likelihood ratio of serious bacterial illness was 14.
- If the physician had a gut feeling that something was wrong, the positive likelihood ratio was 23.5. The negative likelihood ratio was only 0.38.
- If you think a child is sick, you are probably right. If you don’t think the child is sick, you can be fooled and need to be more careful.
- They found rapid breathing had a positive likelihood ratio of 9.78 for serious infection. This indicates increased metabolic demand in the patient. If you see a tachypneic child, especially if they are afebrile, take a step back and make sure there isn’t something wrong.
The Neonatal Airway

An 11 month old female presented to the emergency department after referral from her pediatrician’s office for acute respiratory distress for the past 15 hours. On arrival, the child appeared lethargic and in moderate respiratory distress. Physical exam demonstrated tachypnea with decreased breath sounds on the left and a room air pulse oximetry of 85%. A two-view chest x-ray showed marked displacement of the mediastinum to the right. Diagnosis? Tension gastrothorax resulting from herniation through a previously undiagnosed diaphragmatic hernia.

Supplemental oxygen and placement of a nasogastric tube were able to sufficiently stabilize the child for transfer to a higher level of care.

Congenital diaphragmatic hernias even scare neonatologists. Congenital diaphragmatic hernias typically develop in utero and affect development of the lung leading to pulmonary hypoplasia. This may result in persistent pulmonary hypertension of the newborn.

The newborn airway.

The first 3 questions you should ask yourself when the baby comes out are: 1) Is the baby term? 2) Does the baby have good tone? 3) Is the baby breathing or crying? If the answer to all questions is yes, you can give the baby to the mother.

Don’t reflexively start oxygen just because the baby looks blue. All babies are some shade of blue when they are delivered. Pulse oximetry of 60% on room air is normal in the first minute of life. Oxygen saturation of 60%, 70% and 80% is normal within 1, 3 and 5 minutes of life. You can print out the chart of normal oxygen saturations per minute of life and tape it to your neonatal warmer. The warmer also has a digital timer you can use to track saturation.

Ultrasound for Foreign Body

Anand Swaminathan MD and Nick Nacca MD

Take Home Point

Ultrasound can’t reliably detect ingested foreign bodies.

CASE

A patient swallowed a bag of synthetic cannabinoid, seized and presented to the emergency room. Can you identify an ingested foreign body with ultrasound?
• Nacca is a toxicologist but happened to be at a conference on ultrasound. When he posed the question to some of the lecturers, they thought they would be able to identify a bag of drugs on the ultrasound. So, in the interest of science, he took several teaspoons of sugar, put them in a condom and tied it off. He made it large enough to swallow. However, they were unable to identify it on ultrasound.

• Three days later, he still hadn’t found the package in his stool. By day 4, it started to get ugly. If he had an empty stomach, he became extremely nauseous. He tried to get ipecac. He tried to drink mineral oil. Nothing helped. He was pretty sure the package was too big to pass through the pylorus. It was hardened, possibly under the influence of the mineral oil.

• He called a gastroenterologist and explained the situation to him. The gastroenterologist performed an endoscopy. The condom was still present in the dependent portion in the stomach. The package was too big to pass through the pylorus. It was hardened, possibly under the influence of the mineral oil.

• So don’t try this at home – but if you do, let us know about it...

Intubating the Hypotensive, Acidotic Patient
Haney Mallemat MD

Take Home Points
• 1 in 4 patients will experience hypotension after intubation. 3% will go into cardiac arrest.
• Patients with a shock index over 0.8, elderly patients and those with intravascular volume depletion are high risk for hypotension.
• Prior to resuscitation, give fluids, oxygenate well and check the blood pressure frequently.
• Hypotension may be treated with push dose pressors such as epinephrine.
• Give the maximum dose of paralytics.

• When Mallemat was a resident, he had a case of a 75 year old female with pneumonia and hypotension. She received IV fluids with a subsequent increase in the blood pressure. His attending had him set up for intubation. Right after intubation, the blood pressure cuff cycled and the blood pressure dropped to 60/40. His attending said, “These things just happen.” We need to prepare for this and act swiftly on the hypotension.
• We focus on the difficult airway but we don’t always talk about the difficult physiologic airway such as the hypotensive and acidic patient getting intubated.
• How common is post-intubation hypotension? One in four patients that we intubate will experience some degree of post-intubation hypotension. 3% will go into cardiac arrest.
• The data suggests that post-intubation hypotension is associated with increased mortality, length of ICU stay and increased risk of cardiac arrest. This is a big deal.
• Why do patients drop their blood pressure? When patients are stressed, their cardiac output is maximal and they are clamped down in the periphery. They are breathing fast to compensate for metabolic acidosis. When we intubate these patients, we take this away.
  ○ RSI medications cause vasodilation. Bradycardia results when we remove the sympathetic storm. We give them sedatives, slow down their rate of breathing and paralyze patients, worsening acidosis.
  ○ We give positive pressure ventilation which increases the intrathoracic pressure, decreases venous return and reduces cardiac output.
  ○ PEEP and end-tidal volume also affect the hemodynamics. Intrathoracic pressure decreases preload and increases pulmonary artery vasoconstriction. It is harder for blood to exit the right ventricle and go to the left ventricle.
• How can you predict who will decompensate? If you are sick, old or dry.
  ○ The risk is increased if the shock index (heart rate over systolic blood pressure) is over 0.8.
  ○ Patients older than 65 years. These patients have decreased cardiopulmonary reserve and are often on vasodilators. They have poor clearance of rapid sequence drugs.
  ○ Intravascular volume depletion.
• How can we prepare?
  ○ Fill the tank. Use ultrasound to assess intravascular status. If you don’t have ultrasound, hang a liter of fluid on the patient to fill up the tank in preparation for the anticipated hypotension.
  ○ Good oxygenation.
  ○ Know what the blood pressure is at all times. You need constant updates on the blood pressure. Don’t wait 5-10 minutes to find out your patient is hypotensive.
• If the patient is hypotensive, you can give push dose pressors with either phenylephrine or epinephrine.
  ○ Phenylephrine provides pure afterload. If the patient has vasodilation, you can use this to restore their arterial tone. There is concern that increasing the afterload when the heart isn’t functioning well will worsen the hemodynamics.
○ Push dose epinephrine is the best drug and provides alpha and beta.

○ Have your push dose pressors ready to go with the rest of your RSI drugs. If the patient is high risk for hypotension, have a norepinephrine drip primed on the pump. Assume the patient will be hypotensive and be pleasantly surprised when they are not.

• What is the target MAP? If the patient is going to be intubated with a MAP of 65 and is high risk for hypotension, you know they will drop their blood pressure. Don’t wait for them to drop their pressure. Increase their MAP to 70 or 75 prior to induction. As they rebound, you can withdraw the medication.

• Patients with high pulmonary artery pressures can die quickly. You need early inotropes such as dopamine or low dose epinephrine. Have it running before intubation.

○ You want to vasodilate the pulmonary artery. Why? The less resistance in this circuit, the better the cardiac output. Inhaled nitrous oxide can be used.

○ Be conscious of hypoxia and hypercarbia. Hypoxia and hypercarbia can increase pulmonary artery vasoconstriction.

• What is the best induction agent? Ketamine is described as the ideal agent due to its minimal effects on hemodynamics. However, sick patients receiving ketamine will often still experience a drop in blood pressure.

• Cut the dose of your sedative by a half or a quarter. Give it to the patient and see what happens. If the patient becomes dissociated or sedated, you don’t have to give more and can give paralytics.

○ You can use propofol if you like; just use 10% of the dose. Start low and titrate up.

• Use the maximum dose of your paralytic. Unlike the sedative-hypnotics which work in the brain, these work in the periphery. If your patient is clamped down and not perfusing, you need to give the maximum dose to make sure the receptors are saturated.

• While you are getting ready to push the drugs, watch the respiratory status and look at the respiratory rate. You may have to bag the patient. You need to match their respirations or you will worsen their acidosis.

○ If you have mainstream capnography (the thing that goes on the end of the ET tube), put it on the bag mask. It will work the same way and you will have an idea if you need to bag more or less.

• Once you have intubated your patient, you need to set the ventilator.

• How much PEEP should you use? The more PEEP, the higher the thoracic pressure and the less the venous return. Give them only as much PEEP as they need.

○ Start low and titrate slowly.

• The tidal volume should always be 6-8cc/kg of ideal body weight (based on height and gender). Start on the lower end and titrate up.

• If the patient is breathing fast to get rid of excess CO$_2$, you may need to have a fast respiratory rate. Keep in mind that the patient may develop air-trapping with fast ventilations. This may lead to additional hemodynamic problems.

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**Pediatric Pearls: Bipolar and Medication Withdrawal**
Ilene Claudius MD, Sol Behar MD and Anthony Rostain MD

**Take Home Points**

• Bipolar disorder presents differently in children compared to adults. Children usually have irritability, inability to sleep and sadness.

• Parents may benefit from resources to support parenting.

• Patients may experience withdrawal with abrupt cessation of medications.

• Medications may be resumed at the usual dose if it is a short time but patients who have been off their medications for longer may require titration before resuming their usual dose.

• Bipolar disorder in pediatric patients may manifest differently than adults. This is a longitudinal disorder over the lifespan and may present in different ways depending on the age of the patient. In children, early signs of bipolar disorder include prolonged states of being angry, irritable, with inability to sleep and dysregulated in an episodic and unpredictable fashion.

○ In adults, mood episodes are more distinguished. Manic patients may feel elated, be unable to sleep, hypersexual and extremely productive followed by a crash into depression.

○ Children usually have a mixed state with irritability, inability to sleep and sadness. They do not usually experience the elation or happiness found in adults.

• How can you determine if the behavior is due to ineffective parenting or a true psychiatric problem? Children who are difficult to raise lead parents to use ineffective techniques resulting a vicious cycle. They have escalating fights. If the parenting response is exaggerated or overly punitive, children may develop oppositional defiance or other conduct problems. Parents need help finding alternate strategies for getting the child to cooperate.

• The diagnosis is controversial in children.
• Recommendations for families dealing with pediatric bipolar disorder.
  ○ If the child is very explosive and irascible, *The Explosive Child: A New Approach for Understanding and Parenting Easily Frustrated, Chronically Inflexible Children* by Ross Greene PhD may be helpful.
  ○ For children with oppositional defiance, *Your Defiant Child: Eight Steps to Better Behavior* by Russell Barkley PhD may be helpful.
  ○ Also, *Parent Effectiveness Training* by Thomas Gordon, which addresses negative patterns that may develop in overwhelmed parents. This helps maximize the chances your child will listen and improves effectiveness.
  ○ Many of these patients are on medications. Is there a risk of withdrawal if they stop medications abruptly?
    ○ Tapering of SSRIs is recommended. There is less data on withdrawal symptoms in children compared to adults. However, they may experience GI upset, irritability, fatigue and worsening of mood or anxiety.
    ○ Children on neuroleptic medications with abrupt cessation may experience withdrawal dyskinesias, hyperactivity and erratic behavior.
    ○ How should you restart their medications? You can resume the medications at their usual dose if they have been off their medication for a short period of time (under a week or so). If they have already gone through withdrawal, you should resume their medication in stages. Consider starting at a half dose and then titrate up.
  ○ What medications can you use for agitation in the acute setting? Olanzapine is a good option. It addresses the agitation and causes some sedation as well. Children who are highly reactive may benefit from clonidine or guanfacine. Low doses of benzo-diazepines may be carefully considered but some children may experience paradoxical agitation.
  ○ If you feel a parent is struggling, bring it up in a non-threatening way. Give parents resources. “Parenting is the hardest job on earth.”

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**Antiemetics and the QTc**

Jess Mason MD and Bryan Hayes PharmD

<table>
<thead>
<tr>
<th>Take Home Points</th>
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<tbody>
<tr>
<td>• Patients without risk factors do not need routine EKG or electrolyte screening prior to receiving ondansetron.</td>
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<tr>
<td>• Ondansetron prolongs the QT interval by 20ms on average, which is unlikely to be significant if there are no other risk factors.</td>
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<tr>
<td>• Metoclopramide is unlikely to cause QT prolongation.</td>
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<tr>
<td>• QT prolongation occurs in a dose dependent manner.</td>
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<tr>
<td>• Do antiemetics really prolong the QT interval? Is this going to cause torsades?</td>
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<tr>
<td>• Check out <a href="https://www.credibledrugs.org">credibledrugs.org</a>. If you type in the medication name, it will give the risk of QT prolongation and torsades. Although ondansetron is listed as having a known risk of torsades, a recent systematic review did not find any conclusive evidence.</td>
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<td>○ They were unable to find any instance of a patient developing a cardiac arrhythmia after a single dose of ondansetron.</td>
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<td>○ “Current evidence does not support routine ECG and electrolyte screening before single oral ondansetron dose administration to individuals without known risk factors.”</td>
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<td>○ The data on oral administration likely may be extrapolated to IV.</td>
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<td>• Patients receiving IV ondansetron in the setting of an underlying arrhythmogenic condition or those on other QT prolonging meds may be at higher risk.</td>
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<td>○ They found that QT prolongation from ondansetron did occur, but it was closely tied to electrolyte abnormalities and other QT prolonging drugs.</td>
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<td>○ 22 patients presenting to the emergency department received 4 mg IV ondansetron and EKGs were obtained before and after administration.</td>
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<td>○ They found the mean increase in QT was 20ms.</td>
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<td>• The clinical significance of the QT prolongation of ondansetron...</td>
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*cited references*
is probably negligible in patients without other risk factors.

- It is reasonable to obtain an EKG if you are giving repeated doses within a few hours.
- The FDA safety warning advised that the QT prolongation occurs in a dose dependent manner. The highest tested dose of 32 mg led to a maximum mean difference of 20ms. At the lower tested single dose of 8mg IV, the maximum mean difference was 6ms.
- **Metoclopramide is considered safe.** There is little risk of QT prolongation to any clinically relevant extent.
  - A study comparing IV haloperidol to IV metoclopramide found change in QTc in either group after treatment.
- **What is the safest antiemetic?** Metoclopramide.
- **QT prolongation is not a perfect predictor of torsades.** Increases of 20ms are unlikely to increase the risk of torsades.
- **Trimethobenzamide (aka Tigan).** This does not have any effect of the QT interval and may be used in patients with known QT prolongation. However, the availability may be limited. It comes in suppository form as well.
- **Take a good medication history.** We frequently prescribe multiple medications that may prolong the QTc such as ondansetron, azithromycin and diphenhydramine.

### What is a Likelihood Ratio? Matt Krise MD

#### Take Home Points

- A positive likelihood ratio tells us how much more likely a patient is to have a disease given the results of a test or physical exam finding.
- The clinical implication can be estimated by adding 15% for a likelihood ratio of 2, 30% for a likelihood ratio of 5 and 45% for a likelihood ratio of 10.
- This shortcut may only be used if the pretest probability is between 10-90%.
- Likelihood ratios can’t be added.

- ** Likelihood ratios are negative or positive.** A positive likelihood ratio tells us how much more likely a patient is to have a disease given the results of a test or physical exam finding. A negative likelihood ratio tells us the opposite.

- The beauty of likelihood ratios compared to sensitivity and specificity is due to two things. You can use them at the bedside. They do not depend on population prevalence. To use sensitivity or specificity at the bedside, you have to be able to apply Bayes’ theorem in your head and this isn’t useful.
- **How do you use likelihood ratios?** Normally, you would have to perform some calculations. There is a better way.
  - The positive likelihood ratios of importance are 2, 5 and 10.
  - A positive likelihood ratio of 1 gives us no information. 10 is considered pretty accurate.
  - Using the simplified method, for a positive likelihood ratio of 2, add 15%. For 5, add 30%. For 10, add 45%. This is easy.
  - If you have a pretest probability of 30% and you have a result with positive likelihood ratio of 10, you have a post-test probability 75%. This is an estimate but is sufficiently accurate to use in a clinical setting.
  - For negative likelihood ratios, take the reciprocals of 2, 5 and 10 (0.5, 0.2 and 0.1) and subtract 15%, 30% and 45% from the pretest probability.
  - However, you shouldn’t use these numbers if the pretest probability is less than 10% or greater than 90%.

### Example.

Assuming patients presenting to the emergency department with shortness of breath and fever have a pretest probability of pneumonia, what physical exam finding would give you the most diagnostic information? The best possible positive likelihood ratio is egophony at 6. This is just over 30%. If you find egophony, the posttest probability is now 25%+30%. That is not bad. If you get a normal chest x-ray, you would probably still treat this patient for pneumonia.

- **Common pitfalls.**
  - You can’t combine likelihood ratios or use them additively. Two different tests for one disease are very rarely independent of one another.
  - You can’t simply multiply a pretest probability by the likelihood ratio.
- This is a super simplified estimate. It isn’t perfect. Likelihood ratios are only accurate if we determine a pretest probability. Most of the time, the pretest probability for a bad disease is low. In the Perry article on subarachnoid hemorrhage, the incidence in a highly selected population was only 8%. The 15/30/45 rule doesn’t apply.
Pelvic Fractures – Part 1: Anatomy of the Bleed
Rob Orman MD and Chris Hicks MD

Take Home Points

- X-rays and fracture patterns are poor predictors of the extent of bleeding due to pelvic fractures.
- The mortality of a patient who is hypotensive and bleeding from a pelvic fracture is 15-40%.
- Pelvic binders may help stabilize bleeding bony fragments.
- Patients who remain unstable despite resuscitation may have active arterial bleeding.

- Why is the bleeding of pelvic fractures so bad?
  - There is a huge network of small arterial and venous structures which often anastomose. The venous plexus consists of fine, intricate, delicate valveless veins that lie over the posterior arch and tear easily. These are difficult to access operatively or compress directly.
  - The bones are very vascular structures as well. The vast majority of bleeding in pelvic fractures is from bony and venous sources. Pelvic binders may help stabilize bleeding bony fragments.

- What fracture patterns are bad?
  - Traditional teaching has described anterior compression (i.e. blown open pelvis) or vertical shear fractures. This is true. However, x-rays of the pelvis and fracture patterns are poor predictors of the extent of bleeding. For example, an unimpressive acetabular fracture may bleed a lot.
  - Any significant displaced pelvic ring fracture. These may be associated with posterior ring injuries. The likelihood of significant bleeding increases with disruption of the posterior pelvic architecture. Look closely for evidence of posterior pelvic ring disruption. Look for any degree of vertical displacement (look at the symphysis pubis).
  - Unimpressive findings on x-ray may be associated with catastrophic bleeding.
  - Displacement of the symphysis pubis greater than 2.5 cm is unstable.
  - What is an open book fracture? This refers to an anterior compression pelvic fracture. It disrupts the symphysis pubis anteriorly. This can allow the pelvic architecture to open up. Structures in the posterior ring such as around the sacroiliac joint. This can lead to tears in the surrounding venous plexus and arterial structures.

- Sometimes these may look impressive on x-ray. Other times a fracture may not be apparent; just massive disruption of the pelvic architecture. These are some of the strongest ligamentous structures in the human body. It takes a lot of force to disrupt these structures. Disruption of the symphysis pubis should be a red flag for other injuries such as to the head, spine, chest and abdomen.

- What is the mortality of pelvic fractures? A patient who is hypotensive and bleeding from an isolated pelvic fracture has mortality between 15-40%. These patients often lack the visual clues of life-threatening injury. If there is an associated intra-abdominal injury, the mortality is greater than 50%. Patients with a pelvic fracture, intra-abdominal and head injury have mortality of over 90%.

- When you encounter a sick patient, it gives you the permission to act. You are only going to help the situation.

- The airway is important but is not always the highest priority intervention. Many of these patients do not need to be intubated right away.

- There is a lot of work that needs to be done before intubation. Make sure you have good IV access. Start volume resuscitation with blood products and place a pelvic binder. If you have a hypotensive patient that hasn’t been resuscitated, they will tank when given induction drugs.

- Is there a role for empiric pelvic binders? If you have a really sick trauma patient with blunt mechanism injury, they may have many injuries and it takes time to detect them. If they have trauma to the pelvis and hemodynamic instability with a possibility of pelvic fracture, place a pelvic binder and worry about it later. Don’t wait for the x-ray or for the patient to destabilize.

- If you have access to x-ray, don’t worry about examining the orthopedic stability of the pelvis. The degree of orthopedic instability does not directly correlate to hemodynamic instability. If you are going to do anything, grab the iliac crests and move them inwards. If they move, hold them there and place a pelvic binder followed by x-ray.

- What does the pelvic binder actually do? There is some evidence that pelvic binders decrease transfusion requirements but there isn’t evidence that they decrease mortality.

- These injuries do not tend to occur in isolation and patients with bad pelvic fractures likely have other bad injuries. In theory, splinting the pelvis decreases the pelvic volume. However, the volume of the pelvis under normal circumstances is fairly large and there is a lot of room to bleed into.
It can stabilize bony fragments.

The pelvic binder does nothing for the arterial bleeds in the pelvis. If you resuscitate the patient and place a pelvic binder but they remain really unstable, it should be a clue they might have an arterial bleed.

Pelvic Fractures – Part 2: Evaluation and Treatment
Rob Orman MD and Chris Hicks MD

Take Home Points
• Trauma patients who will get a CT should still have plain pelvic x-ray as early identification of pelvic fractures can help direct management.
• FAST has a high false negative rate in patients with pelvic fractures.

A trauma patient is brought in with extensive trauma. You know they will get a CT. The patient is unstable. Should you get an x-ray? Yes, if the patient is unstable. It can help with planning and management. If you see a bad pelvic injury that might be associated with bleeding without other apparent source, you can place a binder, resuscitate the patient and activate the angiography team. The additional imaging can be helpful for the angio (interventional) team. For example, a large pelvic hematoma on the left might prompt the team to embolize the tributaries of the left internal iliac.

If the patient has extensive trauma but is not hypotensive, should you get a pelvic x-ray? Yes if you think it will help prevent a pan-scan. Patients with a low pretest probability for significant injury and a normal chest and pelvic x-ray, normal FAST exam with normal physiology won’t get scanned. If you are going to scan the patient regardless (for example, they have a head injury, are obtunded or old), you don’t have to do an x-ray if the patient is stable. It won’t help you.

The FAST exam and pelvic fractures. There is a consistently unacceptably high false negative rate in patients with pelvic fractures. This may be due to a retroperitoneal hematoma distorting the windows. We are unable to visualize the retroperitoneum well enough with ultrasound. Don’t call an indeterminate study as negative.

Peritoneal bleeding trumps bleeding from pelvic fractures. You can bleed your entire blood volume into your peritoneal cavity. These patients need to go to the OR.

Who needs emergent angiography versus preperitoneal packing? There is no algorithm. There should be some institutional guidance in this situation and it depends on access to angiography at your site. If you are unable to access angiography within 30 minutes, the patient should go to the OR. Preperitoneal packing may help. Don’t let the patient bleed out while waiting for angiography.

• The diagnostic peritoneal aspirate. This is rarely done any longer. It is time consuming. If your patient is unstable, you and the trauma team need to get the patient to definitive care. If the patient is stable, you will get a CT. Let your angio team know even if the patient does go initially to the OR.
• What if you don’t have a trauma surgeon or angiography and have to transfer the patient? In the future, transferring centers may place a REBOA catheter to increase time to definitive care.
• It is easy to underestimate the severity of these injuries. These patients may be bleeding to death in front of you.

Cardiology Corner: ACS State of the Art – Part 1: Initial Workup
Rob Orman MD and Amal Mattu MD

Take Home Points
• Chest pain with radiation to the bilateral arms or shoulders and right side has a high likelihood ratio of ACS.
• 5-28% of patients with ACS will have a normal EKG.
• Our biomarker algorithms have been developed to detect myocardial infarction, not unstable angina.


This is a nice review that incorporates a lot of recent literature. This has supplanted the 2010 AHA Scientific statement on Testing of Low-Risk Chest Pain Patients in the Emergency Department. This paper was the source of much discussion, controversy and medical malpractice prosecution and defense. The paper suggested provocative testing should be pursued in all patients with testing of troponin. This usually means stress testing but we know this modality has some problems. The paper described low risk chest pain but failed to define that group.

This article is a review article that encompasses a wide variety of aspects of the evaluation of chest pain in the emergency department.

Another article is Fanaroff, AC et al. Does this patient with chest pain have acute coronary syndrome? The rational clinical examination systematic review. JAMA. 2015 Nov 10;314(18):1955-65. PMID: 26547467.
• History and physical examination.
  - Chest pain with radiation to the bilateral arms or shoulders or right side should make you worry about ACS. This has one of the highest likelihood ratios for ACS. Other concerning features include chest pain worse with exertion and chest pain associated with vomiting or diaphoresis. There is a reasonably high likelihood ratio if the pain feels similar to their prior MI.
  - Some other concerning findings are S3, hypotension and crackles on lung exam.

• This article tends to disregard clinical judgment. They said clinical features in combination with the ECG are poorly predictive for acute MI. This is not really the case. Clinical judgment is pretty good but not perfect. Take a good history and scrutinize the ECG. This is the first step in risk stratification and is important.

• The EKG.
  - The article discusses the power of the EKG to rule in ACS. However, it also notes that a normal EKG does not rule out ACS. About 5-28% of patients with ACS will have a normal EKG. The negative likelihood ratio of this test isn’t powerful enough.

• Biomarkers.
  - The article states "It also is critical to note that there are no false-positive troponin elevations; all reflect myocardial injury and all portend a worse prognosis than otherwise similar patients without a troponin elevation... Any troponin is always worse than no troponin and more troponin is always worse than less troponin". Mattu disagrees. For example, troponin may be elevated in the majority of long distance runners after a run. Troponin may be elevated in supraventricular tachycardia without increased bad outcomes. This doesn’t always correlate with adverse outcomes.
  - "Compared with non-STEMI patients, individuals with unstable angina do not experience myocardial necrosis." All of our biomarker algorithms have been developed to detect acute MI but not unstable angina. However, patients with unstable angina "have a substantially lower acute risk of death and/or major arrhythmias and seem to derive less benefit from intensified antiplatelet therapy and early invasive strategy." We aren’t using these algorithms to rule out coronary disease or unstable angina. These patients have lower risk but not low risk. However, the number of patients with unstable angina and negative troponin has decreased with increasing sensitivity of troponin assays.
  - The spectrum of ACS ranges from stable angina to unstable angina with normal EKG to unstable angina with abnormal EKG (especially ST depression) to non-STEMI and STEMI.
  - The article goes very in depth into timing strategies for troponin and using other biomarkers.

• What is Mattu’s accelerated diagnostic pathway? He uses a time zero and 3 hour conventional troponin-I assay. They do not vary the protocol depending on constant versus intermittent pain or duration of symptoms.

• Combining troponin with risk scoring systems for accelerated diagnostic pathways. They discuss the TIMI score, ADAPT pathways, GOLDMAN score, GRACE score and the current favorite, the HEART score.
  - Can we effectively use these scores from a patient safety standpoint? Yes. They risk stratify patients to very low levels of risk, usually less than 1% risk of major adverse cardiac event at one month. This is about as good as you can get.
  - Can we use these scores from a medicolegal standpoint? Most likely yes. Some of these have been validated. You don’t necessarily have to follow the guidelines if you have good validated literature that indicates an aspect of the guidelines is incorrect. We have good literature saying that we don’t have to follow the guidelines recommending stress testing in 72 hours.
  - What is the preferred scoring system? The best available evidence supports the ADAPT, HEART or EDACS scores.

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**Cardiology Corner:**

**ACS State of the Art – Part 2: Evocative Testing**

Rob Orman MD and Amal Mattu MD

**Take Home Points**

- Stress testing looks for a critical lesion in one of the coronary arteries.
- Although stress testing will likely identify a lesion greater than 70%, myocardial infarction may involve unstable lesions that are only 30-50%.
- Resting sestamibi testing is a good option if available.
- The use of a rapid rule out protocol is validated and defensible.

- At the end of your pathway, the patient is sent for follow-up or stress testing.
- What does stress testing tell you?
  - Stress testing looks for a critical lesion in one of the coronary arteries. This is determined by stressing the patient via a treadmill or injecting medication and determining whether the coronary arteries are sufficiently patent to meet the increased myocardial demand.
- Presumably a lesion of 70% will result in chest pain, EKG changes or wall motion abnormality.
- The stress test is pretty good but not a guarantee and patients may present with a STEMI after a negative stress test. The stress test is fairly good at identifying lesions of 70% of greater but myocardial infarction may sometimes involve lesions that are only 30-50% stenosis.
- The stress test just tells you that the patient’s chest pain is not due to a significant size lesion. It doesn’t rule out non-critical occlusions that may rupture and cause a subsequent MI.
- An exercise stress test on the treadmill has sensitivity ranging from 50-80%. Nuclear medicine stress testing has sensitivity in the low 90s.
- Some EDs have same day resting sestamibi testing available. This is a great test if you can get it done, especially if you do the injection while the patient is having pain or shortly thereafter. A negative test confers a good 12 month prognosis. A positive test is highly predictive of major adverse cardiac events in the future.
- Resting echocardiograms are often performed looking for wall motion abnormalities. However, this is unable to discern a new infarct from an old infarct. Also, many patients present to the emergency department after resolution of their chest pain which limits sensitivity of the study. The authors say the sensitivity and specificity are not sufficient to rely upon.
- Cardiac CTA. Proponents of coronary CTA state that that negative CT predicts excellent 6 and 12 month prognosis. It may identify alternative diagnoses such as a PE or pneumonia. It may decrease bouncebacks as patients may receive a more definitive diagnosis. Critics describe the increase in radiation and risks of contrast. There are also a relatively high number of false positives. Many of the studies were done in very low risk populations that were likely to rule out regardless.
- There is a school of thought that no objective testing is necessary. However, the article advises that “it is not guideline compliant because current practice guidelines recommend testing for CAD after exclusion of myocardial infarction. However, recent literature on rapid rule out protocols shows low risk of major adverse cardiac events.
- The 2015 ACLS guidelines state “We recommend that negative cTnI or cTNT measurements at 0 and between 3 and 6 hours may be used together with very low-risk stratification (TIMI score of 0, low risk score per Vancouver rule, North American Chest Pin score of 0 and age less than 50 years or low-risk HEART score) to predict a less than 1% chance of 30 day major cardiac event.)"
- This says nothing about mandatory stress testing.
- The use of a rapid rule out protocol is validated and defensible.

Headache Diagnostic Pathway
Rob Orman MD and Cam Berg MD

Take Home Points
- 90% of subarachnoid hemorrhages are from aneurysms. These have high morbidity and mortality.
- CT performed within 6 hours of headache onset is nearly 100% sensitive and 100% specific for subarachnoid hemorrhage.
- The Ottawa Subarachnoid Hemorrhage rule may be used to risk stratify patients.
- The risk of subarachnoid hemorrhage with a negative CT within 6 hours is approximately 1/1000.
- Lumbar puncture has a high rate of false positive results.
- About 90% of subarachnoid hemorrhages are from aneurysms. These are the ones we want to detect because they have high morbidity and mortality. The other 10% are perimesencephalic bleeds that aren’t as dangerous and may not be consequential if missed.
- CT performed within 6 hours on non-traumatic headache patients was nearly 100% sensitive and 100% specific for the diagnosis of subarachnoid hemorrhage. The time limit of 6 hours is important due to the changes blood undergoes with time. Acute blood on CT is bright. Resolving blood gradually becomes isodense which may be difficult to see in the subarachnoid space.
- The CT scanners used in this study were not very advanced. The radiologists were not specialized in neuroradiology.
- The patient enters the ADP after presenting with a headache concerning for subarachnoid hemorrhage. Patients are entered into the pathway based on clinician gestalt.
- The Ottawa Subarachnoid Hemorrhage rule is used to risk stratify patients. The absence of any of these findings essentially rules out subarachnoid hemorrhage. This rule has been prospectively validated at multiple sites.
  - Age > 39.
  - Neck pain, stiffness or limited flexion.
  - Witnessed loss of consciousness.
  - Exertional onset.
  - Thunderclap.

If the Ottawa decision rule is negative, no further work-up is performed. However, if there is something about the patient that makes you think they are higher risk than the average patient, you might still want to pursue an LP.

If the Ottawa decision rule is positive, the patient receives a noncontrast head CT.


This article advised CT within 6 hours was extremely good at ruling out subarachnoid hemorrhage. They recommend LP be performed after CT only in patients with a pre-CT probability of greater than 20% for subarachnoid hemorrhage.

In comparison, the subset of patients included in the Perry article had a pre-CT probability of subarachnoid hemorrhage of 7.7%. 20% would be a very high risk group.

If the CT is positive, the patient rules in. If the symptom onset was under 6 hours and the CT is negative, the patient is ruled out.

There is a small risk of subarachnoid hemorrhage with negative CT under 6 hours (1/1000). Should you discuss this with patient? Berg says, "Based on the results on your tests today, it appears extremely unlikely you are suffering from a bleeding aneurysm. To the best our knowledge, the possibility is about 1 in 1000 or less. To be 100% certain the next thing we would do is a more invasive test like a spinal tap. At this point, I would not recommend the test but I would be happy to perform it if you remain worried."

Lumbar puncture has a very high incidence of false positive results. About 15% of emergency lumbar punctures have red blood cells due to trauma. If you combine this feature with a low prevalence of actual disease, you get a likelihood ratio of a true positive of a lumbar puncture after negative CT within 6 hours is 1 in 200. It is a false positive 99.5% of the time.

CT performs differently after 6 hours. Instead of being close to 100% sensitive, it is more like 90%. This is not high enough. If the patient has a concerning story with symptoms greater than 6 hours from onset, they would receive a CT head followed by lumbar puncture.

What is a positive lumbar puncture? The ideal is either xanthochromia defined by colorimetric analysis or greater than 2000 red cells in the tube with the lowest number of cells.

Why not just do a CT angiogram? Between 2-5% of the population have an incidental aneurysm. However, there is no evidence of benefit of detection or intervention when patients are asymptomatic. A few small ED trials have looked at this. The data is not promising. It is costly, involves a large amount of radiation and there is no evidence it benefits our patient.

What do you do if the lumbar puncture is positive? Now you do the CT angiogram. The majority of lumbar punctures are false positives. You want a confirmatory test to show there is an aneurysm that could be bleeding.

Since Berg started the ADP, they have decreased lumbar puncture utilization by 30%. They have decreased the length of stay in headache work-ups by about an hour. They are all on the same page. The radiologists, neurosurgery and consultants are in agreement.

If you are going to create an ADP, make sure your consultants are all on board and agree with the plan. It is ok if your gestalt tells you to deviate from the protocol. That is why we practice and train.
Focused Evaluation of First Trimester Vaginal Bleeding
Rob Orman MD and Dave Glaser MD

Take Home Points

- The quantitative hCG is only important if there is no intra-uterine pregnancy seen.
- Bedside ultrasound in the emergency department has high specificity for identifying intrauterine pregnancy.
- RhoGAM administration is controversial for threatened miscarriage under 12 weeks and may be unnecessary.
- There is no need to check urinalysis unless the patient is having urinary symptoms.

CASE
A 24 year old female presents with a complaint of vaginal spotting. She is 6 weeks pregnant by dates. This is her first pregnancy. She has not seen an OB yet. What do we need to do?

- The quantitative hCG. We only need to know this if the ultrasound doesn’t show an intrauterine pregnancy. This will only be followed if the patient does not have an apparent intrauterine pregnancy.
- How good are we at ultrasound?
  - Our specificity is greater than 98%. They concluded that patients with an intrauterine pregnancy identified on point-of-care ultrasound in the ED can be safely discharged without follow-up. They recommend this as routine care in evaluating first trimester pain or bleeding.
  - A study found that we can detect an intrauterine pregnancy in the ED over 90% of the time after 5.5 weeks gestation. Don’t be afraid to use this as our first modality of imaging.
- Rh status. Does the patient need RhoGAM? Glaser describes this as dogma and says there is no supporting literature. RhoGAM is an antibody against the RhD antigen. The idea is that if the fetus’ blood crosses the placenta it will create a reaction that will affect future pregnancies. We have been taught that all Rh negative patients with vaginal bleeding require RhoGAM but there is no supporting literature.
- What does the Cochrane review say? “There are insufficient data available to evaluate the practice of anti-D administra-

tion in an unsensitized Rh-negative mother after spontaneous miscarriage... Immunoglobulin prophylaxis after spontaneous miscarriage for preventing Rh alloimmunization cannot be generalized and should be based on the standard practice guidelines of each country.”
  - ACOG says that alloimmunization attributed to threatened abortion is exceedingly rare and administration of RhoGAM to a patient with threatened abortion prior to 12 weeks gestation is controversial and no evidence based recommendation can be made. Many physicians do not routinely administer RhoGAM to patients with threatened miscarriage up to twelve weeks gestation.
  - Practice patterns vary widely, even among OB/GYNs.
  - The NICE guidelines from the UK only recommend RhoGAM if the woman has a surgical procedure such as a D and C. They recommend not giving RhoGAM prophylaxis to Rh negative women receiving medical management for ectopic pregnancy or miscarriage, threatened or complete miscarriage or a pregnancy of unknown location.
  - Up-to-date says that RhoGAM should only be given to women with significant bleeding and not spotting.
- Urinalysis. We have been taught that asymptomatic bacteriuria is a bad thing. Urinary tract infection and asymptomatic bacteriuria have been associated with increased risk of preterm birth, low birth weight and perinatal mortality. However, these are third trimester complications. The Infectious Disease Society of America guidelines from 2005 recommend a screening urine culture early in pregnancy. There is no association with miscarriage. Also, urine culture rather than urinalysis is recommended. If the woman isn’t having urinary symptoms, there is no need to check a urinalysis.
- Pelvic exam and cultures. We are taught that we need to look at the os and for other signs of bleeding as well as get cultures for gonorrhea and chlamydia.
  - The CDC STD guidelines from 2015 recommend all pregnant women under 25 and older women at increased risk of infection should be routinely screened for gonorrhea and chlamydia. However, this is usually at the first prenatal visit. This doesn’t have to take place in the emergency department. These women should also be screened for HIV, hepatitis B and C and syphilis. None of us are doing this in the emergency department. There is no evidence that screening for an STD affects the outcome of threatened miscarriage. Leave screening for the prenatal visits.
  - The speculum and bimanual exam. Why are we doing a pel-
vic exam? Up-to-date describes this as the standard of care. This will depend on the situation. If the patient just has a little spotting, it is unlikely you will find an open os or products of conception at the os. Although they report that bimanual exam can demonstrate size the uterus, your ultrasound is more likely to be accurate. Your pelvic exam is unlikely to add anything or change management, especially if you see an intrauterine pregnancy on ultrasound. **If there is a lot of pain or bleeding, you will want to do a pelvic exam. However, there is no need in many situations.**

- **How does Glaser work-up these patients?** He brings the ultrasound in the room with him. He takes a history and does a general exam including an abdominal exam. He proceeds with the pelvic ultrasound. You could start with transabdominal exam but likely will need to do a transvaginal exam in early pregnancy. **If you find an intrauterine pregnancy, you are done. You don’t need the Rh, urinalysis, formal ultrasound, pelvic cultures or a CBC.**

### 3 Treatments for Refractory V fib

**Rob Orman MD and Josh Bucher MD**

**Take Home Points**

- Although data is limited, esmolol has been used successfully in the termination of refractory ventricular fibrillation.
- Double sequential external defibrillation may be able to defibrillate 95% of the myocardium.
- ECMO may temporize until definitive care but availability is limited at most sites.

**CASE**

You have a patient in ventricular fibrillation. You are doing compressions, giving medications and defibrillating the patient. They remain in ventricular fibrillation. What can you do?

- **Refractory ventricular fibrillation is an interesting situation.** There is no real definition and it may be defined differently depending on the agency (for example, some will say after three defibrillations and others after five defibrillations). **This is a patient in ventricular fibrillation and you are unable to terminate their arrhythmia despite ACLS.** This is a very challenging situation to treat.

- **There are a few options.**
  - Beta-blockers.
  

- **This was a cohort study. Patients receiving esmolol were given a loading dose of 500 mcg/kg followed by an infusion. The infusion varied from nothing up to 100 mcg/kg/min.**

- **They found survival to discharge with a favorable neurologic outcome after refractory ventricular fibrillation was 50% in the group receiving esmolol versus 11%. This was a small study. 6 patients received esmolol and 19 did not. 3 of the esmolol patients survived to discharge with good neurologic outcome and in the control group only 2 of 19 survived to discharge with good neurologic outcome.**

- **Another option is double sequential external defibrillation.** This involves two sets of pads with two defibrillators and simultaneous defibrillation at the maximum energy. The theory is a change in the vector of electricity can result in defibrillation of 95% of the heart.

- **Where are the pads placed?** Right anterior chest and left lateral chest as well as the anterior and posterior position.

- **ECMO.** This is not available at most sites. However, there is some data that suggests patients with a presumably reversible cause of their arrest may have ROSC after their lesion is corrected.

### Paper Chase 1:

**Brain Bleeds and Blood Pressure**

**Sanjay Arora MD and Michael Menchine MD**

**Take Home Points**

- There was no difference in death or disability in patients with acute spontaneous cerebral hemorrhage whether blood pressure was managed to a target of 110-139 mmHg or 140-179 mmHg systolic.

- This study does not apply to patients with subarachnoid hemorrhage due to aneurysm. Most guidelines recommend a target under 140 mmHg in this situation.


- The bottom line: there was no difference in death or disability in patients with acute spontaneous cerebral hemorrhage whether the blood pressure was managed with a low systolic target of 110-139 mmHg versus 140-179 mmHg.

- **Blood pressure management in spontaneous intracranial hemorrhage is controversial.** There is some evidence that arterial hypertension is associated with expansion of the brain hematoma and bigger hematomas are associated with worse outcomes. The theory is that limiting expansion of the hematoma will result in improved outcomes. In addition, it is thought very high blood
pressure leads to failure of the autoregulation in the central nervous system leading to very high intracranial pressure. This is very bad for cerebral perfusion and clinical outcomes. As a result, there are some current guidelines recommending reduction in systolic blood pressure less than 180. There is less information regarding management of patients with systolic blood pressures between 140 and 180 mmHg.

- A previous randomized controlled trial published in 2013 showed a trend towards better outcomes in patients treated to normotension compared to higher ranges. The study was reported as a negative trial as it just missed statistical significance. Some thought this may have been due to the fact that some patients in the intervention group did not achieve the target blood pressure.

- This study was conducted at 110 sites and included patients with spontaneous intracranial hemorrhage. Patients were eligible if they had arterial hypertension with at least one reading greater than 180 mmHg. They had to remain about 140 mmHg and treatment had to be initiated within 4.5 hours. Exclusion criteria included a GCS less than 5 or a massive hematoma with poor prognosis. Patients were randomised to a nicardipine drip versus nothing in an open label manner.

- The primary outcome was the proportion of patients who died or had major disability at 3 months. There were multiple secondary outcomes including safety, hematoma expansion, etc.

- What did they find? This was negative trial. Death or disability occurred in 39% of the treatment group and 38% of the standard group. Most of the secondary outcomes such as rapid neurologic deterioration, serious adverse events favored the control group and not the intervention group.

- The authors only looked at patients who reached the target. More than 80% patients were able to reach the target within 2 hours. The results were even worse in patients who reached the target.

- What does this mean? This is pretty damning evidence showing no benefit to aggressive BP reduction in the setting of spontaneous intracranial hemorrhage. This only applied to patients within the range between 140-180 mmHg. The guidelines still recommend dropping the blood pressure below 180 mmHg systolic.

- This does not apply to aneurysmal subarachnoid hemorrhage. Most recommend targeting a blood pressure less than 140 mmHg.

Paper Chase 2: Calf Clot Demystification
Sanjay Arora MD and Michael Menchine MD

Take Home Points
- Therapeutic anticoagulation for isolated calf DVT is associated with a reduction in proximal DVT extension and pulmonary embolism but increased risk of bleeding.
- Patients should be given anticoagulation for isolated calf DVT unless they have increased risk of bleeding or very low risk features.
- The number needed to treat to prevent clot extension or PE is 16.


- The bottom line: therapeutic anticoagulation for isolated calf DVT was associated with a reduction in proximal DVT extension and pulmonary embolism but with increased risk in bleeding. The study supports anticoagulating patients with calf DVT unless they have very low risk features or high bleed risk.

- Sometimes the work-up for DVT identifies clot in the calf (the veins distal to the knee). It is important to know whether your ultrasound tech actually is looking in the calf. You may have to tell them to look there as it is not routine. How should these be managed?

- This is a common problem and there are few studies available to guide therapy. Those who support anticoagulation cite increased risk of pulmonary embolism. Those against anticoagulation say clot progression and subsequent pulmonary embolism is rare.

- This was a single center, retrospective cohort study which reviewed all lower extremity venous duplex ultrasounds over a 3 year period and identified patients with isolated DVT to the calf. They excluded patients with chronic DVT or prior diagnosis of pulmonary embolism. This was not a randomized controlled trial. Anticoagulation was determined by the physician. Anticoagulated patients were grouped together regardless of agent used.

- They looked at the rate of DVT and PE as well as safety. 697 patients with isolated calf DVT were identified from over 14000 lower extremity venous duplex studies. 313 patients were excluded leaving 384 patients. 243 patients (63%) were anticoagulated and 141 patients were not.

- 5% of the control group developed proximal DVT compared to 1.6%. 4.3% of patients developed a PE in control group compared to 1.6% in the anticoagulated group. Combined, the absolute difference was 6 with a number needed to treat of 16.
What was the number needed to harm? 2.6% of controls experienced bleeding compared to 8.6% of the anticoagulated group. These groups were different at baseline but additional analysis determined it probably didn’t affect results. It is possible increased testing in the control groups led to increased identification of clots.

What does this mean? You need to consider the risk of bleeding. However, if the patient is symptomatic and you found a distal DVT, just treat them like a proximal DVT and give them anticoagulation. If they are asymptomatic or the clot is an incidental finding, you can either give them anticoagulation or if they are very low risk (small clot, very distal to the knee, no risk factors like cancer or prolonged immobilization) you could consider surveillance on these patients and repeat the study in two weeks and defer anticoagulation pending progression.

The recent 2015 CHEST guidelines recommended serial imaging over two weeks rather than anticoagulation for acute isolated distal DVT without severe symptoms or risk factors for progression. This is not just repeat study in two weeks but rather surveillance over two weeks. If there are severe symptoms or risks factors for extension, the guidelines recommend anticoagulation over serial imaging.

- What is high risk? Cancer or unprovoked clot.

Paper Chase 3: MRI in Pregnancy is OK, but not Gadolinium
Sanjay Arora MD and Michael Menchine MD

Take Home Points
- MRI in pregnant women does not increase fetal mortality.
- Gadolinium contrast should be avoided as it is associated with increased risk of rheumatologic, inflammatory or infiltrative skin conditions in the fetus.

- Bottom-line: pregnant mothers who underwent MRI did not experience increased fetal mortality but receiving gadolinium contrast was associated with a small increased risk in rheumatologic, inflammatory or infiltrative skin conditions in the offspring.

- We know ionizing radiation is not good for anyone, especially fetuses. This has led to guidelines recommending increased use of MRI or ultrasound in children or pregnant women. MRI during pregnancy is generally thought safe but there are some concerns that tissues could be heated during the MRI leading to problems. Some have concerns about the effect of the sound.

- Gadolinium has been shown to cross the placenta. It is excreted by fetal kidneys into the amniotic fluid and recirculated until delivery. There is concern that this could cause nephrogenic systemic fibrosis. This is a rare complication of gadolinium in patients with renal impairment.

- This was a very large registry study of all the maternal pairs with delivery of a live born or stillborn between 2003 and 2015. They tried to answer two questions. Is the rate of stillbirth or congenital abnormality, cancer or hearing loss higher among women getting a first trimester noncontrast MRI compared to those who did not? What is the incidence of skin conditions among the offspring of women who received gadolinium compared to those who did not? Was the rate of stillbirth higher?

- Propensity matching was used to account for the fact that women receiving an MRI were more likely to have children with birth defects as a result of whatever condition prompted the MRI.

- What did they find? They looked at nearly 1.5 million maternal fetal pairs, of whom 1737 had an MRI in the first-trimester. 397 had an MRI enhanced with gadolinium at any point in the pregnancy. Patients receiving an MRI without gadolinium during the first trimester did not have any statistically significant difference in the rate of stillbirth, congenital abnormality or hearing loss. There was a tiny increased risk of vision loss.

- There was a markedly higher rate of stillbirth in patients who received gadolinium (relative risk of 3.7) and inflammatory conditions (36% higher).

- What does this mean? MRI in early pregnancy without contrast enhancement is safe. Gadolinium probably shouldn’t be used. However, gadolinium isn’t needed to see the most common diagnoses evaluated by ED physicians. It is used to evaluate vasculature or in the CNS to characterize brain tumors.
**Paper Chase 4:**  
**IO Lines: Size Matters**  
Sanjay Arora MD and Michael Menchine MD

**Take Home Points**

- Intraosseous access may be challenging in obese patients.
- If the tibial tuberosity can be palpated, the depth to the bone is almost always less than 20mm and the 25mm needle (blue) is sufficient.
- The distance to the humerus is almost always greater than 20mm in obese patients and the 45mm needle (yellow) should be used.


- Bottom-line: if you can feel the tibial tuberosity in obese patients receiving a tibial IO, the 25mm needle is likely to work. If you can’t feel the tibial tuberosity, use the long needle (the yellow). If you are planning on placing a humerus line in an obese patient, use the long yellow needle.

- Intraosseous access has influenced our practice. How do you know when you are in? The needle stands alone. You are able to aspirate marrow. There is minimal resistance to infusion and no surrounding signs of infiltration.

- There are multiple potential sites of insertion such as the proximal tibia, distal tibia or iliac crest and proximal humerus.

- Once you decide on location, you need to determine needle size. You have three options. The pink needle is 15mm and used in pediatrics. The blue needle is 25mm. This is the most common. The long yellow needle is 45mm.

- This is a prospective, observational study of a convenience sample of obese patients in the ED. Enrolled patients had a BMI greater than 30. They measured the soft tissue depth at the three most common sites of insertion; the proximal tibia, the distal tibia and the proximal humerus. They also had a binary assessment whether the examiner could palpate the tibial tuberosity.

- 70 patients were enrolled with a mean BMI of 47.2.

- What did they find? The tibial tuberosity was palpable in 70 out of 75 patients. If you could feel it, the depth to the bone was almost always less than 20mm (making the blue needle sufficient). They did statistical analysis to determine that proximal tibial IO lines with the blue needle have an excellent chance of success in patients with a BMI less than 43. The distal tibial IO line had success in almost all patients up to a BMI of 60. The humeral location was almost always greater than 20mm in obese patients. You can’t use the blue needle for a humeral IO line.

- The blue needle will work in almost all obese patients if you can feel the tibial tuberosity. If not, you will have to use the yellow needle. Always use the yellow needle in the proximal humerus.

**Paper Chase 5:**  
**Non-Occupational HIV Prophylaxis**  
Sanjay Arora MD and Michael Menchine MD

**Take Home Points**

- Physicians are more likely to give postexposure HIV prophylaxis to patients with occupational exposure than non-occupational exposures with high risk sexual exposure.
- 2% of patients with high risk sexual exposure seroconverted.
- There has not been any documented case of HIV seroconversion from occupational exposure since 2001.


- Bottom line: this study finds emergency physicians are less likely to prescribe post-exposure prophylactic HIV medications to patients who present to the ED following high risk sexual exposure than patients with high risk occupational exposure.

- Providers who get a needlestick injury get prophylaxis but patients with high risk sexual activity are often referred to an STD clinic. A previous study presenting clinical scenarios (occupational needlestick versus high risk sexual exposure) to physicians found physicians were twice as likely to prescribe prophylaxis to patients with occupational exposure.


- These studies were performed a long time ago and there have been subsequent changes that may have changed practice patterns. In 2005, the CDC issued guidelines for sexual exposures and recommended postexposure prophylaxis. There has been significant evolution in the HIV medications used for prophylaxis and they are much better tolerated.

- There has not been a single documented case of healthcare provider HIV seroconversion due to occupational exposure since 2001.

- What did they do? The authors of this study asked whether
contemporary emergency physicians offered HIV prophylaxis similarly when there is high risk occupational versus nonoccupational exposure. They conducted a retrospective chart review. They identified patients with ICD-9 diagnoses of body fluid exposure and then reviewed the chart to determine whether the exposure was high risk sexual exposure or occupational.

- High risk was considered exposure to body fluid known to transmit HIV from a source that had HIV or was high risk.
- Rape victims were excluded from the study as they were not treated at this site.

**What did they find?** Of 1972 exposures, 68.9% had occupational exposure and 31.1% had nonoccupational exposure. Only 14% of the occupational exposures were considered high risk but 84% were given HIV prophylaxis. 47% of the nonoccupational exposures were considered high risk. However, they were less likely to be offered prophylaxis (only 72%). HIV prophylaxis was twice as likely to be not offered.

- 4 patients in non-occupational group did seroconvert to HIV (1.9%) but no patients in the occupational exposure group tested positive. 2 of the patients who seroconverted had high risk exposures but were not given prophylaxis.

**What does this mean?** We still have some issues offering post-exposure HIV prophylaxis to patients with high risk sexual exposures. This needs to stop. The medications are well tolerated, easy to prescribe and it is worth reviewing dosing so that your patients can be properly treated.

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**Fake Xanax**
Stuart Swadron MD and Sean Nordt, MD PharmD

**Take Home Points**

- Counterfeit Xanax containing fentanyl and a benzodiazepine analog, etizolam, has resulted in recent overdoses and deaths.
- Urine toxicology will likely be negative as neither fentanyl nor etizolam will be detected.
- Consider in a patient with an overdose who has improved respiratory rate after naloxone administration but remains comatose.

From **kron4.com**, "The San Francisco Department of Public Health is warning people not to purchase "Xanax" on the street, as there are counterfeit pills circulating that contain fentanyl, an extremely potent, short-acting opioid that can cause overdose and death... Three individuals between the ages 20 to 40 years were hospitalized after ingesting a pill inscribed and sold as "XANAX" purchased on the street. All three patients suffered complications of opioid overdose, including sedation, weakness in extremities, muscle breakdown that can lead to kidney damage, and fluid in lungs. Two patients became critically ill."

- **These pills were found to contain fentanyl and etizolam.** Etizolam is a benzodiazepine analog. It is primarily available in Japan and is not sold in the US. These patients presented looking like opioid poisoning. They were given naloxone but remained somnolent.
- **Patients who respond partially to reversal of an opioid overdose may have another agent such as partial agonist, clonidine or coingestion of another agent.**
- **How can you detect ingestion of fake Xanax?** These patients will likely present with respiratory depression. Low dose naloxone is recommended. 0.4mg should be the starting dose. If the patient demonstrates improvement in their respiratory rate but remains comatose, consider coingestion with a benzodiazepine. Benzodiazepine overdose will often have normal vital signs but remain comatose. Etizolam is found on the street. People are buying this online in powder form or branded tablets from around the world.
- **Patients abusing Xanax or other benzodiazepines will often take multiple tablets at a time. This is a particular problem if it is mixed with a potent opioid like fentanyl.** We will likely see a lot of deaths due to this combination.
- **The urine toxicology screen only identifies nordiazepam or oxazepam (Serax).** Alprazolam (Xanax) and flunitrazepam (Rohypnol) won’t show up on the urine toxicology. Etizolam is a benzodiazepine analog and would also not result positive on urine toxicology. Don’t be surprised if it looks a benzodiazepine overdose but the toxicology results are negative. Fentanyl also will not show up as positive on urine toxicology. It is a synthetic opioid.

- **Should you use a reversal agent like flumazenil?** Although there is a case report discussing reversal with flumazenil, you don’t know if the patient is physically dependent on the drug and they might develop withdrawal. Etizolam is marketed as not being as addictive as a benzodiazepine. This is not true.
- **We are going to start seeing this a lot more.** If you see a case, report it to your local Poison Control center.
From the Mailbag
Rob Orman MD and Anand Swaminathan MD

• Dave Glaser MD: “You recently discussed the cost of epinephrine autoinjectors and how we should write for these generically when prescribing for patients. I agree. In addition, many practicing physicians may not know that hospital pharmacies stock the epinephrine autoinjector as a means of giving our own patients epinephrine to prevent any mix-up in the different formulations. In my hospital, when you order a 0.3mg IM dose of epinephrine, the nurse gives the medication via autoinjector. This was instituted some time ago so as not to use the wrong concentration.

  ○ “However, if you order 0.5mg IM, the RN has to draw up the dose from a vial into our own syringe and inject it the old-fashioned way.”

  ○ The cost difference is substantial. It shouldn’t cost the patient hundreds of dollars to fix a problem due to human error. One way to avoid the confusion is to never order epinephrine as a volume or concentration.

  ○ Concerns of side effects due to the higher dose of epinephrine are likely overblown.

• Joel Herrington MD writes in regarding a segment on ovarian torsion. “I had a young female present to my ED with pelvic pain from the night before. She had nausea and vomiting. The pelvic ultrasound showed a mass behind the uterus. The radiologist was able to visualize the right ovary but not the left. I spoke to the radiologist and asked if the mass could be an ovary. He said yes. Even though the patient was not in excruciating pain, I paged GYN regarding a possible ovarian torsion after remembering the lecture with atypical presentations with nausea and vomiting and abnormal ovary.

  ○ “Gyn took the patient to the OR and found a large dermoid cyst with intermittent torsion. The patient’s ovaries are still viable.”

• Amal Mattu MD writes in. “In a recent EMRAP, the question arose as to how long D-dimer stays elevated.” In a recent article by Jeff Kline MD, it was reported that D-dimer only remains reliably elevated for about 3 days. There may be false negatives after 5 days of symptoms or with chronic pulmonary embolism.

  ○ “The D-dimer has a half-life in plasma of approximately 8h, and extrapolating from humans and animal models of autologous PE, the D-dimer level probably remains abnormally high for at least 3 days after symptomatic PE. However, as D-dimer may be continuously shed by unstable clot, it is difficult to know exactly how long after an acute PE a D-dimer assay will remain positive.”
