2019 FMX Emergency and Urgent Care Handouts

Abdominal Pain and Acute Abdomen Emergent and Urgent Care: Urgent Abdominal Pain Not to Miss (CME042-043)

Acute Respiratory Distress Syndrome (CME044-045)

Evaluation and Management of Sepsis/Septic Shock in Adults: Managing the Silent Killer (CME038-039)

On Scene Initial Trauma Response for the Family Physician (CME040-041)
Abdominal Pain and Acute Abdomen Emergent and Urgent Care: Urgent Abdominal Pain Not to Miss

LTC Darrell "Edward" Jones, DO, FAAFP

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LTC Darrell "Edward" Jones, DO, FAAFP

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Dr. Jones serves as Director of Clinical Services for both family member care and soldier care for the U.S. Army Special Operations Command (USASOC). He earned his osteopathic medical degree from Nova Southeastern University College of Osteopathic Medicine in Davie, Florida in 2005. He then completed his residency in family medicine at Womack Army Medical Center (WAMC), Fort Bragg, North Carolina. Dr. Jones is one of only a handful of physicians to have served as the Military Free Fall Physician in Yuma, Arizona. His experience there has given him unique knowledge about high-altitude medicine and free fall/skydiving injuries.

Upon returning to Fort Bragg to serve with USASOC, Dr. Jones deployed to Afghanistan two times over a three-year period, for a total of 13 months, in support of Operation Enduring Freedom. He subsequently served two years as full-time faculty for the WAMC Family Medicine Residency, serving as Student Coordinator and Director of Medical Simulation. He received the Family Medicine Faculty of the Year Award two years in a row before moving to his current position. Dr. Jones continues to pursue his interest in medicine in several different arenas. He presented an EKG seminar at the 2018 AAFP Family Medicine Experience (FMX). In addition, he has presented a variety of topics for the Uniformed Services Academy of Family Physicians' annual conference for each of the last four years. He volunteers his time serving as adjunct faculty for WAMC Family Medicine Residency, and he also has been moonlighting in multiple emergency departments for the past 10 years, seeing 2,500 patients annually.
Learning Objectives

1. Narrow the differential diagnosis of acute abdominal pain based on the location of the pain and the age and sex of the patient.

2. Identify red flag symptoms in patients with acute abdominal pain that indicate emergent or urgent conditions that require surgical consult.

3. Order appropriate diagnostic and imaging studies based on the location of the pain and the presentation of the patient.

4. Recognize etiology of some more relevant causes of abdominal pain: ectopic pregnancy, appendicitis, bowel obstruction, choledocholithiasis, pediatric abdominal emergencies.

Audience Engagement System

Step 1

Step 2

Step 3
Abdominal Pain Stats

- 1.5% of all office visits and 8% of ER visits
- Despite advanced imaging, misdiagnosis of Appendicitis has not changed
- Abdominal pain is the presenting complaint in a high percentage of malpractice claims
- Mortality rate of elderly presenting with acute abdominal pain is 11-14%

### Acute Abdominal Pain Location

<table>
<thead>
<tr>
<th>Right Upper Quadrant</th>
<th>Epigastric</th>
<th>Left Upper Quadrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Cholecystitis</td>
<td>Gastric Esophageal Reflux Disease</td>
<td>Perforated Ulcer</td>
</tr>
<tr>
<td>Cholelithiasis</td>
<td>Coronary Artery Disease</td>
<td>Gastric Esophageal Reflux Disease</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>Peptic Ulcer Disease</td>
<td>Small Bowel Obstruction</td>
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<tr>
<td>Gastric Esophageal Reflux Disease</td>
<td>Gastroenteritis</td>
<td>Gastroenteritis</td>
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<tr>
<td></td>
<td>Acute Cholecystitis</td>
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<table>
<thead>
<tr>
<th>Right Flank</th>
<th>Periumbilical</th>
<th>Left Flank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyelonephritis</td>
<td>Pancreatitis</td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Nephrolithiasis</td>
<td>Small Bowel Obstruction</td>
<td>Nephrolithiasis</td>
</tr>
<tr>
<td></td>
<td>Acute Mesenteric Ischemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aortic Aneurysm</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Right Lower Quadrant</th>
<th>Suprapubic</th>
<th>Left Lower Quadrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Appendicitis</td>
<td>Constipation</td>
<td>Diverticulitis</td>
</tr>
<tr>
<td>Ectopic Pregnancy</td>
<td>Urinary Tract Infection</td>
<td>Infectious Colitis</td>
</tr>
<tr>
<td>Mesenteric Adenitis</td>
<td>Vaginal Infection</td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Intussusception</td>
<td>Pelvic Inflammatory disease</td>
<td>Nephrolithiasis</td>
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<tr>
<td>Infectious Colitis</td>
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<td>Constipation</td>
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<tr>
<td>Pyelonephritis</td>
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<td>Pelvic Inflammatory disease</td>
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<td>Nephrolithiasis</td>
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<td>Ectopic Pregnancy</td>
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<td>Pelvic Inflammatory Disease</td>
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Treatment with Analgesics

• Most Abdominal pain is visceral in nature
  – General aching, pressure, and sharp
• Common practice to withhold analgesics in order to not cause inaccurate diagnosis or delayed treatment (theory)
• Cochrane Review of 6 trials revealed no errors in treatment, inaccurate diagnosis, length of hospitalization, or changes in physical exam
  – However comfort greatly increased with opioid treatment
• No delayed or unnecessary surgeries with opioid treatment
• Another study showed no change in Alvarado score for appendicitis

Acute Appendicitis

• Definition – Acute inflammation of the appendix normally from an obstruction
• Lifetime risk 8.6% of males and 6.7% of females
• Less than 10% of Appendectomies remove normal appendix
• 2nd most common cause of litigation of patients 6-17 yoa
• Differential Diagnosis: Mesenteric Lymphadenitis (16%), Acute ileitis, Ovarian cyst, Ovarian TOA, Pyelonephritis, PID, Testicular pathology, Ectopic pregnancy
Appendicitis Diagnosis

- Slight predominance of males
- More common in children 6-17 years old
- RLQ pain, over McBurney’s point
- Obturator Sign, Psoas Sign, and Rovsing’s sign
- Scoring Systems
  - Alvarado Score (most studied)
  - The Pediatric Appendicitis Score
  - Appendicitis Inflammatory Score (88% High Risk, 50% Mod, 5% Low)

Psoas Sign
Obturator Sign

Appendicitis Scoring systems

<table>
<thead>
<tr>
<th>Diagnostic Tools for the Evaluation of Suspected Appendicitis</th>
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<tbody>
<tr>
<td><strong>Alvarado score</strong></td>
</tr>
<tr>
<td>Sign/symptom</td>
</tr>
<tr>
<td>Migration of pain</td>
</tr>
<tr>
<td>Anorexia</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td>Right lower quadrant tenderness</td>
</tr>
<tr>
<td>Rebound pain</td>
</tr>
<tr>
<td>Temperature ≥ 37.3°C (99.1°F)</td>
</tr>
<tr>
<td>Leukocytosis ≥ 10,000 per μL (10.0 × 10⁹ per L)</td>
</tr>
<tr>
<td>PMN ≥ 75%</td>
</tr>
<tr>
<td><strong>Total possible score</strong></td>
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</tbody>
</table>
Appendicitis Diagnostic Trends

- Prediction scores over predict 30% of appendicitis and miss 3-5%
- 20% had normal serum WBC, <10K
- RLQ pain most common in adults with LR 7.3-8.5,
- Obturator sign most common in children with LR 3.5 (followed by Rovsing's and Psoas signs >3)
- 5% of patients with Alvarado score <3 had appendicitis
- APPY1 Biomarker Panel (score combining CRP, WBC, Procalcitonin)
  - Sensitivity 98-100% and Specificity 35-45%

Appendicitis Uncommon Presentations

- The appendix moved!
- Intestinal rotation causing appendix to end up in the upper abdomen
- Femoral hernia with the appendix strangulated within the hernia
- Groin or Back pain from a retrocecal location of the appendix
- Renal agenesis causing the appendix to rise in the Abdominal cavity
- Pregnancy frequently moves the appendix to a different position within the abdomen
Appendicitis Imaging

- Considerations: Experience of Sonographer, Radiation, time, diagnostic accuracy
- National Cancer Institute, American Academy of Pediatrics, American College of Radiology recommend US as initial choice for children
- Other populations: Pregnant, overweight
- Combining US with scoring system reduced CT usage, 75% to 25%
- Use US to confirm or rule IN, CT to confirm or rule OUT (Level B)
- US Diagnosis: Appendix larger than 6 mm in diameter, non compressible, and appendiceal tenderness

Appendicitis Treatment

- “Cold Steel” right? Not always
- IV Antibiotic Treatment showed less complications, pain meds and sick leave, but 40% required surgery later
- In United States, surgery is the answer
- Laparoscopic Surgery has lower incidence wound infection, postop complications, length of stay, but longer OR time
- Delays of 48 hours before treatment increase risk of perforation
- 11 mm or more increases risk of perforation
Ectopic Pregnancy

- Ectopic Pregnancy is any pregnancy that occurs outside of the uterine cavity
- Most commonly 6-10 weeks gestation
- 2% of all reported pregnancies are ectopic
- 18% of 1st trimester pregnant patients presenting to the ER with vaginal bleeding or abdominal pain are ectopic pregnancies
- 90% occur in fallopian tube, other locations have higher morbidity
- Heterotopic Pregnancy – Ectopic Pregnancy same time as Intrauterine
  - 1 in 4K-30K naturally occurring pregnancies
  - 1 in 100 IVF pregnancies

Ectopic Pregnancy Risk Factors

- ½ of Ectopic Pregnancy patients have no risk factors
- 10% chance of risk of 2nd Ectopic, 25% chance of 3rd
- Damage to Fallopian tube (Surgery, Infection)
- 53% of IUD pregnancies are ectopic
- History of Infertility, Cigarette use, age >35
- NOT Risk factors: OCPs, Emergency Contraception, Previous elective abortions, Miscarriages, C/S deliveries
Ectopic Diagnosis

- Transvaginal US is the standard of care, however only 80% PPV
  - Due to other structures (corpus luteum, endometrioma, paratubal cyst)
- Double Sac Sign on US due to pseudosac
- Expectation of Intrauterine gestational sac
  - Gestational Age 5-6 weeks
  - Use 3,500 mIU/mL for HCG discriminatory level
- HCG rate of rise
  - 49%/day if <1,500, 40% if 1,500-3,000, 33% if greater than 3,000

Ectopic Atypical Presentations

- 1/3 have no clinical symptoms
- 20% have shock, syncope and shoulder blade pain
- 2/3 of the women who died from Ectopic Pregnancy from 2006-2008 complained of diarrhea, dizziness, and vomiting
- Most of the women who died from Ectopics were misdiagnosed in a primary care or ER setting
- High clinical suspicion in a women with shock, syncope
Ectopic Treatment

- Medical vs Surgical
- Medical Management – IM Methotrexate
  - Unruptured mass, hemodynamically stable, without absolute contraindications
  - Absolute Contraindications: Follow up, Pulmonary disease, Renal disease, Bone Marrow suppression, Immunodeficiency, Breastfeeding + others
  - Requires f/u with serial HCGs, 15% failure rate
  - High failure rates with cardiac activity or increasing HCG levels
- Salpingostomy vs Salpingectomy depends on desire for future pregnancy and patency of the contralateral tube
- Expectant Management if HCG <200 and asymptomatic is feasible

Acute Cholecystitis

- Acute Cholecystitis: Inflammation of the Gallbladder, largely due to gallstones
- Affecting 10% of western society
- 80% of patients with gallstones are asymptomatic
- 1-3% of symptomatic patients will develop acute cholecystitis
- Only 30-40% of Acute Cholecystitis patients have infection
- Inflammation can lead to rupture, abscess, or gangrene
Acute Cholecystitis Diagnosis

- Presentation: RUQ pain lasting longer than 6 hours, radiating to shoulder blade or R shoulder, fever, vomiting, and anorexia
- Positive Murphy Sign: pain with deep palpation during inspiration
  - 97% sensitive and 48% specific, both are less in the elderly
  - US palpation more accurate than hand palpation
- Labs: Leukocytosis, mild elevations of LFTs or bilirubin
  - Significant changes in Alkaline phosphatase or bilirubin could signal cholangitis or choledocholithiasis

Acute Cholecystitis Imaging

- RUQ US is the standard of care imaging
  - Gallbladder wall thickening (4-5 mm)
  - Edema, double wall sign
  - Sensitivity 88%, Specificity 80%
- Cholescintigraphy (HIDA) Scan
  - NM scan indicated if US nondiagnostic
  - 97% Sensitivity and 90% specific
- MRCP used to evaluate choledocholithiasis concurrent diagnosis
- CT has 94% sensitivity, but only 59% specificity and can miss stones
Cholecystitis Atypical Presentations

- Concurrent Cholangitis: Evidence of biliary dilatation with evidence of cholestasis on lab evaluation
  - Much higher morbidity and mortality
- Emphysematous Gallbladder, revealing gas within the Gallbladder
  - Due to gas producing bacteria
  - Higher incidence in those patients with Diabetes
- Elderly patients might not have pain or fever
  - Can progress rapidly to gangrenous Gallbladder disease

Acute Cholecystitis Treatment

- Emergency Surgery Required (20%) if: Necrosis/gangrene, perforation, or emphysematous
- IV antibiotics, Ertapenem or 3rd Gen Cephlasporin + Metronidazole
- Indomethacin can reverse the inflammation of the gall bladder in the first 24 hours
- Delayed (7-45 days) vs Early surgical intervention (<7 days)
  - Early has less wound infection, fewer complications without increasing risk
- 15% have Common Bile Duct Stones
  - Laboratory and CBD imaging should be obtained before surgery
Obstructive Pyelonephritis or Infected Hydronephrosis

- Infected Stone: kidney stone that form because of UTIs with urease producing bacteria
- Obstructive Pyelonephritis: Secondary to urinary tract calculi causing pyelonephritis
- Obstructive Pyelonephritis considered a Urologic Emergency
- 19% mortality in untreated, 9% mortality in those who are treated with decompression
- Ureteral stones are responsible for 2/3 of occurrences
- 10% of patients will develop subsequent Obstructive Pyelonephritis

Obstructed Pyelonephritis History and Risk

- History: Abdominal and Flank pain, Nausea, Vomiting, and Fever
- Urinary symptoms of dysuria, hematuria, urgency or frequency
- Increased risk with history of kidney stones, urologic surgery, or ureteral abnormalities (strictures, congenital abnormalities)
- History of Diabetes, HIV, paralysis or immunocompromise
- Anticoagulation or antiplatelet therapy can increase risk of septic shock
Obstructive Pyelonephritis Evaluation

• High Index of suspicion due to only 65% with fever, Leukocytosis in 55%, and elevated Cr in 50%
• CVA tenderness on exam and urinalysis consistent with infection
• Ultrasound sensitivity ~65% for identifying pyonephrosis
• Non-contrast CT of Abdomen and pelvis to determine cause of obstruction
• CRP measurement in distinguishing infected vs sterile hydronephrosis unclear of utility

Obstructive Pyelonephritis Treatment

• Emergent Decompression + Broad Spectrum IV Antibiotics
  – E. coli most common pathogen (66%)
  – Coverage for Gram+ if sepsis, gram+ stain, or history of gram+ cultures
• Two ways to decompress the kidney
  – Percutaneous Nephrostomy Tube
  – Retrograde Ureteral Stent placement
• Kidney urine culture should be performed during decompression
• Due to high mortality and sepsis risk, ICU care required after surgery
• Prophylactic antibiotics for future recurrent UTIs
Intussusception

- Intussusception: Invagination of a segment of bowel into an immediately adjacent segment
- Starts with lead point, which draws the proximal bowel within the distal segment
- Causes edema and eventually bowel ischemia leading to necrosis and perforation
- Ileocolic is the most common type
- Most commonly 6-36 months of age, however 10% >5 yoa
Intussusception Etiology

- 75% of pediatric Intussusception is idiopathic, 10% adults
- 30% of patients have viral illnesses prior to diagnosis
- Original Rotavirus Vaccine (RRV-TV) led to 22 fold increased risk within 5-7 days of vaccination (1/10K vaccinated patients)
- RV5 and RV1 have ~1/100K risk, lower than severe Rota infection
- History of Intussusception is a contraindication to vaccination
- Other Etiologies: Enteric Bacterial infection, Meckel’s Diverticulum, Polyp, Hematoma, Tumor, lymphoma, or vascular Malformation, cystic fibrosis, Crohn’s, or Celiac disease

Intussusception Diagnosis

- 15-20 min episodes of severe, crampy abdominal pain (days to weeks)
  - Infant and toddler drawing up of legs
- Non-bilious vomiting becoming bilious
- 75% presentations have rectal bleeding, 50% gross blood
  - Mixed with mucous gives it a “currant jelly” appearance
- Sausage shaped abdominal mass felt on exam (60%)
- Normal behavior between episodes of cramping and Intussusception
- Scaphoid RLQ (Dance’s sign)
- Classic Triad (currant stool, sausage mass, abdominal pain) only seen in 15% of patients
Intussusception Imaging

- Intussusception can be seen on plain films, also excludes perforation
- US is the imaging of choice and approaches 100% sensitivity and specificity
  - Experienced Sonographer always a limitation
  - Target or Bull’s eye sign
- CT more often used in adults due to broadened differential
  - IV contrast reveals ischemia
  - Oral contrast shows telescoping better, but can delay dx
- Contrast Enema’s can be both diagnostic and therapeutic

Intussusception Treatment

- Acutely ill patients or perforated bowel requires surgery
- Most Intussusception pediatric patients can be reduced with Air or hydrostatic enema
  - Under Fluoroscopic (air or saline) or sonographic guidance (saline)
  - Performed by Radiologist
  - 80-95% success
- Less likely to require surgery if it is idiopathic
- Highest risk is perforation
- Prophylactic antibiotics can be used, but normally only for sepsis or persistent symptoms following reduction
- 10% reoccur, half occur within 72 hours of reduction
Case #1

- 25 yo F presents to the ER with complaints of abdominal pain in the RLQ for the last 24 hours. Nausea, but no vomiting, no fever, +chills and sweats. No PMH, PSH, Medications or Allergies to medications, + smoker, social alcohol use, married without children. Vitals: HR 89, BP 104/72, O2 99%, RR 18. Exam reveals RLQ tenderness to palpation, negative obturator/psoas sign, +heel tap, no CVA tenderness to palpation, pelvic exam did not reveal vaginal bleeding, or evidence of infection, rest of exam normal.
- What labs do you want to know?
  - CBC, HCG Qualitative (if +, then HCG Quant), BMP, LFTs., GC, KOH, Wet Prep, Urinalysis
- What are her risk factors for Ectopic?
  - + smoker
- What are other risk factors for Ectopic Pregnancy
  - History of ectopic pregnancy, damage to Fallopian tube (Surgery, Infection), IUD pregnancies, history of infertility, cigarette use, age >35

Poll Question #1

HCG Quant 2,400, WBC 7.2, H/H 13.8/42, BMP normal, LFT normal, GC neg, Wet Prep/KOH negative, Urinalysis negative; Intravaginal and abdominal US reveals empty uterus and no masses in tube, appendix 4 mm, what is the next step?

A) Discharge home with f/u in 2 days and counsel appropriately
B) Call GYN on call and have her admitted for Ectopic pregnancy management
C) Admit her for observation and repeat Ultrasound tomorrow morning
D) Order a CT scan of Abdomen and Pelvis with IV contrast to r/o acute appendicitis
E) Offer Tylenol for pain control and set up follow with Obstetrics next week
Poll Question #2

Pt returns in 2 days with persistent RLQ pain, repeat HCG reveals quantitative measurement of 2,800. BP 108/66, HR 92, RR 16, O2 99%. What is the next step?

A) Discharge home with f/u with OB in 2 days
B) Follow up in 2 days to repeat HCG
C) Repeat US to look again for tubal or other pelvic mass
D) CT scan to r/o Acute appendicitis
E) Call GYN for consultation on miscarriage and inappropriate rise of HCG

Case #1 Conclusion

• Repeat vaginal ultrasound: US showed R tubal mass without heart rate, with minimal fluid in pelvis.
• What is the appropriate treatment for this patient?
  – Methotrexate or Surgery, either are appropriate, regardless consult GYN
Small Bowel Obstruction (SBO)

- Small Bowel Obstruction: Forward flow of intestinal contents is interrupted or impaired by a mechanical cause
- Occurs in ~4% of patients who present to the ED with Abdominal pain
- Adhesions cause 60-75% of cases
  - Hernias, Malrotations, and congenital abnormalities are other causes
- SBO results in Electrolyte imbalances as well as pressure on the wall
  - Metabolic Alkalosis
- Stasis can cause bacteria to cross the bowel wall and fecalization in the Small Bowel
- Closed loop obstructions are a surgical emergency, Volvulus

SBO Diagnosis

- Distention and Vomiting along with cessation of bowel gas and stool
- High pitched, musical bowel sounds become absent in later presentations
- Metabolic acidosis due to elevated lactate is a sign of ischemia
- Elevated WBC suggests peritonitis and possible perforation
- Abdominal films show air fluid levels and no stool in colon
- ACR recommends CT as initial imaging in patients with high suspicion
- Contrast Fluoroscopy has 97% sensitive for signifying spontaneous resolution
**SBO Treatment**

- Admission to Surgical Service has shorter stays and shorter time to OR
- NG Tube and IV fluids are mainstays of medical treatment
- Antibiotics only if fever and leukocytosis develop
- Nonoperative management successful in 40-70% of cases
- Surgery recommended
  - After 3-5 days of unsuccessful nonoperative management
  - Strangulated Hernia
  - Evidence of Peritonitis

**Acute Pancreatitis**

- Acute Pancreatitis: Sudden onset of reversible inflammation
- 50K annually in United States admitted with Acute Pancreatitis
- Mild Pancreatitis has 1% mortality compared to 30% in Severe Pancreatitis
  - Necrotizing and pancreatic abscesses increase the mortality
- Many guidelines and scoring systems, but many times neither are used or followed
- 14 different guidelines published between 2008 and 2014
- Alcohol and gallstones account for 90% of cases
**Pancreatitis Diagnosis**

- Abdominal pain radiating to the back, vomiting
- Lipase levels that are 3 x the upper limit of normal
- Clay colored stools and persistent hiccups are common
- Jaundice is common when gallstones are involved
- Cullen or Grey Turner sign are uncommon physical exam findings
- If alcohol is the causative agent, Mg and Phosphate should be measured
- Lipase to Amylase ratio >4 suggestive of alcohol origin

**Pancreatitis Evaluation**

- ACG recommends all patients receive RUQ US to evaluate the gall bladder
- CT should not be performed for mild pancreatitis, however it is the diagnostic standard for imaging the pancreas for complications
  - Complications: necrosis, abscess, or pseudocyst
- Scoring systems Ranson, APACHE II, BALI, CT severity index, and Atlanta Criteria
- Some guidelines advocate for daily CRP, >150 mg/dL
- Organ Failure defined as Hypoxemia, Shock, Cr >2 mg/dL, or gastrointestinal bleeding

*ACG: American College of Gastroenterology*
Table 7. Revised Atlanta Criteria for Acute Pancreatitis

<table>
<thead>
<tr>
<th>Severity</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>No organ failure</td>
</tr>
<tr>
<td></td>
<td>No local complications (e.g., peripancreatic fluid collections, pancreatic necrosis, peripancreatic necrosis)</td>
</tr>
<tr>
<td></td>
<td>No systemic complications</td>
</tr>
<tr>
<td></td>
<td>Typically resolves in first week</td>
</tr>
<tr>
<td>Moderate</td>
<td>Transient organ failure (≤ 48 hours)</td>
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<tr>
<td></td>
<td>or</td>
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<tr>
<td></td>
<td>Local complications</td>
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<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>Exacerbation of comorbid disease</td>
</tr>
<tr>
<td>Severe</td>
<td>Persistent organ failure (&gt; 48 hours)</td>
</tr>
</tbody>
</table>

Table 5. BALI Score

Blood urea nitrogen level ≥ 25 mg per dL (8.9 mmol per L)  
Age ≥ 65 years  
Lactate dehydrogenase level ≥ 300 U per L (5.0 µkat per L)  
Interleukin-6 level ≥ 300 pg per mL

NOTE: Measurements should be obtained at admission or over the first 48 hours of admission. Three positive variables are associated with mortality rate ≥ 25%; four positive variables are associated with mortality rate ≥ 50%.
Pancreatitis Treatment

- Bowel rest, pain control, and IVF is the mainstay of treatment
  - 20 ml/kg initially, then 250-500/hr for the next 48 hours
- "Let pain be your guide", transition to PO liquids when pain resolves
- Oliguria and non-resolution of symptoms should prompt ICU transfer
- Prolonged bowel rest should prompt nutrition
  - Nasojejunal feeding has better outcomes than parenteral nutrition
- Probiotics are contraindicated
- ERCP decreases mortality and recommended with cholangitis or gallstone associated pancreatitis with biliary obstruction
- Antibiotics are NOT recommended for prophylaxis
- Necrosis and abscess can be indication for antibiotics
  - AGA recommends with necrosis ACG does not

AGA: American Gastroenterology Association  ACG: American College of Gastroenterology

Acute Mesenteric Ischemia (AMI)

- Acute Mesenteric Ischemia: Condition due to sudden decline in blood flow through the mesenteric vessels.
- Divided into Nonocclusive Mesenteric Ischemia (NOMI) (20%) and Occlusive Mesenteric Ischemia (OMI)
  - OMI is divided into thromboembolism (50%) and thrombosis (30%)
- Mortality can range from 60 to 80%
- Typical patient is an older female with numerous comorbidities
- ½ of all AMI patients older than 45 have some degree of GI arterial disease
- AMI accounts for 1% of all admissions for abdominal pain in older adults (>50 yoa)
AMI Risk Factors

- Thromboembolism
  - Atrial fibrillation, ventricular aneurysm, peripheral artery disease
  - Anything causing arterial emboli
  - Superior Mesenteric Artery is the most common vessel affected by embolism
- Thrombosis
  - History of atherosclerosis, Aortic aneurysm or dissection
  - Postprandial abdominal pain leading to food avoidance and weight loss
- NOMI
  - Hypotension from critical illness (CHF, Sepsis, Renal Disease)
  - Cocaine or Vasopressors can lead to NOMI

AMI Diagnosis

- Abdominal Pain out of proportion to exam (Red Flag)
- Tenderness to palpation is a late finding, associated with necrosis
- Embolism is sudden pain followed by aggressive diarrhea
- Thrombosis is days or weeks of gradually worsening abdominal pain with distention, then diarrhea
- NOMI patients have poor clinical signs and many patients cannot verbalize symptoms
- CT has sensitivity and specificity of 96% and 89% respectively
  - CT Angiography is preferred
AMI Treatment

• Surgical Exploration is required to assess the amount of ischemia
  – Excision of necrotic bowel is primary goal
• Medical treatment focuses on IVF and correction of electrolytes
• Antibiotics focused on intestinal flora should be used prior to surgery
• Second look surgeries to assess bowel after revascularization is needed
• Resection occurs 31% during 1st surgery and 53% during 2nd
• Factors associated with mortality include: advanced age, bowel resection during second-look surgery, metabolic acidosis, renal insufficiency, and symptom duration.
• NOMI is treated medically with reversal of hypotension
  – Catheter directed papaverine is an interventional option
  – Catheter directed thrombolytics if <8 hours old and no peritonitis

Abdominal Aortic Aneurysm (AAA)

• Abdominal Aortic Aneurysm: Abdominal aortic dilation of 3 cm or greater
• 12% of men and 5% women 74-84 yoa have AAA
• Deaths normally occurring within hours of rupture
• 90% of unruptured AAA are asymptomatic
• 11K deaths per year in US with mortality rates of 90% when ruptured
• Risks: Male, Smoking, Age >65, CAD, HTN, MI, Fam History, and PAD
• AAA is due to weakening of the aortic wall and eventually tearing of the wall allowing blood to escape
AAA Diagnosis

- Physical exam has a 68% sensitivity and 75% specificity of detection of AAA
- Obesity with waist above 39 inches reduces the accuracy of the abdominal exam (palpable pulse is a positive sign in obese pts)
- Classic Triad: Hypotension, Abdominal or back pain, and pulsatile abdominal mass (50% of the time)
  - Auscultation of an abdominal bruit is common
- Plain films occasionally diagnose AAA if the aneurysm is calcified
- POC US is quicker, but CT is needed in order to evaluate for endovascular repair

Atypical AAA Presentations

- Misdiagnosis can occur in up to 60% of cases
- Lower extremity edema from Vena Cava compression can occur
- Cardiac chest pain due to location of aneurysm
- Sciatica due to compression of the nerve by the aneurysmal mass
- Bowel obstruction or mesenteric ischemia can occur as well
- Several well known cases have shown expanding retroperitoneal hematomas presenting as groin pain
- Most common alternative diagnoses: Renal Colic (24%), Diverticulitis (13%), GI Bleed (13%), MI (9%), Musculoskeletal back pain (9%)
AAA Treatment

- Maintain Systolic pressure 80 to 100 (narcotics or Esmolol)
- Elective repairs have 4-5% 30 day mortality risk
- Ruptured AAA account for 5% of sudden deaths in the US
- 50% mortality rate for Emergent AAA repairs
- Time to OR and experience of OR team are the main factors affecting outcome of emergent repairs
- Emergency repair endovascularly has shown reduced mortality, but most centers do not have the capability

Case #2

- 76 yo mildly to moderately demented male who was sent to the ER due to one episode of hypotension (92/55) at the Assisted Living Facility. Pt arrives to the local community hospital ED without any complaints, unable to accurately give a medical history. ROS negative for chest pain, SOB, Abd Pain, n/v/d, f/c/s. Pt says he feels fine now and does not complain of anything. Exam reveals a well appearing elderly male with BP of 124/74, normal exam with the exception of abdominal tenderness on palpation in the umbilical to RLQ region. Palpable mass felt, but patient does want to or cannot understand to relax his abdominal muscles.
- Differential? Imaging to Order?
  - AAA, Intussusception, Appendicitis, Colitis, UTI, Pyelonephritis
  - Ultrasound, CT with contrast
Case #2 Continued

• Labs: CBC normal, BMP normal, Urinalysis normal
• CT Result: Reveals Abdominal Aortic Aneurysm with extravasation on CT, Radiologist tells you the patient has had previous AAA repair with stent placement and large thrombotic calcified aneurysm (what you felt on exam)
• Progress: As you are talking to the radiologist, nurse walks over to you and says that the patient is less responsive now and his systolic pressure is in the 60s. Family present now, they tell you this is the second time it has ruptured

Poll Question #3

What is the immediate plan for this gentlemen with a leaking AAA, now unstable?

A) Call General Surgeon on call and have them take him to the Operating Room immediately
B) Normal Saline to maintain systolic blood pressure above 100 mmHg, then transfer the patient to another hospital
C) Due to dementia have family sign comfort care orders and admit to hospitalist
D) Call for emergency release blood and transfuse patient to keep systolic between 80-100 mmHg, transfer the patient to another hospital
E) Place patient in Trendelenburg position and transfer the patient to another hospital
Poll Question #4

Which of these etiologies match the appropriate type of Acute Mesenteric Ischemia?

A) 2 weeks of postprandial pain and loss of appetite = Non-Obstructive Mesenteric Ischemia
B) Cocaine induced Acute Mesenteric Ischemia = Thrombosis
C) Sudden acute abdominal pain with mesenteric ischemia on CT = Thromboembolism
D) Vasopressor induced Mesenteric Ischemia = Thromboembolism
E) History of Atrial Fibrillation and a Ventricular Aneurysm = Thrombosis

Practice Recommendations

• 1) Use US first (instead of CT) in children to rule in Appendicitis (Level B)
• 2) Opioids, NSAIDS, or Acetaminophen should be offered to patients with suspected Acute Appendicitis (Level A)
• 3) IV Antibiotics can be used as first line therapy in children or adults with acute appendicitis (Level A)
• 4) Closed-loop obstruction should be treated as a surgical Emergency (Level C)
• 5) CT Abdomen with IV/PO contrast is recommended with suspected intestinal obstruction (Level C)
Practice Recommendations

• 6) Enteral nutrition is preferred over parenteral nutrition for patients with severe pancreatitis (Level A)

• 7) Imipenem/cilastatin (Primaxin) use results in a significant decrease in pancreatic infection in patients with pancreatic necrosis (Level B)

• 8) One-time screening for AAA with ultrasonography should be performed in men 65 to 75 years of age who’ve smoked 100 cigarettes or more (Level B)

• 9) In clinically stable women, in whom a non-ruptured ectopic pregnancy has been diagnosed, laparoscopic surgery or intramuscular methotrexate administration are safe and effective treatments. (Level A)

Practice Recommendations

• 10) Surgical management of ectopic pregnancy is required when a patient is exhibiting any of the following: hemodynamic instability, symptoms of an ongoing ruptured ectopic mass (such as pelvic pain), or signs of intraperitoneal bleeding. (Level A)

• 11) If the concept of the hCG discriminatory level is to be used as a diagnostic aid in women at risk of ectopic pregnancy, the value should be conservatively high (eg, as high as 3,500 mIU/mL) (Level B)

• 12) Abdominal ultrasound (AUS) is the preferred initial imaging technique for patients who are clinically suspected to have Acute Cholecystitis (Level B)
Contact Information

• Darrell Edward Jones, DO
• armydocjones@gmail.com

Questions
References


References


- Adrian A Indar, surgical fellow and Ian J Beckingham. Acute cholecystitis BMJ. 2002 Sep 21; 325(7365): 639–643


Acute Respiratory Distress Syndrome

CPT Megan Mahowald, MD

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CPT Megan Mahowald, MD

Physician/Hospital Medicine Fellow, Department of Family Medicine, Womack Army Medical Center (WAMC), Fort Bragg, North Carolina

Dr. Mahowald is a Captain in the U.S. Army. She earned her medical degree from the Uniformed Services University of the Health Sciences in Bethesda, Maryland, and completed a family medicine residency at Madigan Army Medical Center in Tacoma, Washington. She is a second-year hospital medicine fellow at WAMC. She earned a master’s degree in education and continues to pursue her dual interest in medicine and education by creating, implementing, and improving the inpatient medicine curricula for the WAMC Family Medicine Residency Program and the hospital medicine fellowship program.
Learning Objectives

1. Conduct a differential diagnosis of ARDS in symptomatic patients.

2. Diagnose ARDS, utilizing current evidence-based criteria.

3. Describe evidence base treatments for ARDS to include lung-protective measures.

4. Develop collaborative care plans for ARDS survivors that offer supportive care, promoting optimal health and function.

Audience Engagement System

Step 1

Step 2

10am

Step 3

CME001 (PBL) Acute and Chronic Heart Failure

Location
Room 113A

Date
Thursday, Sep 28 10:00 AM

Duration
1 hour

Audience Engagement System

CME001 (PBL) Acute and Chronic Heart Failure
Outline:

• Epidemiology and history
• Definition and diagnostic criteria
• Clinical presentation and work-up
• Management
• Prevention
• Post-ARDS Survivors

“Edema of the lungs, with general asphyxia. Livid cyanosis with great dyspnea is the outstanding feature....A yellow serous fluid fills the air passages in such quantifies that it may drip from the mouth of the living patient when the stretcher is tilted head downwards.”

c. 1915
AES Question 1:
Which of the following is true about acute respiratory distress syndrome (ARDS)?

A. Estimated 40% in-hospital mortality
B. Under-recognized condition with up to 40% of cases undiagnosed
C. Most common cause of death during the 2009 H1N1 pandemic
D. <50% of survivors return to work 12 months after discharge
E. All of the above

Epidemiology and Disease Burden:

- Represents about 10% of total ICU admissions
- Significant geographical variation
- **Under-recognized and under-treated**
- 40% in-hospital mortality
- High rates of cognitive dysfunction, prolonged psychiatric morbidity, and critical illness polyneuropathy in survivors
Case One:

45 year-old male presenting to the ER complaining of fever, sore throat, and dry cough for the three days and progressive shortness of breath for 1 day.

His medical history is only notable for allergic rhinitis.

In triage, he is in obvious respiratory distress with peripheral cyanosis.

**Triage Vitals:**

T 38°C, HR 120, BP 90/60 (M 70), RR 36, SpO2 54% on RA
Case One:
His respiratory distress and hypoxia persists despite supplemental oxygen with 15L non-rebreather mask. He is intubated in the ER.

His ventilator settings are:
PRVC Tv: 450  Rate: 24  PEEP 5  FiO₂ 80%

ABG (30 minutes after intubation):
pH 7.30   PaCO₂ 55   PaO₂ 80

POCUS: hyperdynamic left ventricle

CASE COURTESY OF A. PROF FRANK GAILLARD, RADIOPAEDIA.ORG, RID: 35985

AES Question 2:
Vent: PRVC Tv: 450  Rate: 24
PEEP 5  FiO₂ 80%

ABG (30 minutes after intubation):
pH 7.30   PaCO₂ 55   PaO₂ 80

POCUS: hyperdynamic LV

Does he have ARDS?
A. Yes
B. No
C. Not enough information

CASE COURTESY OF A. PROF FRANK GAILLARD, RADIOPAEDIA.ORG, RID: 35985
Acute Respiratory Distress Syndrome (ARDS)

“The clinical pattern...includes severe dyspnoea, tachypnoea, cyanosis that is refractory to oxygen therapy, loss of lung compliance, and a diffuse alveolar infiltrate seen on chest X-ray.”

Acute Respiratory Distress in Adults
Ashbaugh et al. 1967

Berlin Definition

- Onset within 7 days of a known clinical insult or new or worsening respiratory symptoms
- Respiratory failure cannot fully be explained by cardiac failure or fluid overload
- Bilateral opacities consistent with pulmonary edema on chest x-ray or chest CT
- Minimum PEEP setting or CPAP, 5 cm of water
Berlin Definition

Categorization of severity:

<table>
<thead>
<tr>
<th>Severity</th>
<th>PaO₂:FiO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>201-300 mm Hg</td>
</tr>
<tr>
<td>Moderate</td>
<td>101-200 mm Hg</td>
</tr>
<tr>
<td>Severe</td>
<td>≤ 100 mm Hg</td>
</tr>
</tbody>
</table>

Risk Factors:

Direct Lung Injury:
- Pneumonia*
- Aspiration*
- Pulmonary contusion
- Inhalation injury
- Near-drowning
## Risk Factors:

<table>
<thead>
<tr>
<th>Direct Lung Injury</th>
<th>Indirect Lung Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia*</td>
<td>Sepsis (non-pulmonary)*</td>
</tr>
<tr>
<td>Aspiration*</td>
<td>Non-thoracic trauma/Hemorrhagic shock</td>
</tr>
<tr>
<td>Pulmonary contusion</td>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Inhalation injury</td>
<td>Major burn injury</td>
</tr>
<tr>
<td>Near-drowning</td>
<td>Drug overdose</td>
</tr>
<tr>
<td></td>
<td>Transfusion of blood products</td>
</tr>
</tbody>
</table>

## Clinical Presentation: *History and Physical*

- Usually occurs within 6-72 hours of inciting event
- Complaint: Dyspnea
- Acute distress, tachypneic with diffuse crackles on lung exam, use of accessory muscles
Clinical Presentation: Labs

- ABG – hypoxemia with acute respiratory alkalosis

Clinical Presentation: Imaging

[Images with captions]

Case courtesy of Dr. Alexandra Stanislavsky, Radiopaedia.org, rID: 16868
Case courtesy of Dr. Sajoscha Sorrentino, Radiopaedia.org, rID: 16290
Image courtesy of Copetti et al., https://doi.org/10.1186/1476-7120-6-16
## Differential:

<table>
<thead>
<tr>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>Interstitial lung diseases</td>
</tr>
<tr>
<td>Connective-tissue diseases</td>
</tr>
<tr>
<td>Diffuse alveolar hemorrhage</td>
</tr>
<tr>
<td>Sympathetic crashing acute pulmonary edema (SCAPE)</td>
</tr>
<tr>
<td>Drug-induced lung disease</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
<tr>
<td>Endobronchial tuberculosis</td>
</tr>
<tr>
<td>Hemophagocytic lymphohistiocytosis</td>
</tr>
</tbody>
</table>

## AES Question 3:

The patient is brought up to the ICU. His rapid viral panel is positive for H1N1. His labs are otherwise unremarkable.

Which of the following is an appropriate ventilatory management strategy for this patient?

A. Limit tidal volumes to 4-8 cc/kg of ideal body weight  
B. Limit tidal volumes to 4-8 cc/kg of actual body weight  
C. Allow patient to pull whatever tidal volumes he needs with a pressure support mode of ventilation  
D. Start with low tidal volumes (4-8 cc/kg), but allow volumes up to 15 cc/kg if required to prevent double-triggering
Management of ARDS

Pathophysiology

### Pathophysiology

<table>
<thead>
<tr>
<th>Exudative Phase</th>
<th>Proliferative Phase</th>
<th>Fibrotic Phase*</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-10 days</td>
<td>2-3 weeks?</td>
<td>Chronic</td>
</tr>
<tr>
<td>Lung's initial response to injury</td>
<td>Repair process with resolution of pulmonary edema</td>
<td>Obliteration of normal lung architecture</td>
</tr>
</tbody>
</table>

### Management of ARDS:

- Treat the underlying cause
- **Supportive care**
  - Manage hypoxia
  - Prevent further tissue damage
- Evaluate need for higher level of care
Management of ARDS:

- Treat the underlying cause
- **Supportive care**
  - Manage hypoxia
  - Prevent further tissue damage
- Evaluate need for higher level of care

No pharmacologic therapy exists for treatment of ARDS

Fundamentals of Management:

**Oxygenation Goals:**
- Target \( \text{Pao}_2 \) 55-80 or \( \text{SpO}_2 \) 88-95%
- Use the *lowest* \( \text{FiO}_2 \) possible to maintain adequate oxygenation

**Carbon Dioxide Goals:**
- Allow for permissive hypercapnia and permissive respiratory acidosis
  - \( \text{Paco}_2 < 50 \text{ mmHg} \) and/or \( \text{pH} \geq 7.20 \) if tolerated
Management of ARDS:

Strategies that improve outcomes

Low Tidal Volume

Recommendation:

- Adult patients with ARDS should receive mechanical ventilation with strategies that limit tidal volumes (4-8 cc/kg IBW) and inspiratory pressures ($P_{\text{plat}} < 30$ cm H$_2$O). [SOR A/LOE 1]

Patient-Oriented Outcome:

- Reduction in mortality

Evidence: ARDSNet Group
**Low Tidal Volume**

Recommendation:
- Adult patients with ARDS should receive mechanical ventilation with strategies that *limit* tidal volumes (4-8 cc/kg IBW) and inspiratory pressures ($P_{\text{plat}} < 30 \text{ cm H}_2\text{O}$). [SOR A/LOE 1]

Patient-Oriented Outcome:
- Reduction in mortality

Evidence: ARDSNet Group

35% of patients still receive $> 8 \text{ cc/kg IBW}$

---

**High PEEP**

Recommendation:
- Adults with moderate-to-severe ARDS receive higher rather than lower levels of PEEP. [SOR C/LOE 2]

Patient-Oriented Outcome:
- Shortened duration of mechanical ventilation

Evidence: ALVEOLI trial, LOV trial, ExPRESS trial
Prone Positioning

Recommendation:
• Adult patients with severe ARDS should receive prone positioning for $\geq 12$ hours per day. [SOR A/LOE 2]

Patient-Oriented Outcome:
• Reduction in mortality

Evidence: PROSEVA trial
Conservative Fluid Management

Recommendation:

- A conservative fluid-management strategy is recommended [SOR C/LOE 2]

Patient-Oriented Outcome:

- Shortened duration of mechanical ventilation

Evidence: FACTT trial

AES Question 4:

The patient has been in the ICU for 12 hours. He continues to have severe hypoxia (PaO2:FiO2 < 100) despite prone positioning and high PEEP. He is frequently dyssynchronous with the ventilator.

Which of the following is an appropriate next step in management?

A. Call regional ECMO center for evaluation for ECMO cannulation
B. Consider neuromuscular blockade to improve ventilator synchrony
C. Change to APRV/BiLevel/Bi-Vent ventilation mode
D. Try regular recruitment maneuvers followed by decremental PEEP trial
E. Any of the above
Management of ARDS:

Strategies that *might* improve outcomes

- Neuromuscular blockage
- BiVent/APRV/Bi-Level
- Open Lung Ventilation
- Extracorporeal Membrane Oxygenation (ECMO)
Neuromuscular Blockade:

**Concept:**
Lung-protective ventilation is paramount in management of ARDS. Patient-ventilator dyssynchrony can lead to breath stacking which increases the risk for ventilator-induced lung injury and barotrauma. Muscle paralysis eliminates ventilator dyssynchrony and minimizes muscle oxygen consumption.

**Evidence:**
ACURASYS Trial (2010): improved 90-day mortality in cisatracurium arm
ROSE Trial (2019): Stopped early for futility. No difference in mortality.

BiLevel/APRV/Bi-Vent:

**Concept:**
Continuous positive airway pressure with brief expiratory intervals. Increased airway pressure contributes to lung recruitment. This *spontaneous* mode of ventilation improves ventilator synchrony and decreases need for sedation/paralysis.

**Evidence:**
Bi-Level-APRV Trial (2017): better oxygenation, less sedation, fewer days of mechanical ventilation, shorter ICU stay
Open Lung Ventilation:

**Concept:**
Recruitment maneuvers (RM) transiently increase transpulmonary pressure in an attempt to open previously collapsed alveoli.

**Evidence:**
Open Lung Approach for ARDS (2016):
- Improved oxygenation with no adverse effects
ART trial (2017):
- Increased mortality with RM and high PEEP

Extracorporeal Membrane Oxygenation (ECMO):

**Concept:**
- Venovenous ECMO provides oxygenation and carbon dioxide removal, allowing for lung rest and reduction in ventilator-induced lung injury
- Murray Score for ECMO referral

**Evidence:**
CESAR Trial (2009): Absolute mortality reduction in ECMO arm
Management of ARDS:

What does NOT work

- High frequency oscillatory ventilation
- Surfactant replacement
- Neutrophil elastase inhibition
- Systemic anticoagulation
- Ketoconazole
- Lisofylline
- Activated protein C

- Statins
- B$_2$-agonists
- Antioxidants
- Aspirin
- Steroids (controversial)
- Inhaled vasodilators
- N-acetyl-cysteine
# Management of ARDS for the Family Physician

<table>
<thead>
<tr>
<th>Recognize ARDS in a patient with acute respiratory distress/failure (Berlin Criteria)</th>
<th>Treat underlying cause (if possible)</th>
<th>Utilize lung protective ventilation with low Tv/High PEEP (Tv 4-8 cc/kg IBW)</th>
<th>Restrictive fluid approach Dry lungs = happy lungs</th>
</tr>
</thead>
</table>

**Early referral to higher level of care**

- Consider neuromuscular blockade prior to transport if severe ventilator dyssynchrony and persistent hypoxia
AES Question 5:

Which of the following is likely an effective strategy for primary prevention of ARDS?

A. Administration of pneumococcal and seasonal influenza vaccines
B. Administration of aspirin to all hospitalized patients
C. Encouraging hospitalized patients to lay flat while sleeping
D. Institution of daily lung injury prevention checklist for all mechanically ventilated patients
## Prevention:

### 1° Prevention
- Vaccinations for prevention of influenza and pneumococcal pneumonia
- Aspiration precautions in hospitalized patients

### 2° Prevention – Identifying At-Risk Patients
- Lung Injury Prevention Score (LIPS)
- Early Acute Lung Injury score (EALI)
- Surgical Lung Injury Prediction (SLIP)
- Biomarkers (theoretical)

## Prevention:

### 2° Prevention – Limiting Iatrogenic Injury in At-Risk Patients
- Goal to mitigate “second hit”
- Restrictive transfusion practice, timely treatment of sepsis, lung-protective mechanical ventilation, fluid-conservative resuscitation, prevention of new aspiration events
- Creation of institutional “Best Practices Bundles”
ARDS Survivors

Post-hospitalization:

**Pulmonary Function:**
- Most return to normal or near-normal physiology and function
- Pulmonary function testing may have a persistent, mild diffusion defect

**Physical Impairments:**
- Critical illness polyneuropathy, critical illness myopathy, entrapment neuropathy, contractures, tracheal stenosis, heterotopic ossification, tooth loss, scars from invasive procedures
### Post-hospitalization:

**Cognitive Impairments:**
- Affects a wide variety of cognitive domains including attention, visual-spatial abilities, declarative memory, and executive function
- Impairments persist > 5 years in 20% of patients

**Mood disturbances:**
- 2/3 of patients will have substantial symptoms
- Over half of survivors have prolonged psychiatric morbidity (>12 months)

### Caregiver and Family Burden:

57% of ICU survivors who receive long-term mechanical ventilation still require assistance of a family caregiver *one year* after their critical illness

- Many caregivers suffer from anxiety, depression, and/or PTSD
- Caregiver burnout may compromise rehabilitation of survivors
- Preliminary programs to train and educate family members are currently being developed
PRACTICE RECOMMENDATIONS

ARDS is common condition, but is under-diagnosed and under-treated

- Consider ARDS in any patient with hypoxic respiratory failure and bilateral pulmonary infiltrates

- Patients with ARDS should receive mechanical ventilation with strategies that limit tidal volumes (4-8 cc/kg IBW) and inspiratory pressures (SOR A/LOE 1)

- Consider using high PEEP strategies for patients with moderate or severe ARDS (SOR B/LOE 3)

PRACTICE RECOMMENDATIONS

ARDS is common condition, but is under-diagnosed and under-treated

- Adult patients with severe ARDS should receive prone positioning for ≥ 12 hours per day. [SOR A/LOE 2]

- Pneumococcal and seasonal influenza vaccinations are the primary form of primary prevention for ARDS (SOR C/LOE 3)

- Patients who survive ARDS are at high risk for physical, cognitive, and psychologic disturbances that may persist for years after discharge. Recognition, evaluation, and appropriate management may improve long-term outcomes and quality of life (SOR C/LOE 3)
Questions

Resources:

Resources:


Contact Information

Megan Mahowald, MD
Email: megan.b.mahowald.mil@mail.mil
On Scene Initial Trauma Response for the Family Physician

Byron Hepburn, MD, FAAFP
Chetan “Chet” Kharod, MD, MPH

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Byron Hepburn, MD, FAAFP

Professor, Department of Family and Community Medicine/Assistant Dean for Military Health, University of Texas (UT) Health San Antonio; Associate Vice President and Director of the Military Health Institute, UT Health San Antonio

Dr. Hepburn (Maj Gen, USAF, Ret) is a Distinguished Graduate of the U.S. Air Force Academy and one of only a few Air Force pilot-physicians. During a distinguished military career spanning 38 years, he served as Deputy Surgeon General of the Air Force. In this position, Dr. Hepburn directed operations of the Air Force Medical Service, a $5 billion integrated health care delivery system with 75 military treatment facilities worldwide. In addition, he served as the inaugural director of the San Antonio Military Health System (SAMHS) and completed his military career as Commander of the 59th Medical Wing, the Air Force’s largest medical wing.

After retiring from the military, Dr. Hepburn became the inaugural director of the Military Health Institute (MHI) at UT Health San Antonio. The mission of the MHI is to strengthen collaborative efforts of the university with the U.S. Department of Defense, the Veterans Administration, and local/state/national organizations. The ultimate goal is to improve the health and resiliency of the nation’s military members, veterans, and their families through innovative medical research, education, and clinical care. With his worldwide experience as a clinician and leader in humanitarian and military medical operations, Dr. Hepburn believes the medical lessons learned from recent conflicts will help save lives in the response to trauma incidents in the United States.
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Dr. Kharod, a retired Air Force Colonel, is board certified in emergency medicine (EM) and emergency medical services (EMS) and has completed subspecialty fellowships in international EM and EMS/disaster medicine. He served in the United States Air Force for more than 26 years, proudly following in his father’s footsteps. He deployed multiple times to Southwest Asia and other locations worldwide, providing Critical Care Air Transport, frontline emergency care, special operations medical support, and leadership of multifunctional combat support teams. Dr. Kharod has served as a special operations flight surgeon and squadron commander. His military experience spans clinical, operational, academic, research, and leadership domains, with a variety of emergency response, field oversight, and executive roles. He has extensive prehospital experience in a variety of settings, including medical oversight of special operations medics, independent duty medical technicians, pararescuemen, and combat medics. Dr. Kharod has delivered invited talks and keynote presentations in numerous national and international venues, and he is a subject matter expert in resiliency advocacy, leadership, and education innovation.

Learning Objectives

1. Understand the importance of ensuring on scene personal/group safety

2. Know the essential initial medical actions for effective handoff to EMS.

3. Be aware of opportunities for further preparedness.
Audience Engagement System

Step 1

Why be prepared for trauma response?
Mass Shooting – November 5th, 2017

1st Baptist Church,
Sutherland Springs,
Texas

26 killed, 20 wounded

Timely response saved lives

Sutherland Springs Shooting Victim:
Ryland Ward

Shot 5 times by a high velocity weapon

Tourniquets applied left arm and leg

Life saved!
### Unfortunate reality...

Since Sandy Hook (December 14, 2012), there have been over 2,051 mass shootings with over 2,322 killed and 8,520 wounded in the US.

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### Poll Question 1

In the US, the #1 cause of death (ages 1-44 yrs.) is?

A. Infectious disease  
B. Cardiovascular disease  
C. Cerebrovascular accident  
D. Trauma
Leading Causes of Death in U.S.

Trauma is the leading cause of death for age ranges:
- 1-4 Years of Age
- 5-9 Years of Age
- 10-14 Years of Age
- 15-24 Years of Age
- 25-34 Years of Age
- 35-44 Years of Age

Full Impact of Motor Vehicle Collisions

2,211,439 motor vehicle collisions leading to injury or death in 2016

34,439 fatalities

Retrieved from https://www.cdc.gov/motorvehiclesafety/
Tri-modal Distribution of Trauma Deaths

Minutes matter = Exsanguination is the initial primary concern

“Golden Hour” = 80% of trauma deaths in first hour after injury

Rapid trauma care has greatest level of impact in these patients


Civil-Military Information Exchange
This lecture is an exposure to emphasize key life-saving principles

It is not intended to replace or substitute ATLS, PHTLS, or TECC, etc.

General Principles Apply

Active Attacker
Motor Vehicle Collision (MVC)
Mass Casualty (MASCAL)

Regardless of event type
Response Overview

• On-Scene Safety
• Activating the Public Safety Response System
• Incident Assessment and Patient Triage
• Providing Initial Care: “MARCH”
• Hand-Off to Public Safety Teams

Poll Question 2

Are you at medicolegal risk if you stop to help?

A. No, there is universal Good Samaritan coverage
B. Yes, there is no protection
C. Maybe, depends on state law and specialty
D. Just keep driving
Good Samaritan Laws

Physicians acting as Good Samaritans generally have legal immunity:

1) to claims of ordinary negligence,

2) but **NOT** to gross, willful or wanton negligence.

On-Scene Safety: Active Attacker Response

**Avoid**
Move away from threat

**Deny**
Prevent threat from getting to you

**Defend**
Be prepared, aggressive, and committed
On-Scene Safety:  
Active Attacker Response

• Until attacker neutralized, stay safe
• Scene assessment may be limited if attack is ongoing
• Silence cell phones

On-Scene Safety:  
Motor Vehicle Collision (MVC)

• Assess Scene Hazards
• Determine Courses of Action
• Respond Appropriately
On-Scene Safety: 
Motor Vehicle Collision (MVC)

1) Maintain personal safety
2) Allow efficient traffic flow
3) Park at least 100’ away (not alongside) the accident
4) Leave hazard lights on
5) Set parking brake

In any trauma event:

Active Attacker  Motor Vehicle Collision (MVC)  Mass Casualty (MASCAL)

Once the scene is safe, we begin our initial actions...
Activating Public Safety Response

• Name & Specialty
• Give Location
• Description of Incident
• Brevity is key

Poll Question 3
While driving on a winding rural road you come upon an SUV/Motorcycle collision. You park your vehicle well away from the active roadway, advise 911 and safely begin to assess and sort the injured. Which patient would be categorized as “immediate” and require rapid medical attention?

A) Distraught 25 year old mother crying next to the back door of her SUV—screaming “My Baby, My Baby….” (obviously concerned about the status of her infant safely secured in the rear seat)

B) 30 y/o male SUV driver, wearing seat belt, complaining of slight chest & forearm discomfort following the activation of his airbag

C) 20 y/o male lying supine under his motorcycle - responsive, wearing a helmet, has an open left femur fracture with active pulsatile bleeding

D) 20 y/o female—located 20 feet from the collision site adjacent to a large rock, unresponsive with a massive open skull injury, agonal respirations
Initiate Patient Triage

- Immediate
- Delayed
- Minor
- Expectant/Dead

Triage: Immediate

- Massive hemorrhage
- Compromised airway
- Severe dyspnea
Triage: Delayed

- Stable, but needs medical attention
- Fractures
- Lacerations
- Mild head injury

Triage: Minor

- “Helping Hands from the walking wounded”
- Not all wounds are physical
Triage: Expectant/Dead

- In extremis
- Requiring lot of resources/time
- Can re-triage if situation settles
- “Walking wounded” can help console others

Initiating Treatment: “MARCH”

Massive Hemorrhage
Airway
Respiration
Circulation
Head injury / hypothermia
Massive Hemorrhage

- Direct pressure
- Wound packing
- Tourniquet placement

**Extremity bleeding:**
Direct pressure or tourniquet

**Junctional bleeding:**
Direct pressure or wound packing

**Internal bleeding:**
Early recognition is critical
Pressure Dressing / Wound Packing

- Apply direct pressure
- Pack the wound
- Particularly good for junctional bleeding

Poll Question 4

Tourniquets are only used as a last resort in life-threatening extremity hemorrhage.

A. True

B. False
Tourniquets (TQs)
For life-threatening extremity bleeding

Airway: Conscious Patient

- Trauma airways can be dramatic
- Conscious patients are typically able to breathe on their own
- Sit patient up, lean them forward, or lay them on their side
Airway: Unconscious Patient

- Clear the airway
- Perform the appropriate maneuver
- Place patient in rescue position

Respiration

- Assess respiratory status
- Allow optimal position for breathing
- Decompress suspected tension pneumothorax
- Seal open chest wounds
- Mouth-to-mouth not recommended in MASCAL
Circulation

- Check for bleeding
- Check pulses
- Check capillary refill
- Apply pressure or TQ as needed

Hypothermia

Head Injury

- Keep patient warm
- Monitor level of consciousness
Saving Lives: “MARCH”

Massive Hemorrhage
Airway
Respiration
Circulation
Head injury / hypothermia

When help arrives...

Police
Fire
EMS
Professional Handoff to EMS

- Give report to EMS
  - Relevant safety information
  - Number of patients
  - Care rendered

- Render assistance if requested
  - Work within your qualifications
  - Be prepared to assist with transport

Response Review

- On-Scene Safety
- Activating the Public Safety Response System
- Incident Assessment and Patient Triage
- Providing Initial Care: “MARCH”
- Hand-Off to Public Safety Teams
Practice Recommendations

- Know your facility & community response plans
- Be individually & organizationally prepared to act
- Obtain appropriate training and equipment
- Participate in disaster preparedness exercises

Planning Resources

- State-specific planning toolkits (e.g.,
  https://www.dshs.texas.gov/commprep/planning/toolkits.aspx)
- FBI Active Shooter Planning (https://www.fbi.gov/file-repository/active_shooter_planning_and_response_in_a_healthcare_setting.pdf)
- California Hospital Association
  (https://www.calhospitalprepare.org/active-shooter)
Opportunities for Further Preparedness

- Active Attacker Training
- Stop the Bleed Training
- Advanced Trauma Life Support (ATLS)
- Purchase medical and “Stop the Bleed” kits for your motor vehicles

Contact Information

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Questions