

# EM Resident

Official Publication of the Emergency Medicine Residents' Association

December 2021/January 2022

VOL 48 / ISSUE 6

# 21 Greatest Hits

## EM Research

*The Most Pivotal Studies of 2021*

Meet Your New  
EMRA Board

New Nerve Blocks  
for Trauma

Emphysematous  
Pyelonephritis

COVID-Related  
Pericardial Effusion

# Exciting opportunities at our growing organization

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- Medical Student Clerkship Director

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**FOR MORE INFORMATION PLEASE CONTACT:**  
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# New Year, New View

**Jessica Adkins Murphy, MD**  
 Editor-in-Chief, *EM Resident*  
 University of Kentucky

New Year's in my home state of Kentucky is a time of togetherness, optimism, and cabbage. For some, eating cabbage is as strong a tradition as resolutions and countdowns to midnight. In fact, my Appalachian grandparents, usually not superstitious people, *always* ring in the new year with cabbage on the table. "Coleslaw, cooked cabbage, however we can have it," my granny Barbara Adkins told me. "The more cabbage you eat, the wealthier you'll be!"

This tradition takes an inexpensive staple food and instills it with a magic quality. Something overlooked throughout the rest of the year suddenly promises new beginnings, just by adding a bit of mindfulness and imagining a more prosperous future for ourselves.

As residents and fellows, our plentiful staple food is clinical experience. Though our time and money are tightly limited, we are endowed with a bounty of interactions with patients, mentors, and learners. These experiences can make us more understanding, teach us knowledge and skills, and illuminate how much we do

not know. Conversely, at times clinical demands also threaten to inundate us. When the volume of work, grief, and our own shortcomings begin to run together, residency can become a blur of stress and uncertainty. For some, it becomes difficult to summon the energy to serve their patients' needs, much less to improve their emergency department, residency program, or our broken healthcare system.

In the new year, perhaps we can renew our resolution to find the cash in the cabbage, and bring your personal passion to every shift that you can. Some of my co-residents do this by teaching medical students. A simple suturing lesson for a third-year medical student turns a resident's tedious laceration repair into a rewarding teaching exercise. Others of you are critical-care-bound residents frustrated by obsolete hospital protocols for cardiac arrest management. Producing critical care research or investigating how these protocols are written can be the first steps in turning misguided dogma into evidence-based patient care. Perhaps you can reduce your own burnout and improve wellness for the next class of residents by making scheduling improvements to a particularly taxing rotation.

I try to remain optimistic by keeping my eyes open to my patients' social challenges and considering how I can address them. For example, this summer I attempted to prescribe buprenorphine to an incarcerated patient, only to be told it was the detention facility's policy not to give buprenorphine. This motivated me to write EMRA policy in support of equitable healthcare for incarcerated patients, particularly in support of mental health and addiction treatment. At ACEP21, your EMRA program representatives voted to adopt that policy. Now, in efforts to change detention facility policy or in cases where patients do not receive the addiction care they need, policy leaders and advocates can cite the opinion of EMRA, the largest and oldest independent resident organization in the world.

This December 31, many of us will be working. The ball may drop while you're running a trauma or placing a central line. But I hope at some point you have time to reflect on the past year and renew your commitment to finding the magic in the daily grind, like my family in Eastern Kentucky eating cabbage on New Year's Eve with hope for a plentiful tomorrow. ★



Let's keep in touch!

Email [emresidenteditor@emra.org](mailto:emresidenteditor@emra.org) | Instagram [@jessicaadkinsmurphy](https://www.instagram.com/jessicaadkinsmurphy) | Twitter [@DrAdkinsMurphy](https://twitter.com/DrAdkinsMurphy)

# TABLE OF CONTENTS

- 3** Sponsor Thank You  
EMRA @ ACEP21
- 4** Meet Your EMRA President  
NEW BOARD
- 5** New Board Members  
NEW BOARD
- 8** 2020-2021: 21 Greatest Hits  
EM Research Edition  
RESEARCH
- 12** Fomepizole for  
Acetaminophen Toxicity  
TOXICOLOGY
- 14** Ultrasound Tips for Finding  
the Common Bile Duct!  
ULTRASOUND
- 16** Elusive Effusion: A Rare of  
Case of COVID-19-Related  
Pericardial Effusion and  
Cardiac Tamponade  
COVID-19, CARDIOLOGY
- 18** The Pericapsular Nerve  
Group (PENG) Block  
for Hip Pain  
PAIN MANAGEMENT, ULTRASOUND
- 20** POCUS for the Win:  
Focal Segmental  
Glomerulosclerosis  
ULTRASOUND
- 22** ED Management  
of Emphysematous  
Pyelonephritis  
UROLOGY, ULTRASOUND
- 23** Blocking Breaks  
to Breathe Better  
PAIN MANAGEMENT, ULTRASOUND
- 26** Acquired  
Methemoglobinemia  
HEMATOLOGY
- 28** A Case Report of  
Torsades de Pointes  
and Hemochromatosis  
CARDIOLOGY
- 31** 3D Printing PPE in the  
COVID-19 Pandemic  
COVID-19, RESEARCH,  
WELLNESS
- 34** Targeted Programming  
to Prepare Emergency  
Medicine Residents to  
Enter the Workforce  
Amid a Pandemic  
WORKFORCE, COVID-19,  
CAREER PLANNING
- 37** Pandemic PTSD and  
Protecting Our Mental  
Health  
WELLNESS, COVID-19
- 39** How to Get Back  
into the ED Groove  
WELLNESS
- 40** The Intersection of  
Administration and  
Health Equity Panel  
SOCIAL EM, ADMINISTRATION  
& OPERATIONS
- 42** A Last-Minute Swerve  
into EM  
MATCH ADVICE
- 43** Earning Patients' Trust  
by Respecting Pronouns  
SOCIAL EM
- 45** Human Trafficking  
AWARENESS
- 48** EMRA @ CORD  
ACADEMIC ASSEMBLY
- 50** News & Notes  
TELEMEDICINE TIPS, AND MORE
- 51** ECG Challenge  
CARDIOLOGY
- 53** Board Review Questions  
PEERPrep
- 54** EMRA Perks  
MEMBERSHIP BENEFITS
- 55** EMRA Publications  
MEMBERSHIP BENEFITS

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# Meet Your EMRA President

## Angela G. Cai, MD, MBA

Innovation Fellow, US Acute Care Solutions  
@angelagcai



As a recent residency graduate pioneering an innovation fellowship in emergency medicine while learning the landscape of first-time parenthood, Dr. Cai brings a unique perspective to the EMRA presidency.

First plugging in to EMRA as a committee member, Dr. Cai became EMRA's Director of Health Policy amid a dynamic political environment. Her diplomacy and problem-solving were further displayed when COVID forced a quick pivot to the first-ever virtual Health Policy Primer, a perennially popular event organized by EMRA's Director of Health Policy and the ACEP Young Physicians Section during ACE Leadership & Advocacy Conference.

Now leading the organization through an uncertain climate with predicted workforce challenges, Dr. Cai's collaborative, reasoned approach will serve residents and medical students well.

### **Q: What's your first priority as EMRA president?**

**A:** "The answer to this question is both hard and easy: hard because [EMRA does so much](#), but easy because EMRA's core mission has remained steadfast since our founding. EMRA's mission is to be the voice of emergency medicine physicians-in-training and the future of our specialty.

"As EMRA president, my first priority is to sustain EMRA's trainee voice as one that is authoritative, representative, and worthy of your confidence. Our voice is increasingly critical with questions about the future of our specialty have grown over the last year.

"Just as the young leaders before us shaped (really, invented) the specialty of emergency medicine — so will we."

### **Q: Where do you want EMRA to be at this time next year?**

**A:** "I hope at this time next year, we will say that EMRA has:

- Led the trainee voice in workforce advocacy and career planning guidance;
- Developed a focused strategic plan and a budget that reflects those priorities (we perform triennial strategic planning);
- Continuously optimized our board and staff culture and operations in order to effectively serve EMRA members."

### **Q: How can EMRA members make a difference?**

**A:** "Tell EMRA what we can do for you by emailing [president@emra.org](mailto:president@emra.org) (your message comes directly to me), reaching out through our committees, or by [submitting a resolution](#) (next deadline is Feb. 11).

"If you are unloading your frustrations regarding something on which EMRA can make a difference into the void of the Facebook/Twitter-verse or the confines of your residency group chat, you're doing it wrong! Social channels are valuable ways to connect, but they're not always the best forum for in-depth conversation and context. Please get in touch; we want to hear your perspective and your concerns. We want to have a dialog to offer background that might inform your outlook and your actions. You may not understand the whole problem or the whole solution or have time to fix it, but let's figure it out together." ★

# President-Elect Abbey Smiley, MD

The Ohio State University • @AbbeySmileyMD

I ran for EMRA President committed to ensuring the best possible future for our residents, our specialty, and our patients. As the healthcare climate and the Emergency Medicine workforce continue to evolve over the coming years, it is imperative that residents, as the future of our specialty, are both well-informed and well-represented. I'm a big believer that change happens when people come together to start having conversations, even when those conversations might be difficult to have. It's with that spirit of transparency and collaboration in mind that makes one of my highest priorities bringing these important conversations to residents and helping to foster collaboration across all EM organizations.

## What is the best advice you've ever received?

Be kind to yourself and others. Embrace challenges as an opportunity to grow.

## How do you recharge after a tough shift?

For me, recharging from shift looks different depending on the day. However, whether it's as simple as listening to music on my drive home, curling up with a hot cup of tea, grabbing a post-shift meal with my coresidents, or lifting at the gym, taking a few minutes out of my day

to decompress is a key part of my day. My favorite recharge? Coming home and being greeted by my dog! Nothing makes the day melt away more.

## What is something people don't know about you?

I played in the orchestra through college and started (one game) on my college's rugby team.

## 1 skill you want but don't have (yet)

Fluency in a second language — Spanish



## 1 skill you have but don't (necessarily) want?

A high caffeine tolerance

## Does pineapple go on pizza?

Yes!

## Favorite comfort food (or drink)?

Chicken tikka masala and garlic naan with a hot cup of spearmint tea

# Secretary/EM Resident Editor-in-Chief Jessica Adkins Murphy, MD

University of Kentucky • @DrAdkinsMurphy

## What's your first priority as an EMRA board member?

My priority is using EM Resident to extend your reach in emergency medicine. By optimizing the quality and dissemination of your articles in print and online, I hope to maximize your content's potential for education and service.

## What is the best advice you've ever received?

Some of the most formative words I grew up with were the 4-H creed: "To Make the Best Better." This mantra, and the experiences I had through Kentucky 4-H, challenged me from a young age to push myself to be the best person I could be. Even as a child it compelled me to open my eyes to the issues in my community, craft solutions, and follow through.

## How do you recharge after a tough shift?

I love cuddling with my Great Dane and reconnecting with my husband and my family.

## What is something people don't know about you?

My family has a time-honored tradition of going squirrel hunting every year. I've even cleaned, cooked, and eaten squirrel meat. That's as free-range as it gets!

## 1 skill you want but don't have (yet)

Time management! I'm working on prioritization, balance, and saying "no" to opportunities when necessary.

## 1 skill you have but don't (necessarily) want

Binging true crime podcasts for hours at a time may not be the healthiest "skill" I developed in quarantine.



## Does pineapple go on pizza?

Yes! But it needs some heat to balance it out, like peppers or jalapenos.

## Favorite comfort food (or drink)

Pad Thai, of course!

## Vice Speaker of the Council

# Amanda Irish, MD, MPH

University of Connecticut • @akiirish

### What's your first priority as an EMRA board member?

To engage with our members and develop policy to support the diverse needs of current and future residents alike.

### What is the best advice you've ever received?

Something said to me in the Marine Corps: "thousands before you..." To me it means despite apprehensions or challenges, thousands like you have come before and succeeded.

### How do you recharge after a tough shift?

It depends, often food, impromptu counseling from my partner, puppy snuggles, and hard cider or wine.

### What is something people don't know about you?

I've played myself on stage.

### 1 skill you want but don't have (yet):

Speaking Spanish when I intend to.

### 1 skill you have but don't (necessarily) want:

Speaking French when I intend to speak Spanish.

### Does pineapple go on pizza?

Yes, when the timing is right.

### Favorite comfort food (or drink)?

Pizza



## Director of Education

# Erin Karl, MD

Medical Education and Simulation Fellow • Hennepin County Medical Center  
@ErinKarl\_MD



### What's your first priority as an EMRA board member?

As Director of Education, my top priority is to advocate for the continued improvement of emergency medicine resident and EM-bound medical student education. For residents, this includes advocating for the elevation of residency educational requirements. For EM-bound medical students, this includes

advocating for innovation within the residency application process. For all our members, this includes advocating for the continued creation of EMRA's amazing educational resources.

### What is the best advice you've ever received?

One of the best pieces of advice I have received is, "If you don't have a seat at the table, you're probably on the menu." As a fierce advocate for resident and medical student education, I fight to ensure that we always have a seat at the table whenever decisions about our education are being made.

### What is something people don't know about you?

My husband and I met on Bumble, where my opening line was, "#1 on my bucket list is to successfully run and win The Amazing Race, so I am looking for the perfect teammate. Please list your qualifications below." His answer was not only the best, but he then sassily

counter-asked me why he should select me to be his partner. It worked; I married him. PS: CBS, if you are reading this right now, you have found your next winning team!

### How do you recharge after a tough shift?

After a tough shift, spending time with my husband (Luke) and dog (Dante) always helps. Of course, pizza and a nap can also fix most things in life.

### 1 skill you want but don't have (yet):

As a natural "yes" person, I would love to learn how to say, "thank you, but no thank you." I am working on it.

### 1 skill you have but don't (necessarily) want:

I am a professional procrastinator. I always get it done on time, though!

### Does pineapple go on pizza?

No, never, but corn does. Trust me.

### Favorite comfort food (or drink)?

Pizza, always.



# Member at Large

## Blake Denley, MD

Ochsner Health Emergency Medicine Residency  
@BlakeDenleyMD

### What's your first priority as an EMRA board member?

My first priority is to serve as a listening ear for any EMRA member who has concerns, questions, or ideas.

### What is the best advice you've ever received?

When you're assigned a task, do it right the first time.

### How do you recharge after a tough shift?

By spending time at home with my boyfriend and golden retriever.

### What is something people don't know about you?

I'm a world champion jump roper.

### 1 skill you want but don't have (yet):

Spanish fluency

### 1 skill you have but don't (necessarily) want:

I can eat more desserts than anyone else I know. And I do...

### Does pineapple go on pizza?

Yes, as does corn.

### Favorite comfort food (or drink)?

Raising Cane's Box Combo (no coleslaw, extra toast, two extra sauces, sweet tea)



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For Physicians

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# 2020-2021 21 Greatest Hits EM Research Edition

**Jason D. Vadhan, DO**

EMRA Research Committee Vice Chair  
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**Christopher Zalesky, MD, MSc**

EMRA Research Committee Chair  
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It is often difficult to keep up with all of the highest impact papers in emergency medicine. The EMRA Research Committee has compiled a quick review of some of the most practice-affirming or practice-changing papers published from September 2020 to September 2021. This is by no means a definitive list, but all of these papers will likely be good to know for your next shift!

## THERAPEUTICS



### ***A Randomized Trial Comparing the Efficacy of Five Oral Analgesics for Treatment of Acute Musculoskeletal Extremity Pain in the Emergency Department***

This randomized control trial compared the efficacy of 5 oral analgesics for the treatment of acute musculoskeletal extremity pain. All patients were deemed to need an x-ray and be appropriate for oral pain control by the treating physician. In the end, no particular analgesic was more efficacious at 1 or 2 hours. However, there was significantly more nausea and vomiting among patients treated with opioids.

Regimens included:

1. 400 mg ibuprofen and 1,000 mg acetaminophen
2. 800 mg ibuprofen and 1,000 mg acetaminophen
3. 30 mg codeine and 300 mg acetaminophen
4. 5 mg hydrocodone and 300 mg acetaminophen
5. 5 mg oxycodone and 325 mg acetaminophen



### ***The Use of Tranexamic Acid to Reduce the Need for Nasal Packing in Epistaxis (NoPAC): Randomized Controlled Trial***

The largest RCT of TXA in epistaxis (496 participants) demonstrates that TXA does not provide improved benefit compared to traditional nasal packing at reducing the need for anterior nasal packing (43.7% of the experimental group still required anterior nasal packing to achieve tamponade). Limitations of the study include the studied population (primarily older men on anticoagulation), and the dose of TXA used.



### ***Regional anesthesia on the finger: traditional dorsal digital nerve block versus subcutaneous volar nerve block, a randomized controlled trial***

A prospective, multicenter, RCT of 409 ED patients compared the subcutaneous volar nerve block vs. the traditional dorsal digital nerve block. All patients had a finger injury requiring regional anesthesia for surgical treatment. Results demonstrated that numbing the thumb via a dorsal block is preferred, whereas individual fingers achieve better dorsal analgesia via the dorsal block and better analgesia on the proximal phalanx via a volar block. Overall, the dorsal nerve block gave greater anesthesia but required 2 injections and a greater amount of lidocaine.



### ***Isopropyl alcohol nasal inhalation for nausea in the triage of an adult emergency department***

A randomized, double-blind, placebo-controlled trial assessed the efficacy of isopropyl alcohol (IPA) to patients who presented to triage in the ED with the chief complaint of isolated nausea and vomiting. Patients scored 3 or higher on the nausea/vomiting numerical rating scale. Among 118 patients, 62 patients who received IPA reported improved nausea and vomiting-related symptoms vs. placebo and required less rescue treatment. This is the third RCT demonstrating the efficacy of inhaled IPA for the acute treatment of uncomplicated nausea and vomiting.

## GASTROENTEROLOGY



### ***A Randomized Trial Comparing Antibiotics with Appendectomy for Appendicitis***

A non-blinded, pragmatic non-inferiority randomized trial of 1,552 patients with appendicitis compared quality of life at 30 days between patients treated with 10 days of antibiotics vs. appendectomy for appendicitis. The results demonstrated that antibiotics have comparable outcomes to surgery for acute appendicitis etiologies, with the exception of patients with an appendicolith who had higher rates of complications in the antibiotic group.

## NEUROLOGY



### ***Prospective Validation of Canadian TIA Score and Comparison with ABCD2 and ABCD2i for subsequent stroke risk after transient ischemic attack: multicenter prospective cohort study***

This prospective multicenter cohort study was designed to validate the Canadian TIA Score for patients needing risk stratification for future adverse neurologic events. Results demonstrated that among the 7,607 ED patients presenting for TIA, 1.4% had a subsequent stroke within 7 days, and 1.1% required carotid endarterectomy/stenting. The Canadian TIA score outperformed the ABCD2 and ABCD2I in risk stratifying patients with an improved area under the curve. The Canadian TIA risk score was also able to identify a low-risk cohort appropriate for rapid outpatient evaluation. The Canadian TIA score is now validated and can be used in clinical practice.



### ***MAGraine: Magnesium compared to conventional therapy for treatment of migraines***

The single-center, prospective, double-blinded, randomized, three-armed trial compared magnesium, metoclopramide, and prochlorperazine for the treatment of migraine. This study found that magnesium was not inferior in efficacy to the other two medications, which can be especially useful in patients who simultaneously present with prolonged QT. However, patients who received magnesium for migraine management were more likely to require additional analgesia subsequently. One significant limitation of this study is that it was stopped early due to COVID, causing it to be underpowered, with  $n = 157$ .

## CARDIOLOGY



### ***Effect of a Restrictive vs Liberal Blood Transfusion Strategy on Major Cardiovascular Events Among Patients With Acute Myocardial Infarction and Anemia: The REALITY Randomized Clinical Trial***

An open-label, noninferiority, randomized trial attempted to identify an optimal transfusion strategy in patients with acute myocardial infarction and anemia. Primary outcome was major 30-day adverse cardiovascular events. The study concluded that among the 668 participants, between the restrictive (transfuse at  $HgB \leq 8$ ) and liberal transfusion groups (transfuse at  $HgB \leq 10$ ), major adverse cardiac events occurred in 11.0% of patients in the restrictive group vs. 14.0% in the liberal transfusion group. The authors concluded that a restrictive transfusion resulted in a noninferior rate of MACE after 30 days with a relative risk of 0.79 (1-sided 97.5% CI, 0.00-1.19). They also cautioned that the non-inferiority confidence interval was large enough to contain worse outcomes in the restrictive group, warranting a larger study to confirm these results.



### ***Diagnostic accuracy of electrocardiogram for acute coronary OCCIusion resuLTing in myocardial infarction (DIFOCULT Study)***

This is a retrospective case-control study evaluating the performance of EKG STEMI criteria or expanded EKG Acute Coronary Occlusion Myocardial Infarction (ACOMI) criteria for the identification of Acute Coronary Occlusion. In this study, 1,152 STEMI and 2,353 non-STEMI patients were evaluated. In the non-STEMI group 28% were found to have an acute coronary occlusion identifiable on EKG with ACOMI criteria. These non-STEMI patients with ACOMI had similar mortality rates to STEMI patients. The author shows that a refined EKG paradigm for the identification of acute coronary occlusion would have improved sensitivity to identify those who need acute reperfusion therapy.



### ***Effects of Fluoroquinolones on Outcomes of Patients with Aortic Dissection or Aneurysm***

This was a retrospective cohort study that compared patients who were diagnosed with aortic aneurysms or aortic dissections and their mortality risk after fluoroquinolone exposure. Patients were identified after their initial hospitalization and then outpatient data was followed, looking at prescription days of fluoroquinolones (experimental group) or amoxicillin (negative control group) and then monitored for adverse outcomes. The study concluded that exposure to fluoroquinolones was associated with a higher risk of all-cause death (adjusted hazard ratio [aHR]: 1.61; 95% confidence interval [CI]: 1.50 to 1.73) as well as aortic-related death (aHR: 1.80; 95% CI: 1.50 to 2.15). Increasing evidence has shown fluoroquinolones should be avoided in high-risk patients unless no other treatment options are available.

## CRITICAL CARE



**The ED-AWARENESS Study: A Prospective, Observational Cohort Study of Awareness With Paralysis in Mechanically Ventilated Patients Admitted from the ED**

The single-center, prospective cohort study assessed the prevalence of awareness with paralysis in ED patients receiving mechanical ventilation. In this study, 383 patients were surveyed following extubation for awareness during paralysis. The study identified a prevalence of 2.6% (10/383), with rocuronium usage at any point resulting in higher instances of awareness (70%) vs. all other paralytics (31.4) (95% confidence interval 0.94 to 8.8). While there are many possible reasons for this prevalence, it is much higher than the rate observed in general anesthesia (~1%), and care should be taken to start appropriate and timely post-intubation sedation.



**Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest**

This is an open-label randomized control trial of 1,850 adults with an out-of-hospital cardiac arrest who subsequently underwent targeted hypothermia (at 33°C), or targeted normothermia. Primary outcome was mortality at 6 months. Functional outcomes at 6 months were also evaluated. The study concluded 50% of the patients treated with hypothermia died, compared to 48% of the normothermic group (relative risk with hypothermia, 1.04; 95% confidence interval [CI], 0.94 to 1.14; P = 0.37). Similarly, 55% of patients in the hypothermic group suffered from severe disability (modified Rankin scale score  $\geq 4$ ), compared to 55% of normothermic patients (relative risk with hypothermia, 1.00; 95% CI, 0.92 to 1.09), thus concluding that targeted hypothermia does not decrease mortality within 6 months when compared to targeted normothermia. This study should be narrowly interpreted, as it is a highly selected patient population that does not compare well to the general U.S. cardiac arrest population in regard to rates of bystander CPR, rates of presenting with a shockable rhythm, and neurologically intact survival rates.



**Lung-Protective Ventilation and Associated Outcomes and Costs Among Patients Receiving Invasive Mechanical Ventilation in the ED**

A retrospective study assessed how ventilation settings in the ED affected ICU outcomes among 4,174 patients. In this study, 58.4% of patients on ventilation received lung-protective ventilation in the ED (defined as tidal volume  $\leq 8$  mL/kg predicted body weight) and were less likely to suffer from ARDS (aOR, 0.87; 95% CI, 0.81-0.92) or in-hospital death (aOR, 0.91; 95% CI, 0.84-0.96). ED ventilatory care of critically ill patients can have lasting effects on mortality and other adverse outcomes.



**Early head-to-pelvis computed tomography in out-of-hospital circulatory arrest without obvious etiology**

In patients who present following an out-of-hospital cardiac arrest, identifying obvious causes can be challenging and not immediately identifiable. A prospective, observational pilot study assessed the safety and efficacy of early head-to-pelvis CT imaging to identify the cause of cardiac arrest. Among 104 patients a sudden death CT scan (SDCT) protocol (non-contrast CT head, ECG-gated cardiac and thoracic CT angiogram, and nongated venous-phase abdominopelvic CT angiogram) identify the cause of cardiac arrest in nearly 39% of patients. In addition, life-threatening complications of resuscitation were identified in 16% of patients. Though exploratory, these findings suggest that a sudden death CT protocol can expedite the diagnosis of potential causes and identify resuscitation complications in patients with out-of-hospital cardiac arrests.



**Noninvasive Ventilation Use in Critically Ill Patients with Acute Asthma Exacerbation**

A retrospective cohort study assessed the association between noninvasive ventilation and a subsequent need for invasive mechanical ventilation and in-hospital mortality among patients admitted to the ICU with an asthma exacerbation. Noninvasive ventilation was associated with a lower likelihood of receiving invasive mechanical ventilation (adjusted generalized estimating equation odds ratio, 0.36; 95% CI, 0.32-0.40) and decreased in-hospital mortality (odds ratio, 0.48; 95% CI 0.40-0.58) unless patients had concomitant comorbid pneumonia and/or severe sepsis.

## PEDIATRICS



**Short-Course Antimicrobial Therapy for Pediatric Community-Acquired Pneumonia: The SAFER Randomized Clinical Trial**

A multicenter, blinded, non-inferiority RCT compared rates of cure for community-acquired pneumonia with a short course (5 days) vs. standard course (10 days) of amoxicillin. In this study, 281 pediatric ED patients between 6 months and 10 years old with CAP who were being discharged were randomized. The results demonstrated that the short course of antibiotic therapy was comparable to longer course antibiotics. Clinical cure occurred in 88.6% in the short group and 90.8% in the control group (risk difference, -0.016; 97.5% confidence limit, -0.087). In pediatric patients who are otherwise healthy presenting with community-acquired pneumonia, it is reasonable to consider a shorter course (< 10 days)

of antibiotics and follow-up with primary care physician to ensure clinical cure. Though these results are consistent with other trials, the results themselves are not as robust, and an additional trial is likely needed with different endpoints to confirm these findings.



### **Risk Factors and Outcomes after a Brief Resolved Unexplained Event: A Multicenter Study**

To evaluate whether current American Academy of Pediatrics risk criteria predict BRUE outcomes, a multicenter retrospective cohort study assessed more than 2,000 infants less than 1 year of age who presented with a suspected BRUE without a probable alternative or definite diagnosis. Among these patients, 87% met AAP higher-risk criteria for having at least 1 AAP risk factor; 63% were hospitalized, with the most common explanations being less serious such as GERD (18.5%), choking or gagging (8.2%), viral respiratory infections (4.4%), and breath-holding spells (4.1%). A serious diagnosis was identified in 4.0% of patients, with 45% of these diagnoses being made after discharge from the index visit without an explanation. Having at least 1 AAP risk factor (ie, higher-risk criteria) was associated with a recurrent event in the ED or hospital (odds ratio [OR] 5.9; 95% confidence interval [CI] 2.7–12.6) and a recurrent event that led to an explanation (OR 15.1; 95% CI 2.1–108.6). The results suggest that while the absence of AAP high-risk criteria had a robust NPV (97%) for underlying serious conditions, the presence of criteria did not have a strong PPV (4%).



### **Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old**

This paper represents the first official guidelines from the American Academy of Pediatrics for the evaluation of well-appearing febrile ( $\geq 38^{\circ}\text{C}$ ) infants 8–60 days old. These landmark guidelines are divided into three algorithms for infants 8–21 days of age, 22–28 days of age, and 29–60 days of age. There is an abundance of information in this paper and it is worth becoming familiar with and having handy for when this situation arises. Importantly, there are inclusion and exclusion criteria listed to ensure kids are appropriate for utilization of these guidelines.

## **PRE-HOSPITAL**



### **Tranexamic Acid During Prehospital Transport in Patients at Risk for Hemorrhage After Injury: A Double-blind, Placebo-Controlled, Randomized Clinical Trial**

Pragmatic, phase 3, multicenter, double-blind, placebo-controlled, superiority randomized trial which assessed clinical outcomes among 6559 patients at risk for hemorrhage who received prehospital tranexamic acid (single

dose). The 30-day all-cause mortality was assessed among patients who received 1g TXA (treatment) or 100 mL saline (placebo) prior to hospitalization. Results showed 30-day mortality among patients receiving TXA was 8.1% vs. placebo 9.9% (95% CI, -5.6% to 1.9%;  $P = .17$ ). Post-hoc analysis, stratified by time to TXA administration, showed giving TXA within 1 hour of injury in patients with severe shock lowers 30-day mortality compared with placebo (18.5% vs 35.5%; difference, -17%; 95% CI, -25.8% to -8.1%;  $P < .003$ ).

## **ULTRASOUND**



### **Diagnostic Accuracy of Lung Point-Of-Care Ultrasonography for Acute Heart Failure Compared with Chest X-ray Study Among Dyspneic Older Patients in the ED**

A retrospective cohort study assessed whether POCUS was comparable to chest x-ray in identifying acute heart failure exacerbation among older patients. An 8-zone lung ultrasound protocol was used to look for signs of pulmonary edema; 148 patients were enrolled. For the diagnosis of acute heart failure, POCUS had a sensitivity of 92.5% and a specificity of 85.7% vs. chest x-ray with a sensitivity of 63.6% and specificity of 92.9%. Overall, POCUS had a significantly higher sensitivity for the diagnosis of acute heart failure, while demonstrating comparable specificity.



### **Impact of point-of-care ultrasound on treatment time for ectopic pregnancy**

A retrospective, observational, cohort study assessed whether transabdominal POCUS by itself or in addition to consultative radiology ultrasound (RADUS), reduces ED treatment time for patients with ectopic pregnancy requiring operative care. Among 109 patients admitted with ectopic pregnancies, 36 received POCUS (with 23 of those 36 also receiving RADUS), and 73 received RADUS only. POCUS involved the RUPTURE exam (Right Upper and Pelvis Timley Ultrasound for Ruptured Ectopic) to evaluate for an intrauterine pregnancy and abdominal free fluid. The average ED treatment time in the POCUS group was 157.9 min vs. 206.3 min in the RADUS group ( $p = 0.0141$ ). The median time to OR for ruptured ectopic pregnancies was 203.0 min (interquartile range [IQR] 159.0) in the POCUS group versus 293.0 min (IQR 139.0) in the RADUS group ( $p = 0.0002$ ). These results conclude that POCUS was associated with significantly faster time to OR for ectopic pregnancies. \*

# Fomepizole for Acetaminophen Toxicity

## *A Novel Use for a Classic Antidote*

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Acetaminophen toxicity is one of the most common causes of liver toxicity in the United States. Acetaminophen ingestions are the most common cases called into poison centers in the United States, accounting for more than 100,000 calls per year.<sup>1</sup> Each year in the United States, acetaminophen overdoses are estimated to result in 56,000 emergency department visits, 2,600 hospital admissions, and 500 deaths.<sup>2</sup> According to the United States Acute Liver Failure Study Group registry, 42% of all cases of acute liver failure in the United States are attributable to acetaminophen overdose.<sup>3</sup>

The therapeutic antipyretic mechanism of action is not well understood. However, acetaminophen is thought to inhibit COX receptors in the CNS selectively. Toxicity develops at 150 mg/kg or >7.5 g/day. Acetaminophen is metabolized by glucuronidation primarily to nontoxic metabolites. However, in large overdoses these pathways become saturated, and more acetaminophen is converted by CYP2E1 into the toxic metabolite N-acetyl-p-benzoquinone imine (NAPQI). As shifts toward the CYP2E1 pathway occur, glutathione serves to reduce NAPQI to nontoxic metabolites. Please reference image one.

Glutathione stores become depleted in large acetaminophen overdoses and are subsequently unable to reduce all the generated NAPQI to its nontoxic metabolites. Glutathione depletion leads to more NAPQI and resultant hepatic necrosis. N-acetylcysteine (NAC) is the only Food and Drug Administration (FDA) approved antidote in acetaminophen toxicity and is the mainstay treatment for significant acute overdose. However, new data reveals that fomepizole may be hepatoprotective in high dose acetaminophen toxicity when reviewed in animal models, and possibly an effective adjunct to treatment regimens, especially in massive overdose or in unknown time of ingestion (TOI).<sup>4,5</sup>

### **Background/History**

Conventionally used in methanol/ethylene glycol overdose, fomepizole acts to competitively inhibit alcohol dehydrogenase (Figure 1). This action reduces the formation of the toxic metabolites from the metabolism of methanol and ethylene glycol. Fomepizole also acts as a potent inhibitor of the CYP2E1 protein which is induced by acetaminophen.<sup>6</sup> CYP2E1 is the primary driver for NAPQI formation, and this pathway would thus be inhibited by fomepizole administration. When used alongside NAC, which enhances the creation of glutathione, fomepizole can serve as an adjunct by inhibiting the conversion of acetaminophen to NAPQI.<sup>7,8</sup> Although NAC has excellent data showing its efficacy in reversing detrimental acetaminophen effects when administered in the first 8-10 hours after ingestion, patient presentations are not always cut and dry.<sup>4,9</sup> There are many reports of massive acetaminophen ingestions as well as delayed patient presentations in which NAC alone is unable to prevent or halt ongoing hepatic necrosis.<sup>4</sup>

### **Dosing**

When used for toxic alcohols, the dose of fomepizole is 15 mg/kg IV over 30 min; followed by 10 mg/kg q12hrs for 4 doses until the toxic alcohol level is < 20 mg/dL or acidosis resolves. If additional doses of fomepizole are required, the dose is increased to 15 mg/kg IV q12hrs for as long as necessary.<sup>10</sup>

In the management of acetaminophen toxicity, fomepizole is given as a one-time dose of 15 mg/kg IV.<sup>5</sup> Fomepizole may be considered as an adjunctive therapy when concentrations of acetaminophen (µg/mL) and ALT (IU/L) drawn at the same time are multiplied together and yield a value of >10,000 µg/mL \* IU/L, as these patients have a high likelihood of developing hepatotoxicity despite NAC administration.<sup>11</sup>

### **Adverse Effects**

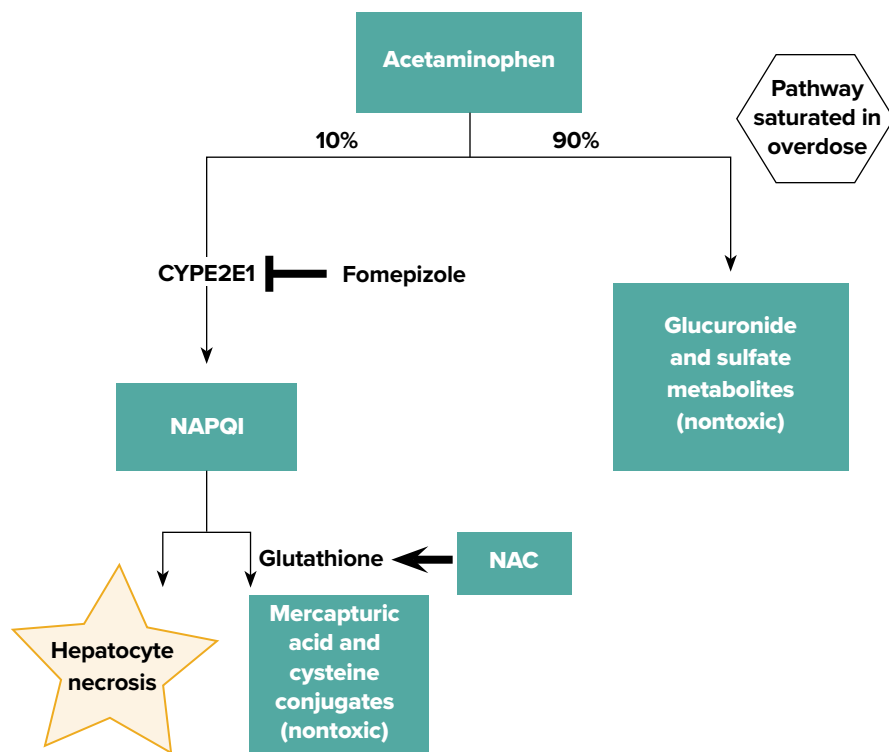
The most common adverse effects attributed to fomepizole include headache, nausea, dizziness, somnolence, and metallic taste. Less common adverse effects include fever, bradycardia, transient transaminitis, rash, phlebitis, and eosinophilia.<sup>12</sup> The safety and efficacy of fomepizole in pediatric patients has not been established.

### **Cost Effectiveness**

Utilizing multimodal treatment strategies to acetaminophen overdose does not come without cost burden and should be thoroughly considered prior to initiation. The average cost of fomepizole for one dose is approximately \$1,000.<sup>13</sup> NAC approximately \$5000 for oral routes and approximately \$3000 for IV routes during a retrospective metanalysis in 2009.<sup>9</sup> However, these costs pale in comparison to those of a liver transplant and its associated follow-up, estimated to cost up to \$575,000.<sup>14</sup>

### **Conclusion**

Acetaminophen toxicity is one of the most common causes of liver toxicity and reported poison center ingestions in the



**FIGURE 1. The Metabolism of Acetaminophen**

The glucuronidation and sulfation pathways yield non-toxic metabolites. The CYP2E1 pathway metabolizes acetaminophen to the toxic NAPQI. Glutathione conjugates to NAPQI to form nontoxic metabolites. Fomepizole inhibits CYP2E1. (Image created by Nicholas Titelbaum, MD)

United States. NAC has been cited as the primary antidote for acetaminophen toxicity traditionally. However, based on new research, fomepizole may be used as an adjunctive treatment. The dual therapy has been suggested to be more efficient and hepatoprotective in patients at risk of developing acute liver failure secondary to massive acetaminophen overdose. The proposed dosing of fomepizole in these circumstances is 15 mg/kg IV once. By adding this single medication to the regimen, we can potentially protect unnecessary healthcare costs and save patients from risky and costly liver transplants. ★

### TAKE-HOME POINTS

- Acetaminophen overdose is a major cause of acute liver failure in the U.S.
- NAC is the primary antidote for acetaminophen toxicity
- Fomepizole may be used as an adjunctive treatment for patients at risk of developing acute liver failure due to acetaminophen overdose
- The dose of fomepizole used for acetaminophen toxicity is 15 mg/kg IV once

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# Where in The World is the CBD?



## Ultrasound Tips for Finding the Common Bile Duct

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For new sonographers, looking for the common bile duct (CBD) can feel like that old school game called “Where’s Waldo” from the 1990s, but fret not. The goal of this article is to equip you with a targeted approach when looking for the common bile duct.

### ANATOMY REVIEW

First, let’s review the landmarks that will orient us to where the CBD *should* be. As demonstrated in Figure 1, the portal triad meets the gallbladder neck via the hyperechoic main lobar fissure. Notice in Figure 2 that the CBD is directly anterior to the portal vein.

In the transverse view, it is typically lateral to the hepatic artery (though an estimated 15% of patients will have that orientation reversed). When in doubt, color flow is recommended to distinguish between the hepatic artery, which does demonstrate flow, and the CBD, which does not. This will also help you differentiate between the CBD and the IVC (Figure 2).

### Hunting for the CBD

#### General Approach

The curvilinear probe is the ideal choice for this exam type. However, if the CBD can only be identified through an intercostal window, the phased array probe can be effective. You should look for either the “exclamation point sign,” the “Mickey Mouse sign,” or the gallbladder by one of three methods: the subcostal sweep, the “X-7” approach, or

the axillary transhepatic approach.

The subcostal sweep refers to sweeping beneath the right rib cage in a medial to lateral fashion. The X-7 approach places the probe approximately 7 cm to the right of the xiphoid process over the rib cage. The transhepatic axillary approach refers to scanning through the liver in the right axilla similar to the technique for the right upper quadrant view of a FAST exam.

#### Anatomical Landmarks

##### Exclamation Point Sign

Sweep through the liver looking for the “exclamation point sign.” When visualizing the gallbladder in its long axis, the exclamation point is composed of two structures: the gallbladder and the portal vein. As demonstrated in Figure 1, the portal vein is the little “period,” and the gallbladder is the long



structure towering over the period. With the portal vein identified, you can then apply your anatomy knowledge and find the CBD anterior to the portal vein. Remember you can also use color flow to verify that it is a duct rather than a vascular structure.

### **Mickey Mouse Sign**

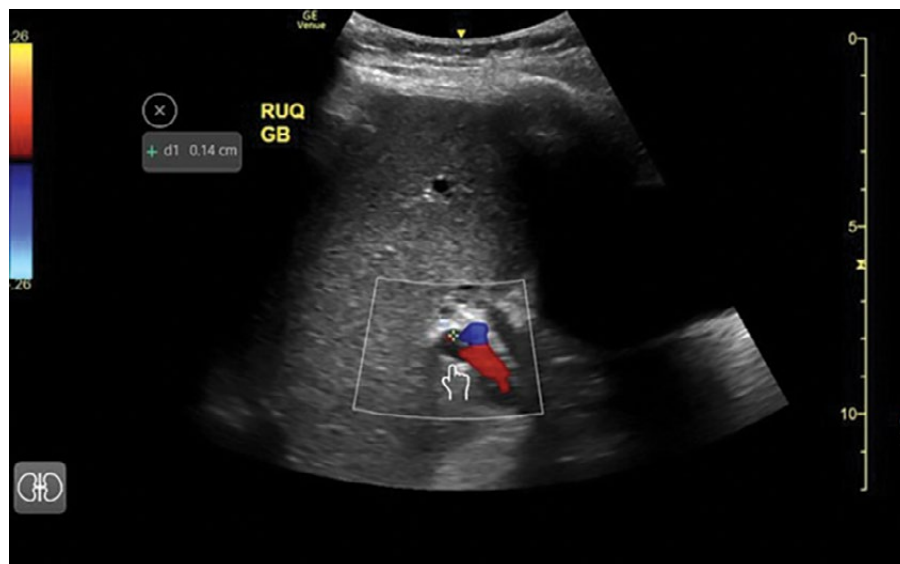
The “Mickey Mouse Sign” refers to the portal triad. As demonstrated in Figure 1, imagine that Mickey is facing you on the screen. In about 85% of patients, Mickey’s right ear is the CBD and his left ear is the hepatic artery. Color flow can be of great assistance in distinguishing the two structures.

### **Gallbladder**

Identify the gallbladder in its long axis. Sweep through the gallbladder looking for its neck, then recall that the gallbladder neck sits near the liver’s main lobar fissure. Track the hyperechoic main lobar fissure in the opposite direction of the gallbladder, which should bring you to the portal triad.

### **Measuring CBDs**

You found it! Now let’s assess it for dilation as a sign of biliary obstruction. The intraluminal diameter of the CBD is measured from the inner wall to the inner wall. As a general rule of thumb, the CBD should be less than the first digit of the



**FIGURE 2.** The Common Bile Duct (arrow), measuring 14 mm, is just anterior to the portal vein (finger).

patient’s age<sup>1</sup>. For example, a 40-year-old should have a CBD < 4mm, while an 80-year-old should have a CBD < 8mm.

### **Still can’t find it?**

Consider the possibility that it is so dilated that you did not initially recognize it. Once you have identified the portal vein, look for the “double-barrel sign.” Ultrasound is specific for finding CBD dilatation.

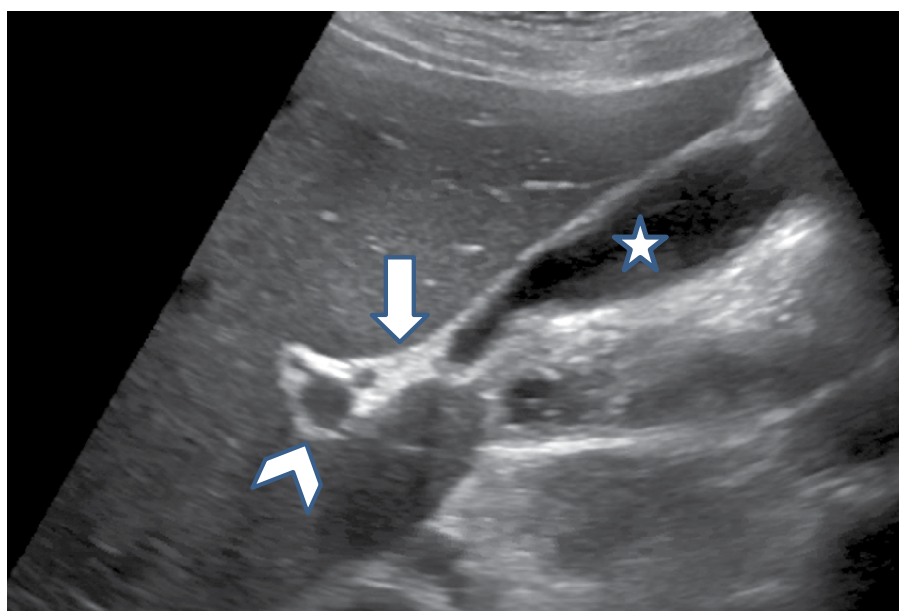
### **You still can’t find it.**

#### **What’s next?**

We advocate that assessing the

CBD should be part of every biliary ultrasound exam. However, there is a paucity of evidence regarding the sensitivity of ultrasound for evaluating CBD. Furthermore, some research suggests that in the absence of abnormal biliary labs and other ultrasound signs of gallbladder pathology (ie, wall thickening, pericholecystic fluid, and gallstones), the identification of the CBD rarely changes management.<sup>2</sup>

*Identifying the common bile duct can be difficult for new sonographers. By familiarizing yourself with the anatomy and practicing your technique, you can optimize the success of your hunt. ★*



**FIGURE 1.** The Main Lobar Fissure (arrow) connects the gallbladder (star) to the portal triad (arrowhead).

**You should look for either the “exclamation point sign,” the “Mickey Mouse sign,” or the gallbladder by one of three methods: the subcostal sweep, the “X-7” approach, or the axillary transhepatic approach.**

# ELUSIVE EFFUSION

## A Rare of Case of COVID-19-Related Pericardial Effusion and Cardiac Tamponade

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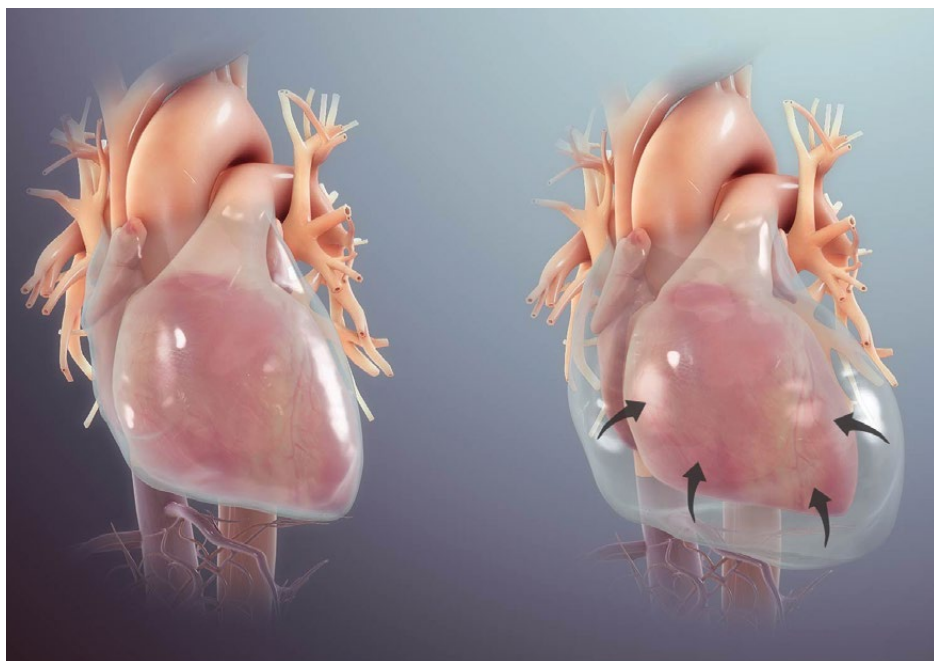
ChristianaCare/Doctors for Emergency Services

### Case

A 56-year-old female with a history of CKD, multiple sclerosis, atrial fibrillation, DVT and PE on rivaroxaban, and recently recovered COVID-19 pneumonia presented to the ED due to sudden onset of mid-sternal chest pain that began earlier in the morning. The patient reported waking up in the middle of the night with left shoulder pain but then developed sudden heaviness in her chest. She was recovering from her COVID-19 pneumonia at a subacute rehab facility and had been doing well prior to these symptoms. Per medical records from her rehab facility, she did not miss any doses of her anticoagulation. A ROS was otherwise negative.

In the ED, her heart rate was 103 bpm, BP 123/67 mmHg, RR 24 breaths/min, temperature 36.7 C, and oxygen saturation 90% on 4L NC with no baseline oxygen requirement. Her physical examination was significant for conversational dyspnea, diminished breath sounds at the bilateral lung bases, and chronic bilateral lower extremity non-pitting edema. Blood work was significant for potassium of 5.6, creatinine 2.01, WBC 17.3, D-Dimer 948, CRP 240, LDH 324, and troponin <0.01. An EKG showed sinus tachycardia and chronic ST-segment changes unchanged compared with prior. A CT Chest without contrast showed interval development of a moderate to large simple appearing pericardial effusion with new small bilateral pleural effusions and associated compressive atelectasis (Figure 1).

A subsequent bedside echocardiogram showed a circumferential



pericardial effusion with concern for RV collapse (Figure 2) which warranted an emergent pericardiocentesis.

During the pericardiocentesis, 230 mL of serosanguinous fluid was removed. A pericardial drain was left in place and removed 2 days later after no further output was noted. Fluid studies were consistent with an exudative process with fluid LDH of 955 (ratio of fluid/serum LDH > 0.6). Bacterial, viral, and fungal cultures were all negative.

Given the patient's clinical history of recent COVID-19 pneumonia and lack of evidence of another infectious process, it was determined that the patient's pericardial effusion was due to ongoing inflammation from COVID-19. The patient was treated with colchicine (NSAIDs were avoided given her initial presentation of an AKI with history of CKD) and there was no effusion seen on a repeat echocardiogram prior to discharge. She was continued on colchicine for a total of three months and remained asymptomatic on outpatient follow-up visits with cardiology.

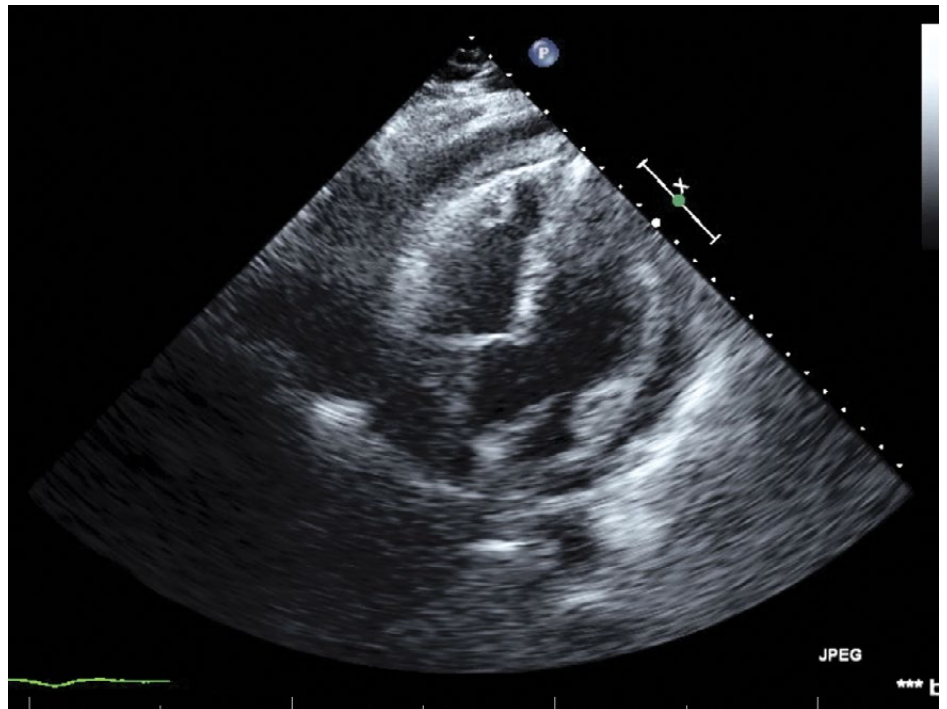
### Discussion

Acute pericarditis involves inflammation of the pericardial sac, which is made of an inner mesothelial visceral layer that surrounds the heart. Normally, this layer produces ~50 mL of fluid to lubricate the heart and prevent excess motion. The inflammation associated with pericarditis can lead to excess fluid production and the development of an effusion which can ultimately cause hemodynamic instability. Whether an effusion leads to cardiac tamponade is determined by both the volume of fluid and the rate of accumulation. Autoimmune diseases, neoplasms, uremia, and certain infections such as TB can cause large effusions that do not result in tamponade because their slow growth allows the pericardium to stretch and accommodate to the volume of fluid. Conversely, tamponade can develop with small effusions if the fluid accumulates over a short period of time.

Acute pericarditis typically presents with  $\geq 2$  of the following: sharp and

pleuritic chest pain that is worse with laying down and improved with leaning forward, pericardial rub, new widespread STE or PR depressions, and new or worsening pericardial effusion. When acute pericarditis leads to a clinically significant effusion and cardiac tamponade, Beck's Triad may be seen. This triad includes hypotension, jugular venous distention, and muffled heart sounds. Pulsus paradoxus, which is a decrease in systolic blood pressure by more than 10 mmHg with inspiration, can also be present in these patients. This happens when increased pressure from the effusion causes impaired ventricular relaxation and filling which leads to decreased preload and stroke volume.

Most cases of acute pericarditis in the world are idiopathic. However, for cases in which the cause is known, a virus is often to blame. In the pediatric population, coxsackie and echovirus are the most common viruses implicated, while in the adult population, CMV, HSV, and HIV infections are most implicated. Recently, a series of case reports have described the effect of COVID-19 on myocardial and pericardial tissue. It appears the majority of cases of myocarditis, pericarditis, and pericardial effusions secondary to COVID-19 are due to the overwhelming inflammatory



**FIGURE 2. Limited Echocardiogram performed during pericardiocentesis showing moderate to large pericardial effusion with concern for RV collapse**

reaction and infiltration rather than direct viral invasion.<sup>1</sup>

A case series published in the European Heart Journal presented three cases of pericarditis thought to be related to COVID-19 infection. Several viral, bacterial, and fungal tests were performed in each of the cases without

any causative factors identified other than the patient being COVID-19 positive on RT-PCR testing. Interestingly, one of the cases tested the pericardial fluid for COVID-19 and was positive.<sup>2</sup> In another case report of a patient with pericardial effusion and subsequent tamponade, it was determined that the systemic inflammatory response from the infection was the cause of the effusion. They noted that unfortunately there is no validated test to assess for COVID-19 in pericardial fluid, however the PCR testing they performed on the fluid was negative.<sup>3</sup> In all cases published thus far, trials of NSAIDs and colchicine along with emergent pericardiocentesis led to resolution of the effusion and improvement of the symptoms related to pericarditis.

As prevalence of COVID-19 remains high, it is important to be aware of the possible cardiac effects of the infection in both the acute to subacute phases of the illness. Although further investigation is needed, it does appear that COVID-19 can lead to fulminant myopericarditis and subsequent cardiac tamponade and therefore requires us to maintain a high index of suspicion for this life-threatening diagnosis. ★



**FIGURE 1. Cross Section of CT Chest without contrast depicting a new large, circumferential pericardial effusion**

# The Pericapsular Nerve Group (PENG) Block for Hip Pain

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## Case

A 97-year-old-female presents to the ED with left hip pain after a mechanical fall at home. Her left lower extremity is shortened and externally rotated, and she yells in pain when it is manipulated. Radiographs confirm what you already suspected: a left hip fracture. You try to keep her comfortable while she waits for a hospital bed, but she continues to groan in pain despite multiple doses of IV morphine. Not wanting to continue with opioids, you consider alternative options.

## Background

Hip fractures are common injuries evaluated in the ED. The majority of patients who suffer a hip fracture are over 80 years old, and as the population ages, the incidence of hip fractures is expected to increase.<sup>1</sup> These injuries can be extremely painful and debilitating. Pain management is crucial not only for patient comfort but also because sufficient analgesia decreases complications and promotes postoperative mobility.<sup>1</sup> Although emergency physicians are unlikely to be involved in postoperative care, they are typically the first clinician to evaluate these patients and thus frequently

responsible for minimizing patient discomfort in the initial stages.

Opioids have long been a mainstay for treatment of pain; however they are associated with side effects including constipation, sedation, respiratory depression, and dependence.<sup>2</sup> Regional anesthesia can be a useful and appropriate alternative. Techniques such as the femoral nerve block, 3-in-1 femoral nerve block, and fascia iliaca block are relatively safe, fairly effective, and avoid the use of opioids.<sup>3</sup> However, these blocks may not be providing adequate analgesia based on the innervation of the hip.<sup>3,4</sup>

Since the anterior hip capsule receives most of the sensory input of the hip,<sup>4</sup> any nerve block should ideally target the nerves that supply this area. A recent anatomic study has confirmed that the anterior hip capsule is innervated by the obturator nerve, accessory obturator nerve, and the femoral nerve.<sup>5</sup> Because of the way that the high articular branches of the femoral nerve and accessory obturator nerves course, there is some concern that consistent blockade of these nerves is not achieved with the fascia iliaca block and the 3-in-1 femoral nerve block.<sup>3,6</sup> Furthermore, it has also been suggested that these techniques do not reliably block the obturator nerve.<sup>6,7</sup> The anterior inferior iliac spine (AIIS) and iliopubic eminence (IPE) have been identified as key landmarks where articular branches of the nerves course.<sup>5</sup> Based on this information, the pericapsular nerve group (PENG) block was developed in 2018 to specifically

target these articular branches.<sup>3</sup> The creators of this technique reported achieving pain reduction while avoiding motor blockade after performing this block on five patients with varying hip pathology including intertrochanteric fractures, subcapital fractures, and metastases of the femoral head and acetabulum.<sup>3</sup>



**FIGURE 2.** Positioning of the patient, provider, and ultrasound machine for the PENG block.

Below, we describe how to perform this novel technique.

## Performing the PENG Block

To perform this block, we advocate a two-person approach where one individual is responsible for using ultrasound (US) to guide and maintain the block needle in place while the other person injects the anesthetic.

## Setup

Two syringes should be attached to a three-way stopcock. One syringe should contain local anesthetic and the other should contain normal saline. One end of IV tubing should be connected to the stopcock and the other end to a spinal needle. This device will facilitate administration of anesthetic (Figure 1).



**FIGURE 1.** Assembly of the equipment to administer local anesthetic

## Positioning

The patient should be supine with the operator standing on the ipsilateral side of the affected extremity. The US machine should be placed so that the screen is in a direct line of sight.

## Landmark Identification

A low-frequency curvilinear probe should be placed in a transverse orientation at the proximal thigh and over the femoral head. The probe should then be rotated 45 degrees so that it is parallel to the inguinal crease.

Visualize and identify the femoral head and femoral artery (Figure 3). While maintaining the femoral artery in view, slide the probe cephalad until the ilium, the AIIS and the IPE come into view with the psoas tendon located just on top of the ilium (Figure 4). The target for anesthetic placement is the osseous surface of the ilium just below the psoas tendon.

## Performing the Procedure

As nerve blocks are typically done with aseptic technique, the skin should be prepped in a sterile fashion, and a sterile cover should be placed on the probe. Apply sterile gel to the skin and again identify the landmarks for the block. While maintaining the probe in a firm position, identify the needle insertion site for in-plane approach. The insertion site is approximately 2 cm away from the probe.

Using a 27g needle, inject a small amount of local anesthetic to create a skin wheal at the intended needle insertion site. Then, begin inserting a 20-22g block needle in line with the probe and adjust as needed until the needle can be visualized on the US screen. If satisfied with the projected path of the needle, continue to advance the needle until it reaches the desired location just deep to the psoas tendon. After ensuring that the needle has penetrated the overlying fascia layer, aspirate to confirm that vasculature was not accidentally punctured. Begin hydrodissection with small amounts of sterile normal saline to lift the psoas tendon from the ilium. Visualizing the elevation of the psoas tendon confirms that the needle is in the correct position, and the operator can begin injecting local anesthetic (Figure 5).

The volume of the anesthetic will be determined by a weight-based approach to avoid toxicity. In general, the total volume for this block will be near 40-50 cc. Typically, the anesthetic volume will need to be supplemented with sterile normal saline. It is important to note that if the operator is experiencing pressure while injecting, the needle should be readjusted into the space below the psoas tendon to avoid injection into muscle or tendon.

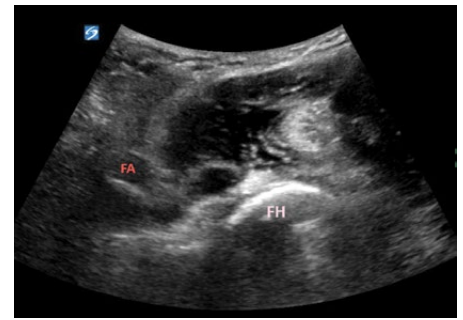
## How Effective is the PENG Block?

In theory, the PENG block has certain advantages in comparison to other existing hip blocks. Because it encompasses a larger selection of sensory nerves, the PENG block should result in more extensive analgesia which may potentially result in less opioid use.<sup>6</sup> Furthermore, as the PENG block targets the sensory nerves, it may avoid motor blockade which would allow for earlier mobilization by patients.<sup>6</sup>

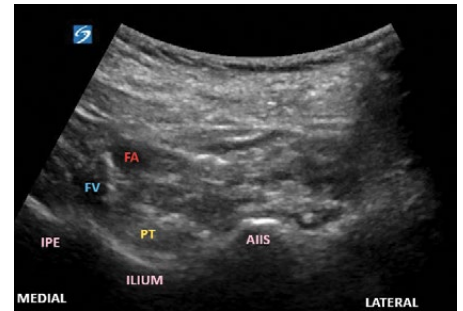
Because the PENG block is relatively new, most of the available literature on its effectiveness consists of case reports and case series. A comprehensive literature review identified 74 patients who received the PENG block, the vast majority of whom were undergoing surgery or arthroplasty.<sup>6</sup> Overall, utilization of the PENG block, whether in isolation or in combination with other blocks, resulted in decreased pain and administration of opioids.<sup>6</sup> No serious adverse events were reported, and only two patients experienced quadriceps weakness, likely due to deposition of anesthetic in unintended locations.<sup>6</sup> Although promising, it is difficult to evaluate the efficacy of this block given the lack of observational studies and randomized-controlled trials.<sup>6</sup>

There are several trials in progress comparing the PENG block to other blocks. One double-blinded study comparing the PENG block to the femoral nerve block demonstrated that patients who received the PENG block reported significantly less pain in the recovery room and maintained better quadriceps strength than those receiving the femoral nerve block.<sup>1</sup>

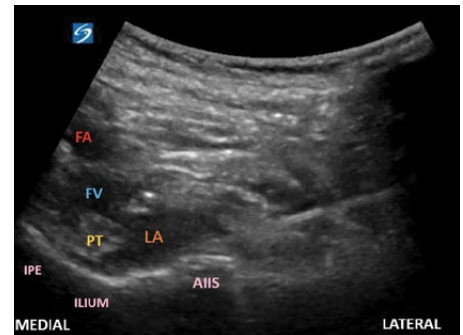
Although this block appears to be most commonly performed by anesthesiologists



**FIGURE 3. Starting Point Landmarks** (FA = femoral artery, FH = femoral head)



**FIGURE 4. Anatomy Prior to Anesthetic Administration** (FA = femoral artery, FV = femoral vein, PT = psoas tendon, AIIS = anterior inferior iliac spine, IPE = iliopubic eminence)



**FIGURE 5. Administration of Local Anesthetic** (FA = femoral artery, FV = femoral vein, PT = psoas tendon, AIIS = anterior inferior iliac spine, IPE = iliopubic eminence, LA = local anesthetic)

in the perioperative setting, successful utilization of this block in the ED has been described. *Luftig et al* report that use of the PENG block in the ED provided three patients with pelvic fractures enough analgesia such that they were able to move the hip with minimal or no discomfort.<sup>8</sup>

Though more studies are needed to validate its performance and ability to spare motor function, the PENG block has already shown great potential for alleviating acute hip pain in the ED. ★



# POCUS for the Win

## Focal Segmental Glomerulosclerosis

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### CASE

#### 9-Year-Old Female with Generalized Edema and Dyspnea

A previously healthy, fully immunized 9-year-old female presents to the emergency department with 3-4 weeks of worsening edema in her face, abdomen, and lower extremities; progressive dyspnea on exertion; and orthopnea. She has no history of fever, upper respiratory symptoms, diarrhea, or sore throat. A review of systems is otherwise negative. Physical exam demonstrates left-sided facial edema, bibasilar rales, tachypnea with subcostal retractions while supine that improves with sitting up, anasarca, and trace peripheral edema of both lower extremities. Point-of-care ultrasound was used for bedside evaluation of

the anasarca and to evaluate for other possible sources of orthopnea.

#### **Diagnosis: Focal Segmental Glomerulosclerosis**

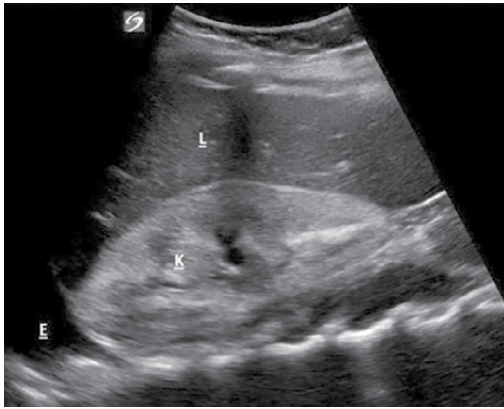
In the ultrasound images above (Figures 1-3), the patient had demonstrated hyper-echogenicity of both kidneys suggestive of medical renal disease. In addition, the ultrasound discovered bilateral pleural effusions that ultimately required diuretic therapy. The patient was found to be hypertensive to the 150s/90s and was treated with isradipine in the emergency department.

Labs and urine studies revealed an acute kidney injury (creatinine of 1.1 mg/dL), proteinuria (5,486 mg/L) with an elevated urine protein to creatinine ratio (9.6 mg/mg), hypertriglyceridemia (622 mg/dL), hypoalbuminemia (2.7 g/dL), hyperparathyroid (108.3 pg/mL), normal C3 and C4, and a normocytic anemia (hemoglobin 7.3 g/dL, MCV 82.9 fL).

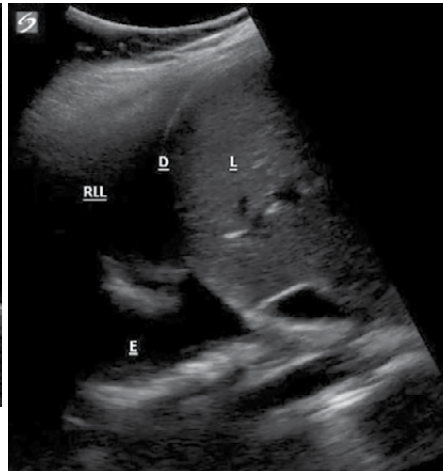
Biopsy of the left kidney revealed focal segmental glomerulosclerosis (FSGS) with scarring, mild tubular atrophy, and interstitial fibrosis. The patient was discharged on hospital day three with amlodipine for blood pressure management and prednisolone for FSGS.

#### **Ultrasound Review: Renal Ultrasound**

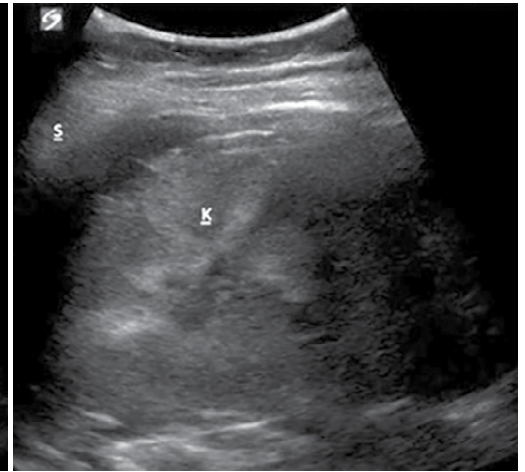
PoCUS can be used to help evaluate patients with suspected kidney pathology and to diagnose causes of renal colic, renal failure, hematuria, and decreased urine output. Compared to computed tomography (CT), ultrasound can result in shorter lengths of stay, lower cost, and improved safety. Renal ultrasound is becoming more popular as the initial test in the evaluation of suspected nephrolithiasis and renal colic. There are a few dilemmas involved in utilizing renal ultrasound to diagnose nephrolithiasis since ultrasound is not accurate in



**FIGURE 1. PoCUS of Patient's Right Kidney.** L = liver, K = kidney, E = pleural effusion



**FIGURE 2. PoCUS of Patient's Right Lung Base. Showing a positive spine sign.** RLL = right lung, E = pleural effusion, D = diaphragm, L = liver



**FIGURE 3. PoCUS of Patient's Left Kidney.** S = spleen, K = kidney

predicting stone passage and, unlike CT scan, does not evaluate other causes of flank pain.

### Technique

To perform a renal ultrasound, a curvilinear transducer should be used for optimal axial and lateral resolution. Each kidney should be scanned in 2 planes: longitudinal and transverse. Physicians can quickly assess for medical renal disease on both sides using a standard RUQ (Morrison's Pouch) window as well as a standard LUQ (splenorenal) window. Remember, the left kidney is more posterior and superior. Color and Doppler modes can be utilized to differentiate between vascular and non-vascular structures such as hydronephrosis, and for blood flow restriction as patients with nephrotic syndrome are at higher risk for coagulopathy including renal vein thrombosis.

1. **For the right kidney:** Place probe on the patient's right side along the mid-axillary line at the most intercostal space with probe marker initially pointing towards the head. The probe should be rocked from superior to inferior pole of the kidney and fanned from anterior to posterior to evaluate the entire kidney. After the longitudinal view is obtained, the probe marker should be oriented anterior to create the

transverse view of the kidney.

The probe should be fanned again superior to inferior to visualize the entire kidney. Slide the probe towards the head to visualize the diaphragm to evaluate for fluid above the diaphragm.

2. **For the left kidney:** place the probe initially over the posterior axillary line at the second most inferior intercostal space. The probe marker should be oriented towards the patient's head and then anteriorly.

### TIP#1

For the left kidney, the knuckles should be touching the cot for optimal views.

### TIP#2

Having the patient take breaths in and holding (briefly) may allow for the structures to come into better view as well.<sup>8</sup> ★

### Check out these videos for a walkthrough of the renal ultrasound

[3D How To: Left Kidney Ultrasound – SonoSite Ultrasound](#)

### Check out these videos for a walkthrough of a pleural effusion

<https://www.coreultrasound.com/pleural-effusions-part-1>

<https://www.coreultrasound.com/pleural-effusions-part-2>

## TAKE-HOME POINTS

- ✓ FSGS is a major cause of morbidity stemming from the many proteins that are lost in the urine (eg, albumin creating pleural effusions, immunoglobulins causing an immunocompromised state, and antithrombin inducing a coagulopathic environment).
- ✓ Physicians can quickly assess both kidneys for sonographic patterns such as changes to the parenchymal echogenicity, corticomedullary differentiation, and renal size as possible indicators that the nephrotic syndrome is more complex than minimal change disease.
- ✓ Remember to always evaluate both kidneys in both longitudinal and transverse axis.
- ✓ Having the patient take breaths in and holding (briefly) may allow for the structures to come into better view.
- ✓ If there is concern for renal colic or nephrolithiasis, consider scanning the bladder as well.
- ✓ Consider scanning above the diaphragm as well when assessing the kidneys to look for pleural effusions.<sup>7,8</sup>

# ED Management of Emphysematous Pyelonephritis

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**E**mphysematous pyelonephritis is a rare diagnosis in the ED but can be life-threatening. Typically an evolution from ascending *E. coli* cystitis,<sup>1</sup> its hallmark and namesake is intraparenchymal gas produced by necrotizing infection. Patients at higher risk for developing this condition include female patients and persons with diabetes (70%-90%),<sup>2-4</sup> frequently with preexisting microvascular complications, such as diabetic neuropathy and nephropathy.<sup>4</sup>

Patients are typically ill-appearing and often present with flank pain, dysuria, pyuria, acute kidney injury, bacteremia, and sepsis.<sup>5,6</sup> However, many present with more ambiguous abdominal symptoms, and the cause is elucidated only on imaging.<sup>6,7</sup> Imaging is critical to the diagnosis and expeditious treatment of emphysematous pyelonephritis, as patients may need aggressive source control via nephrostomy tube, stent, or less commonly nephrectomy.<sup>8</sup> We present a patient with an atypical presentation of emphysematous pyelonephritis.

## Case

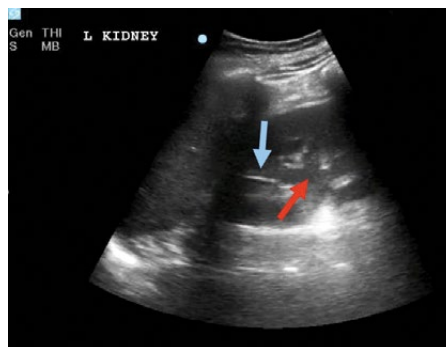
A 62-year-old female patient presented to the ED with a 4-day history of diffuse, vague abdominal pain. She reported pain primarily over the left upper quadrant and bilateral flanks, along with subjective fever, nausea, and emesis. She denied dysuria and hematuria. Past medical history was significant for long standing hepatitis C, cirrhosis, and a recent diagnosis of hepatocellular carcinoma. She also had a history of unspecified liver surgery after

a high-speed motor vehicle crash in the remote past.

Vitals on arrival demonstrated elevated blood pressure, tachycardia to the 100s, and temperature of 100.1°F. Physical exam revealed an uncomfortable patient with diffuse abdominal and flank tenderness. Initial lab testing was significant for a leukocytosis to  $21.6 \times 10^3/\mu\text{L}$ . Urinalysis was negative for nitrates, leukocyte esterase and bacteria; positive for protein +1, ketones, and hemoglobin +1.

The patient was started on IV fluids and broad-spectrum IV antibiotics.

Abdominal point-of-care ultrasound demonstrated linear air with shadowing within the kidney parenchyma, concerning for emphysematous pyelonephritis.



## When to Ultrasound?

Abdominal pain is a common presenting complaint in the emergency department.<sup>8</sup> In the case of this patient with vague abdominal symptoms, without obvious urinary symptoms, and with a negative urinalysis, suspicion for kidney stone or pyelonephritis was not particularly high, let alone the much rarer diagnosis of emphysematous pyelonephritis in a non-diabetic patient. POCUS is an excellent option that can be performed rapidly at the bedside, and for many cases of abdominal pathology including small bowel obstruction, cholecystitis, appendicitis, and obstructive renal processes may either inform the decision to proceed with CT or bypass it altogether.

**When in doubt, pick up the ultrasound probe — a simple FAST exam along with survey of the kidneys and bowel can indicate some intraabdominal sources of sepsis along with free fluid, dilation of the bowel, and more.**

## Case Resolution

After diagnosis of emphysematous pyelonephritis was made, the patient was sent for nephrostomy tube placement with interventional radiology. Tube placement was uncomplicated and interval CT scan demonstrated decompression of the collecting system. Shortly after returning from the radiology suite, she decompensated precipitously, quickly becoming hypotensive despite fluid resuscitation and was started on vasopressors.

She was admitted to the ICU for ongoing management of sepsis secondary to emphysematous pyelonephritis, including IV antibiotics. Blood and urine cultures grew pan-sensitive *E. coli*, and IV antibiotics were deescalated to ceftriaxone. The patient improved significantly over the following 48 hours, transitioned to general care, and one week after admission the patient was discharged from the floor. ★





# Blocking Breaks to Breathe Better

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## Case

**A** 54-year-old man presented to the ED with a chief complaint of left chest wall pain. He reported that he was in a bar fight several days ago, and since then had persistent pain in his left chest where he was struck. The pain is worsened with deep inspiration and coughing. He denied any other injuries, and a review of systems revealed no other complaints.

Vital signs were blood pressure 173/94, heart rate 95, respiratory rate 18, temperature 98.9°F, and pulse oximetry 95% on room air. Physical exam revealed clear lung sounds bilaterally. The patient's left lateral chest wall was tender, but there was no crepitus, ecchymosis, or deformities. No other injuries were identified. Imaging revealed lateral nondisplaced fractures of the left 3rd and 4th ribs only.

## Background

Chest wall injuries are a common injury in the United States, with rib fractures being a typical manifestation. The Eastern Association for the Surgery of Trauma (EAST) estimates that rib fractures account for 10% of patients hospitalized for trauma. Elderly patients with multiple rib fractures, in particular, have a mortality of 3-13%, leading many protocols to necessitate intensive care unit (ICU) admission for such patients.<sup>1</sup> A large degree of mortality is attributed to chest wall pain impacting respirations and cough, leading to pulmonary complications such as pneumonia, and thus management is directed toward adequate analgesia.

EAST guidelines recommend using several pain control modalities, including oral and parenteral medications as well as

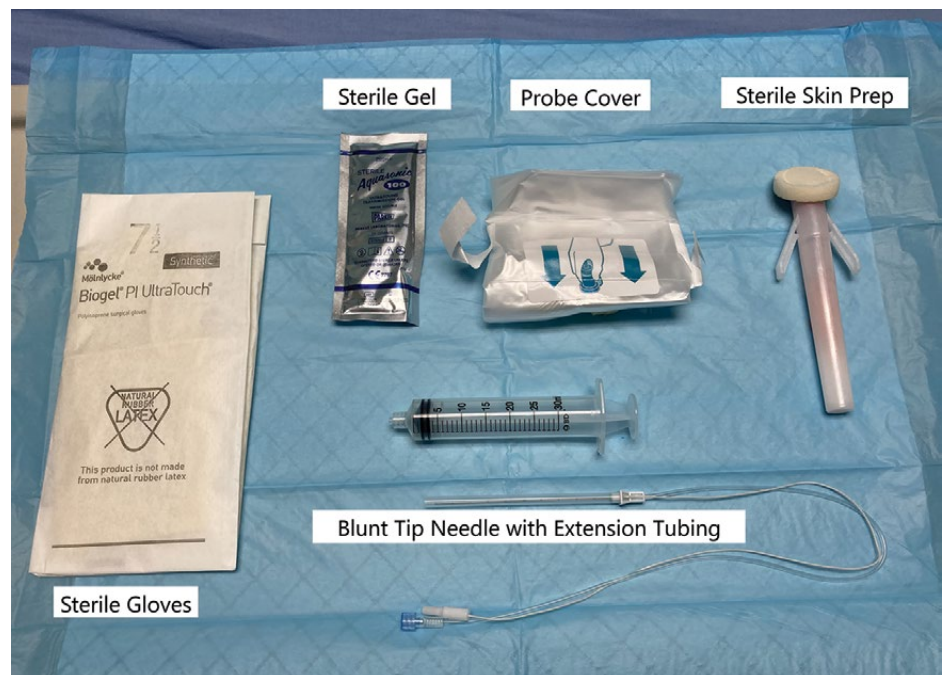
regional anesthesia. Regional anesthesia is associated with reduced opioid use and improved pulmonary toilet, which can be particularly desirable in elderly patients prone to delirium and post-rib fracture pneumonia.<sup>1-4</sup> However, the described techniques include methods such as epidural anesthesia or thoracic paravertebral blocks (TPVB), which emergency physicians are not routinely trained to perform and thus are not readily available in the ED.

One potential alternative is the ultrasound (US)-guided serratus anterior plane block (SAPB). The SAPB was first described in 2013 as a way to anesthetize the chest wall for breast surgery.<sup>5</sup> Since then, it has been adopted for many other purposes, including analgesia after chest wall trauma.<sup>6,7,8</sup> Small studies have found non-inferiority between the SAPB and thoracic epidural anesthesia or TPVB for traumatic rib fractures; with SAPB also avoiding the undesirable sympathetic effects of neuraxial anesthesia.<sup>7,8</sup> Additionally, there are no contraindications in patients with coagulopathy or on antiplatelet/anticoagulant therapy, and SAPB is relatively easy to perform by an emergency physician trained in US-guided procedures.

## Performing the Block

A sample of acceptable equipment is displayed in Figure 1. The patient is placed ideally in the lateral recumbent position, with the hemithorax to be anesthetized up. After sterile preparation of the skin, a high-frequency linear US transducer in the transverse orientation

**Elderly patients with multiple rib fractures, in particular, have a mortality of 3-13%, leading many protocols to necessitate intensive care unit (ICU) admission for such patients.**



**FIGURE 1. A Sample of Acceptable Equipment**

is placed in the middle to the posterior axillary line, at the level of the 4th and 5th ribs. (Note: some sources suggest the 5th and 6th ribs, but as anesthetic will spread along a fascial plane, a plane block requires less precise infiltration).<sup>9</sup>

Physicians should choose the local anesthetic most appropriate to the desired duration of effect. Our experience with the indications for SAPB would typically require a longer-acting anesthetic such as bupivacaine. The maximum dose of anesthetic should be calculated for each patient in order to avoid local anesthetic systemic toxicity (LAST). Even when below the maximum dose, patients should be placed on a cardiac monitor, with pulse oximetry and IV access, as well as ready access to intralipid emulsion.

Key structures to identify are the latissimus dorsi muscle, the serratus anterior muscle, the 4th and 5th ribs, and the underlying pleural line as demonstrated in Figure 2. The block will principally anesthetize the lateral cutaneous branches of the intercostal nerves, which penetrate both above and below the serratus anterior muscle.

Enter the skin with the needle in-plane with the probe orientation. The needle should be advanced until the tip is visualized in the plane between the

latissimus dorsi and serratus anterior muscle, or alternatively may be placed below the serratus anterior muscle, above the ribs. Some operators have suggested angling the needle toward the rib, as a “backstop” to prevent the needle from violating the pleura should the patient cough or move. Ideally, with the help of a second operator and after aspiration to avoid intravascular injection, a small amount of anesthetic is injected to confirm the position of the needle tip, often termed “hydrodissection.” If the anechoic fluid appears to flow backwards towards the needle, this suggests the tip is placed in the muscle belly and needs to be adjusted. If appropriately placed, fluid will advance away from the needle tip, with clear separation of the lats and serratus anterior, as in Figure 3. Once the placement is confirmed, the remainder of the anesthetic may be slowly injected, with periodic gentle aspiration.<sup>10,11,12</sup>

In addition to LAST, performers of the SAPB should evaluate the patient afterward for signs of pneumothorax, which can quickly and easily be done with high accuracy with ultrasound at the point of care. One case report suggested that pneumothorax may be less likely when placing an anesthetic

above the serratus anterior muscle, with the trade-off that the patient may experience less relief; however, there are no high-quality studies yet to confirm this.<sup>13</sup> There have also been concerns raised regarding blockade of the long thoracic nerve during SAPB interfering with its identification during axillary dissection in surgery, but this would likely be less important when performed for non-surgical chest wall pain.<sup>14</sup>

### What's Next

US-guided regional anesthesia is relatively new in the ED, partially due to several real and perceived barriers to its use, such as increased time to perform the block, or lack of familiarity with nerve identification and nerve block technique. Helpful to the emergency physician is the recent American College of Emergency Physicians' (ACEP's) policy paper supporting the use of ED US-guided nerve blocks.<sup>15</sup> Ongoing research and educational

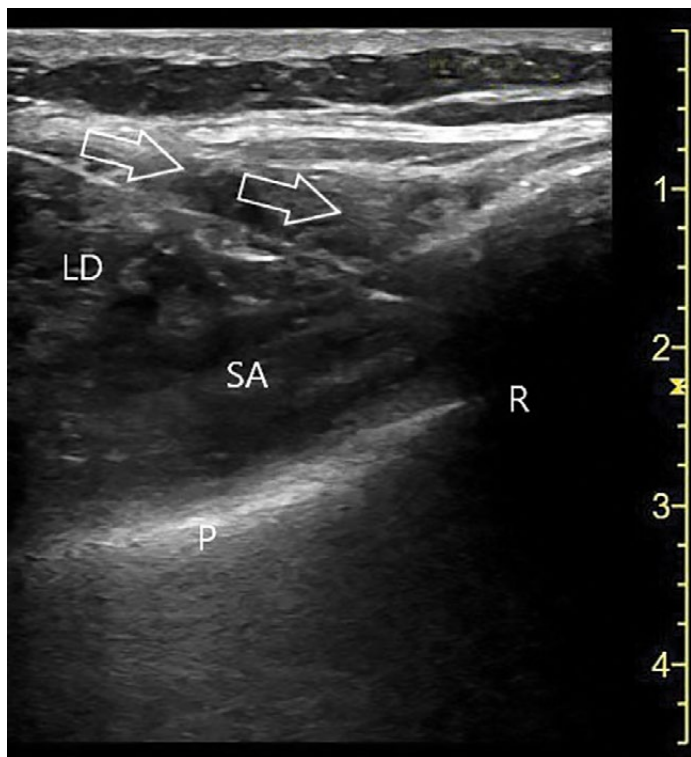
## EAST guidelines recommend using several pain control modalities, including oral and parenteral medications as well as regional anesthesia.

training initiatives for UGRA in EM training programs will help to alleviate subspecialty resistance, which is often cited as a barrier for performing more common blocks such as the fascia iliaca compartment block for hip fractures.<sup>16</sup> As training in US-guided procedures during residency becomes more commonplace, more and more physicians will be familiar with the basic procedural tenets to accomplish UGRA.

The use of SAPB blocks in the ED is currently a topic of ongoing research, with several studies registered on ClinicalTrials.gov. With emergency physicians becoming more familiar with this block, it can be adopted for other painful chest wall conditions, such as herpes zoster, chest wall abscesses or lacerations, and thoracostomy tube placement.<sup>17</sup>

### Case Conclusion

*After obtaining patient consent, a left-sided SAPB with 10mL of 0.5% bupivacaine and 20mL of sterile normal saline was performed under US guidance. No complications were noted, and on re-evaluation 10 minutes after the procedure, the patient-reported complete relief of his pain. He was discharged home with recommendations for continued over-the-counter analgesic medicines and clear return precautions. A follow-up phone call revealed high patient satisfaction with effective pain relief in the subsequent 10-12 hours. ★*



**FIGURE 2. LD – Latissimus Dorsi**  
SA – Serratus Anterior; R – 4th Rib, P – Pleural line;  
Arrows – Needle path



**FIGURE 3. Anesthetic Placement (A)**

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## A REAL PAIN IN THE MOUTH

# Acquired Methemoglobinemia

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We present the case of an adult female evaluated at an emergency department 3 times with cyanosis and hypoxia. She is ultimately found to have methemoglobinemia due to several days of topical benzocaine use following oral surgery.

Acquired methemoglobinemia, a pathologic condition due to elevated quantities of methemoglobin in the blood, is an infrequent presentation in a healthy adult patient. More commonly, children and those with underlying oxidative disturbances may develop acquired methemoglobinemia as they have less enzymatic activity to reduce methemoglobin. Unlike hemoglobin,

methemoglobin is a poor oxygen carrier, and thus methemoglobinemia causes hypoxia and cyanosis. Benzocaine and dapsone are the most common triggers of acquired methemoglobinemia.

This case illustrates the risk associated with topical anesthetics, and demonstrates the clinical presentation, pathophysiology, and management of methemoglobinemia.

### **Case**

A 56-year-old female with a history of smoking and oropharyngeal cancer status post radiation therapy presented to the emergency department with hypoxia and cyanosis but no respiratory distress. The patient arrived via

emergency medical services (EMS) with no complaints. Her husband called EMS when he noticed she was turning blue while seated in a chair. Her review of systems was negative for lightheadedness, vision changes, headaches, chest pain, palpitations, shortness of breath, recent travel, leg swelling, or pain. Her vitals were significant for an oxygen saturation of 74% on room air but otherwise normal. Her physical exam was notable for a thin adult female in no distress with cyanosis. Her lungs were clear to auscultation bilaterally and she had a regular rate and rhythm on cardiac auscultation.

Notably, this was the patient's third visit to the emergency department within the prior week. Her first visit was for a mechanical fall where she was noted to be hypoxic, but without pulmonary complaints. She underwent a CT scan to evaluate for pulmonary embolism (PE), which was negative for a PE, but it did reveal chronic lung disease and subacute anterior left 5th and 6th rib fractures. She was discharged after her oxygen level stabilized following supplemental oxygen administration and she was able to ambulate without desaturation.

Four days later, the patient again presented to the ED with chief complaints of weakness and fatigue. She was noted to have an oxygen saturation in the 70s on room air. Arterial blood gas (ABG) at that time was within normal limits. She was offered admission and further workup but declined. The clinician considered that the patient's poor oxygen saturation could be due to an inaccurate reading by the machine given her lack of symptoms. She was recommended to follow up with pulmonology and her primary care physician.

One day after her second visit, we evaluated her again, as her husband had noticed recurrence of her cyanosis. She was again hypoxic and immediately placed on 15 L non-rebreather mask. We obtained a chest x-ray which was normal and a venous blood gas which revealed a pH of 7.36, pCO<sub>2</sub> of 35, and pO<sub>2</sub> of 39. Other basic labs were relatively unremarkable.

Given her recent presentations for similar complaints and visible cyanosis,

we considered shunt physiology on our differential. An ABG was significant for a PaO<sub>2</sub> of 200. The respiratory therapist noticed an abnormal dark color of the arterial blood sample and brought it to show us. She was concerned that it may be venous as it appeared very dark, almost chocolate, in color. Notably, arterial carboxyhemoglobin level was 0.5% and methemoglobin level was 16%.

After further discussion with the patient, it was discovered that 3 days prior to her first visit she underwent oral surgery for tooth extraction, gum debridement, and alveolar recontouring for oral prosthesis. She admitted to using copious amounts of topical benzocaine and had used benzocaine just prior to her presentations to the emergency department.

Her hypoxia was subsequently attributed to methemoglobinemia secondary to excessive benzocaine use. The case was discussed with the local poison control center, and it was determined that the patient did not meet criteria for administration of methylene blue. She was admitted for observation and within 24 hours had resolution of her cyanosis and hypoxia following benzocaine cessation. She was discharged with instructions to avoid any additional topical benzocaine.

## Discussion

Methemoglobin is created when the iron in hemoglobin is oxidized from the ferrous (Fe<sup>2+</sup>) to the ferric (Fe<sup>3+</sup>) state. When hemoglobin has normal oxygenation, the electron undergoes partial transfer to the oxygen bound to the iron. When the oxygen is released, the electron returns to the iron. Methemoglobin forms if the electron is not returned to the iron appropriately.

Using the enzymes NADH-dependent methemoglobin reductase and cytochrome b<sub>5</sub> reductase (CYB5R), our bodies maintain methemoglobin levels below 1% of our total serum hemoglobin.<sup>1</sup> In a typical adult patient without underlying anemia, cyanosis will occur when methemoglobin comprises 15% of total hemoglobin. Symptoms of toxicity including profound acidosis, arrhythmias, seizures,

and coma can occur at methemoglobin levels over 50%.<sup>2</sup>

The treatment of toxic levels of methemoglobin starts with 1 to 2 mg/kg of intravenous methylene blue with normal saline. After rapid infusion, one may re-dose at 1 mg/kg after 30 minutes if needed. Methylene blue requires glucose-6-phosphate dehydrogenase (G6PD) activity, as it acts through the reduced form of nicotinamide adenine dinucleotide (NADPH) reductase system. Patients with G6PD deficiency, or those who have severe methemoglobinemia, may require exchange transfusion or hyperbaric oxygen therapy in order to clear the methemoglobin. Most mild cases of methemoglobinemia do not require treatment, but rather can be monitored for 1 to 3 days. Frequently, methemoglobin levels return to normal as long as the offending agent is identified and discontinued.<sup>1</sup>

Topical oral anesthetics are a known cause of methemoglobinemia. Children and those with underlying oxidative disturbances such as G6PD deficiency are at higher risk of developing acquired methemoglobinemia. Infants less than three months of age are at particularly high risk, as they have less enzymatic activity to reduce methemoglobin<sup>3</sup> and a higher percentage of fetal hemoglobin, which is easier to convert to methemoglobin. Regarding the most common causes of acquired methemoglobinemia, benzocaine was surpassed only by dapsone in a retrospective case study. However, it was found that the mean peak of methemoglobin level was significantly higher in cases due to benzocaine use than in those due to dapsone use (43.8% and 7.6% respectively).<sup>4</sup>

This case highlights the importance of maintaining a broad differential, especially when patients return to the ED with the same complaint. For patients presenting with hypoxia and cyanosis, acquired methemoglobinemia should be included on the differential. Dapsone and topical anesthetics are common offenders in methemoglobinemia, so a thorough medication history is pertinent to diagnosing and treating this condition. ★

# A Case Report of Torsades de Pointes and Hemochromatosis

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## Case

A 33-year-old female with past medical history of hypothyroidism, questionable hemochromatosis, and alcohol use disorder presented to the emergency department (ED) with a chief complaint of palpitations. She was at an appointment with her hematologist when she began to feel lightheaded and experienced palpitations. Vital signs at the clinic revealed tachycardia with a rate >200 BPM along with borderline hypotension. Therefore, she was sent to the ED for further evaluation.

Prior surgeries include herniorrhaphy. She reported using 1 pack of cigarettes per day, a history of alcohol use, and no recreational drug use. Her prescription medications included levothyroxine, hydroxyzine, and omeprazole.

On arrival to the ED, the patient had laboratory results from her hematologist from several days prior, which were notable for a potassium of 2.8 mEq/L. She stated that she had previous issues with hypokalemia of unclear etiology. Initial vital signs in the ED included HR 99 BPM, BP 98/53, otherwise normal. EKG in triage showed a rate of 142 BPM and multiple runs of wide complex tachycardia consistent with ventricular tachycardia with intermittent supraventricular beats (Figure 1). She was immediately brought to a room and placed on the cardiac monitor. She continued to have 5-10 second runs of monomorphic ventricular tachycardia followed by several seconds of normal sinus rhythm. She then developed nausea and was given 4 mg IV ondansetron.



While labs were being drawn, defibrillator pads were applied, and she was given 10 mEq IV potassium chloride given her known hypokalemia. She was given a bolus of 150 mg amiodarone followed by an amiodarone drip of 1 mg/minute. She also received 2g magnesium sulfate given the known relationship between hypokalemia and hypomagnesemia. After several minutes, repeat EKG revealed normal sinus rhythm with a long QT interval of >500 msec (Figure 2).

In further discussion with the patient, she revealed that she did have a history of a long QT interval in the past which was attributed to hypothyroidism, but that her QT interval reportedly normalized at that time. Her labs in our ED were significant for a potassium of 2.7 mEq/L, mildly elevated total bilirubin of 1.7 and AST of 85 with normal ALT of 40. Her CBC was unremarkable. Her troponin was not elevated. Her TSH was elevated at 3.95 with a normal free T4 level of 0.90. After her labs resulted, her potassium was repleted further with 40 mEq IV KCl

and 30 mEq PO KCl. Cardiology was consulted and agreed with continuing the amiodarone drip and aggressively repleting her potassium.

Several hours later while waiting for an inpatient bed, she became unresponsive, cyanotic, and pulseless. Cardiac monitor revealed polymorphic ventricular tachycardia consistent with torsades de pointes. Chest compressions were performed, and the patient was defibrillated once at 200 J biphasic. She regained pulses and returned to her normal level of consciousness after a few minutes. She did not require intubation. Cardiology was again called, who advised discontinuing the amiodarone drip and recommended giving her a lidocaine bolus followed by a continuous lidocaine infusion; 2g IV magnesium sulfate was also administered. She was then admitted to the ICU for further workup and close monitoring.

## Discussion

Torsades de pointes is a subcategory of polymorphic ventricular tachycardia. It is associated with long

QT syndrome and characterized by the unique appearance of small and large amplitude of complexes that appear as though a ribbon is being “twisted around a point.” Common causes include electrolyte abnormalities (hypokalemia, hypomagnesemia, hyperphosphatemia, hypocalcemia), Class 1A antiarrhythmics (procainamide, quinidine, disopyramide), and other medications (many psychotropic medications, antibiotics, antiemetics). Some patients with long QT syndrome have a congenital cardiac ion channel defect that results in a long QT interval.

Interestingly, there have been cases of long QT and torsades de pointes associated with hemochromatosis due to elevated iron stores. It has been hypothesized that even in patients without any known genetic cause of long QT syndrome, without any electrolyte derangements, and without any structural cardiac abnormalities, significantly elevated iron stores may result

in iron deposition in cardiac tissue. Cardiac hemochromatosis may result in a long QT interval and progress to polymorphic ventricular tachycardia due to intramuscular conduction delay.<sup>3</sup> Animal models have also correlated elevated iron stores with increased rates of sudden cardiac death. Ferric iron has been shown to disturb calcium and potassium channels, particularly in phase 2 of the cardiac action potential, which corresponds directly to the length of the QT interval.<sup>4</sup>

### Case Conclusion

While in the hospital, the patient did not have any additional ventricular tachydysrhythmias. She was treated with beta-blockers and about 36 hours of IV lidocaine infusion. An inpatient echocardiogram was unremarkable, and cardiology had low suspicion for contributing cardiac ischemic events. She was fitted for a LifeVest prior to discharge and was referred for more comprehensive genetic testing regarding congenital long

QT syndrome and possible need for an implanted defibrillator.

Review of the patient’s records show that about 5 weeks prior to her presentation in the ED with ventricular tachycardia, her ferritin level was severely elevated >1650 ng/mL (normal range 10-291). She had not yet had any phlebotomy or pharmacologic treatment for iron overload between that lab measurement and her cardiac dysrhythmia.

She was also encouraged to reschedule her phlebotomy appointment with her hematologist given the possible contribution of iron overload on dysrhythmias. While she did test negative for three different genotypes that have been associated with hemochromatosis (H63D, C282Y, and S65C), there may be genotypes not yet identified that would correlate with hemochromatosis and explain her iron overload.

This patient did also undergo the aforementioned genetic testing required to assess whether she has congenital long QT syndrome. Her workup showed she had an autosomal dominant mutation in a gene KCNE1 D76N, which is associated with potassium channel defects in cardiac tissue that can lead to a prolonged QT interval.<sup>6</sup>

This patient had multiple factors that likely contributed to her development of ventricular tachycardia and ultimately torsades de pointes. She presented with severe hypokalemia and hypomagnesemia in addition to having severely elevated iron stores and carrying a mutation in a gene that encodes cardiac potassium channels, all of which increased her risk of prolonged QT interval and progression to torsades de pointes.<sup>1-3</sup> In addition, she had received amiodarone, which is generally a good choice for treatment of ventricular tachycardia and appeared to initially stabilize the patient. However, amiodarone may also increase QT interval, and thus should not be the first choice once established that a patient has a prolonged QT interval.<sup>5</sup> In such scenarios, electrolyte correction, magnesium infusion, and lidocaine are the mainstays of treatment. In the case of patients with underlying hemochromatosis, emergent phlebotomy and deferoxamine treatment may also be considered.<sup>3</sup> ★



FIGURE 1. EKG in Triage

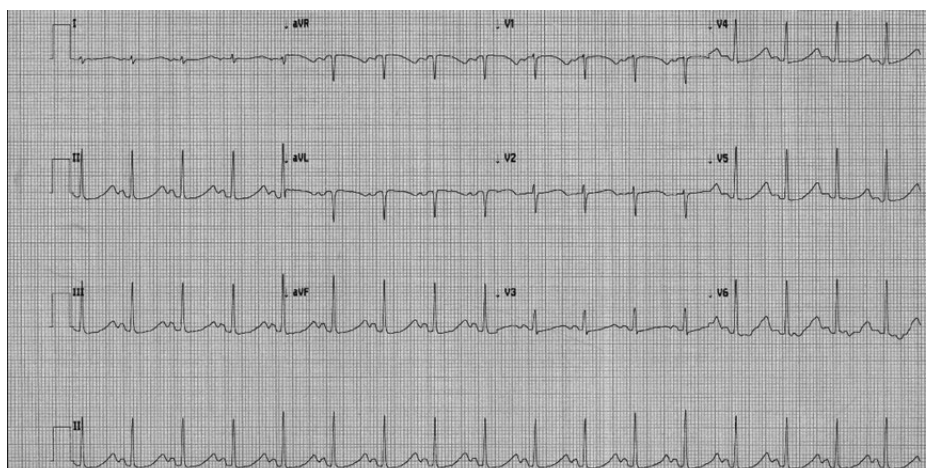


FIGURE 2. Repeat EKG

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# 3D Printing PPE in the COVID-19 Pandemic

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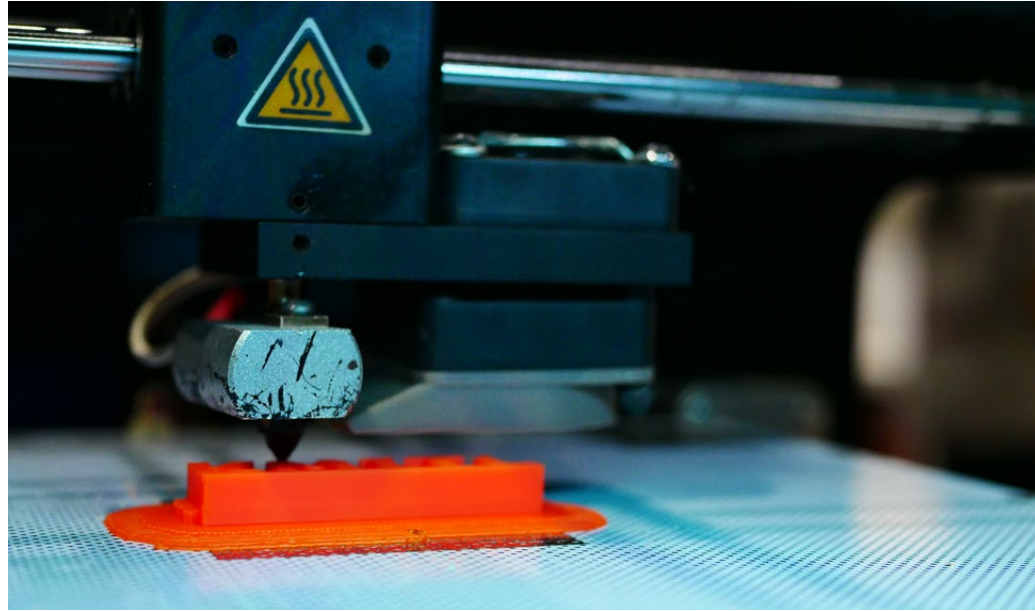
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Supply chain disruption during the COVID-19 pandemic has forced healthcare systems to look for alternative ways to meet dramatically increased demand for personal protective equipment (PPE). One potential solution to this problem is 3D printing of PPE. However, relatively few of these 3D-printed PPE designs have been evaluated by healthcare professionals, and many require extensive redesign to make them practical and safe for use. This paper outlines an interdisciplinary approach to evaluating and refining a 3D-printed face shield design for use in the Emergency Department of a level 1 Trauma center in eastern North Carolina. Survey data indicated that users of the 3D-printed face shields considered them equal to disposable shields in comfort and usability, and superior to disposable shields in durability and protection. A majority indicated they preferred using the 3D-printed shield. Given these results, we believe that 3D-printing of PPE is a viable approach to mitigating future PPE supply chain disruptions.

## Introduction

During the early days of the COVID-19 pandemic in 2020, health care systems across the United States

and worldwide experienced a dramatic disruption to supply chains providing PPE. Hospitals were forced to sanitize and reuse PPE and to look for alternative ways to meet the increase in demand. At Vidant Medical Center in Greenville, NC, one of those creative solutions was to manufacture PPE using 3D printers.

While 3D printing companies and enthusiasts around the country were actively designing and printing PPE such as face shields and N95-type respirators for personal use, few were being used and evaluated by healthcare professionals. In the months since the beginning of this project, several papers have been published describing similar efforts to produce 3D-printed PPE around the world.<sup>1,2,3</sup> To meet our own local needs at Vidant Medical Center in eastern North Carolina, a group of ECU students decided to create a 3D-printed face shield that would be suitable for use in the clinical setting. After several rounds of testing and refinement with a focus group of trauma surgeons and ED physicians, the final product was distributed to Vidant Medical Center ED physicians and survey data were collected to evaluate the face shields on

several qualities including durability, safety, usability, and user preference.

This project was a highly interdisciplinary undertaking. Brody School of Medicine students directed the project with support from local trauma surgeons and ED physicians. ECU's School of Art and Design faculty and students aided in printing and design. A local marine supply company graciously donated their CNC machine for cutting plastic to specifications. ECU's School of Dental Medicine donated silicon dental bib clips to use as headbands. We are grateful for their timely help to keep our frontline workers safe during the early days of the COVID-19 pandemic.

## Materials and Methods

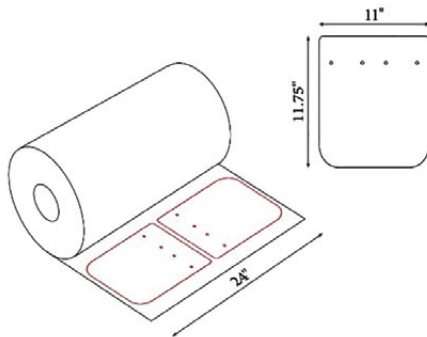
Face shields were assembled from a 3D-printed visor and a few widely available commercial products. These products include a silicon dental bib clip, weatherproofing window foam strips, and clear plastic sheeting.

For a headband, the original design from PRUSA<sup>4</sup> recommended the use of elastic buttonhole fabric, but given supply chain issues with fabric in the early days of the pandemic we sought

alternative options. Instead, silicon dental bib clips served as effective headbands. Their alligator clips attached easily to the visor, their length was adjustable, and they were easy to clean after use. These clips have an estimated cost of \$1.50 per unit.

Weatherproofing window foam strips served as a cushion for the user's forehead. Following testing of several different brands, Duck Brand Foam Weatherstrip Seal was chosen because the adhesive was the best for attachment to the printed visor. This cushion cost \$0.35 per face shield.

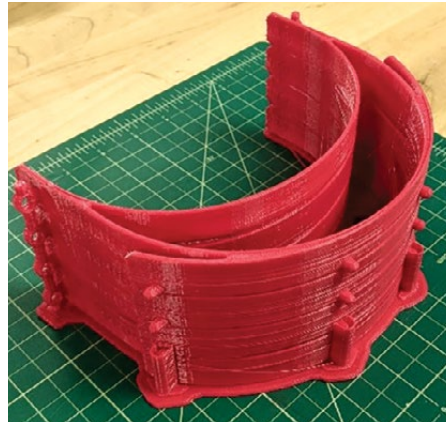
Whereas the bib clip and foam strips require minimal processing, the



**FIGURE 1. Suggested Roll Layout for Cutting Transparent Face Shield Material**

clear plastic sheeting must be cut into 11" x 11.75" rectangles with rounded corners and holes punched into the top to attach to the visor. These dimensions were chosen to maximize protection without compromising comfort and head mobility. A local marine supply group provided a CNC machine capable of cutting a large number of shields from a roll of plastic. A diagram of the correct dimensions and peg hole locations is shown in Figure 1. The plastic sheets we used cost \$0.64 per face shield.

To 3D print the visor component using PLA material, Makerbot 3D Replicator + and Makerbot 3D Replicator 5<sup>th</sup> Generation printers were used. After considering several publicly available designs, the PRUSA CR3 design was chosen for its robustness and stability, although this came at the cost of increased materials and printing times. This template was then modified with the help of ECU School of Design students



**FIGURE 2. Photo Depicting Stacked Visors to Increase Printing Efficiency**

using Maya 3D editing software. In its final iteration, the plastic cost \$1.48 per visor. To maximize printing efficiency, a stacked design was used so that a single print run produces 4 visors, as seen in Figure 2.

A Makerbot Replicator+ printer can produce 4 shields in 8 hours. The Innovation and Design Laboratory at ECU has a fleet of over 20 Makerbot Replicator+ and Replicator 5<sup>th</sup> generation printers (Figure 3), making it capable of producing 120 visors per day if all printers are used to maximal capacity. However, in practice, the printers experience malfunctions on approximately 10-20% of printing runs, necessitating some level of supervision to maintain maximal production.

The completed product currently has a cost of \$3.97 per face shield, not including the cost of the printer or electricity. Although this is likely a greater cost than most disposable face shields

used by hospitals, this shield is designed to be sanitized and reused many times. The final product is shown in Figure 4.

The completed face shield was distributed to residents and attending physicians in the ED of Vidant Medical Center. A survey was then distributed to users of the face shields to evaluate various qualities of the shield compared to the hospital's standard disposable shield (McKesson product #1049043).

Numerical rating scales from -50 to 50 were used to compare the shields based on certain attributes, where -50 represented a complete preference for disposable shields, 0 represented no preference, and 50 represented complete preference for the 3D-printed shield. Survey questions asked users to compare durability, protection, ease of communication, ease of performing procedures, comfort, and overall preference between the 3D-printed shield and disposable shield. Additional questions included the total hours of use, ease of cleaning, and whether corrective lenses were worn with the shield.

## Results

A total of 18 survey responses were submitted. Respondents used the shields for an average of 41 hours each. A graphic representation of the data comparing disposable and 3D-printed face shields is shown in Figure 5.

This chart summarizes the distribution of survey responses comparing qualities of the 3D-printed shield and the standard disposable shield. A score of 50 indicates complete preference for the 3D-printed shield



**FIGURE 3. The Innovation and Design Laboratory at East Carolina University has a large array of Makerbot Replicator+ and Makerbot Replicator 5<sup>th</sup> Generation 3D printers that were made available for our project.**



**FIGURE 4. Final Face Shield Product**

with respect to that quality, -50 indicates complete preference for the disposable, and 0 indicates no preference. Error bars represent 95% CI.

Respondents rated the ease of sanitizing the face shield favorably with an average rating of 15.71. For sanitizing, it was recommended to use ethanol wipes or spray as ethanol does not degrade the PLA material or the acetate sheeting used. PLA material is heat-labile and does not withstand autoclaving, and bleach also degrades the PLA material over time.<sup>1</sup>

Respondents also indicated they would be highly likely to use the shields in the event of a future PPE shortage with an average rating of 36.5, where a rating of -50 represents not likely at all and 50 represents very likely.

## Discussion

### Durability

3D-printed shields received a favorable durability rating of 28.61. This product is designed to be reused over multiple shifts. Printing settings can be altered to increase the density and strength of the visor even more, but this increases weight, materials, and printing times.

### Protection

3D-printed shields offered greater protection compared to the disposable shields as perceived by respondents, with an average rating of 22.25, likely due to its larger plastic shield.

### Comfort

Respondents indicated that the 3D-printed shield was roughly equal to the disposable in comfort with a rating of 4.82. Both have a foam pad to reduce pressure on the forehead. However, the 3D-printed shield is heavier and its strap thinner, placing more pressure on the back of the head. Future iterations may implement a wider strap for improved comfort.

### Ease of communication and performing procedures

Respondents reported that the 3D-printed shield was equal to the disposable in both aspects.

### Overall preference

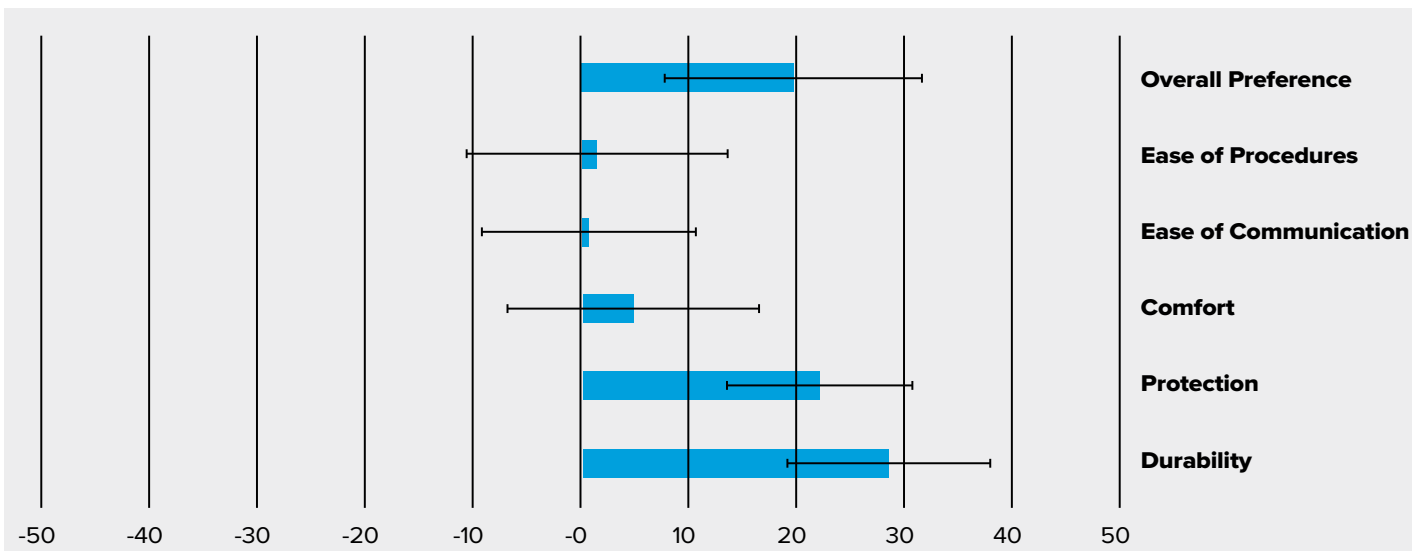
The 3D-printed shield was overall preferred with a rating of 19.81. This may

be due to user perception of increased protection and durability while retaining similar comfort and usability. Focus group feedback suggested that a major advantage of the 3D-printed shield was increased ventilation through the top visor portion, which reduced fogging.

There are several limitations of this study. The sample size was small and included providers from just one ED. The survey recorded user opinions about the face shields, but no formal evaluation of their effectiveness in reducing droplet transmission was undertaken. Additionally, no formal evaluation of the effectiveness of sanitizing was performed as has been done in other studies.<sup>3</sup>

## Conclusion

This project demonstrated the feasibility of supplementing a hospital's PPE supply through 3D printing techniques. This approach was cost-effective and created a durable, reusable product rated favorably by providers. In the event of future supply chain disruption, 3D printing can supplement the PPE needs of frontline providers. Future research should investigate ways to optimize the design, verify the shield's efficacy in reducing infectious disease transmission, and to illuminate other uses of 3D printing in healthcare. ★



**FIGURE 5. User Preference for Disposable or 3D-printed Face Shield**

# Addressing an Uncertain Future

## Targeted Programming to Prepare Emergency Medicine Residents to Enter the Workforce Amid a Pandemic

**E**xpert panelists for *Life After Residency: Contracts, Careers, Pay, and Policy*, organized by the Emergency Medicine Residents' Association in October 2020.



**Jennifer L. Wiler, MD, MBA**  
Co-Founder and Executive Medical Director  
of UHealth CARE Innovation Center



**Laura Medford-Davis, MD, MS**  
Assistant Professor of Emergency Medicine  
Baylor College of Medicine



**Randy Pilgrim, MD, FACEP**  
Enterprise Chief Medical Officer  
Schumacher Clinical Partners



**Theresa Tran, MD, MBA**  
Director of MD/MBA Dual Degree Program  
Baylor College of Medicine



**Elaine Rabin, MD**  
Program Director of the Emergency  
Medicine Residency Program  
Mount Sinai Hospital



**Michelle Lin, MD, MPH, MS**  
Assistant Professor of Emergency Medicine  
Icahn School of Medicine at Mount Sinai

**Miriam A. Buksh, MD**

Beaumont Hospital Royal Oak

**Nicholas Stark, MD, MBA**

University of California San Francisco –  
San Francisco General Hospital  
@NickStarkMD

**Nicholas P. Cozzi, MD, MBA**

Fire Department of New York City/  
Northwell Health  
@NickCozziMDMBA

**Kirstin Woody Scott, MD, MPhil, PhD**

University of Michigan  
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**Phillip Tseng, MD, MBA, MEd**

The Ohio State University  
@\_PhilMD

**Jared Ditkowsky, MD**

Hackensack University Medical Center  
@JditkowskyMD

**Ynhi Thomas, MD, MPH, MSc**

Henry J.N. Taub  
Department of Emergency Medicine  
@YnhiThomas

**D**uring a typical fall season, emergency medicine senior residents in the United States prepare their cover letters and update their resumes in anticipation of their post-residency job search. Unfortunately, the COVID-19 pandemic, which took a toll on the lives of patients served by ED, also dramatically altered the transition process and job search timeline for this past year's graduates.

Due to the substantial reduction in ED patient volumes, many EDs were forced to further adjust staffing ratios — which included layoffs, furloughs, and pay-cuts — and the demand for recruiting new physicians to the workforce decreased further.<sup>1,2</sup> In addition to being strained by the unique emotional challenge of delivering care at the height of a pandemic, EM senior residents were now also left feeling uncertain about how to navigate this complicated job environment. EM workforce supply-and-demand issues existed prior to the pandemic and were being investigated by the various EM governing bodies. Unfortunately, the pandemic potentiated these issues and forced the specialty to reconcile with them in an accelerated fashion.

We, as leaders of the Administration & Operations Committee and Health Policy Committee of EMRA, believed

that providing education and high-level insight about the business and politics of EM could provide clarity to residents starting their careers. Our main objective was to help residents navigate the job landscape amidst the COVID-19 pandemic. We felt that residents could be even better prepared for their first 5-10 years out of residency if they understood in greater detail how EM is being impacted by the current pandemic and by health policy changes.

To promote this educational goal, we developed programming in the form of a virtual expert panel hosted at the American College of Emergency Physician Annual Meeting 2020.<sup>3</sup> We invited six experts from academia, health policy, and business to provide multidisciplinary insight and share concrete guidance about how to best position oneself for today's job market and the specialty's continued evolution (see page 34). Topics of conversation were pre-selected based on feedback from EMRA general body members. The following highlights the three most salient lessons from the discussion. The recording can be viewed here: <https://www.emra.org/be-involved/events--activities/acep/acep20-on-demand/ao-n-hpc-on-demand>.

## LESSON 1

***The COVID-19 pandemic further disrupted the job market of EM. The best way to navigate this disruption is to be a “physician plus”.***

The decrease in the demand for recruiting new members to the fully trained workforce comes at a time when the market is already increasingly competitive because of the steadily rising number of EM residency graduates.<sup>4,5</sup> In 1983, EM had its first Residency Match with 190 residency slots. In 2000, there were approximately 1000 slots. Now there are 257 programs with approximately 2600 residency slots. The increase in workforce supply with an abrupt decrease in demand secondary to the pandemic has left many graduating EM residents struggling to find secure options for employment.

To stand out in this increasingly competitive job market, the expert panel advised that EM trainees should embrace an innovative mindset. Potential employers are now looking for the “physician plus,” meaning that along with strong clinical skills, employers are seeking physicians who will bring additional skills. Examples of this include research training that can broaden the department's academic scope, knowledge about diversity program development to broaden a patient-centered workforce, or medical finance experience that can improve charting/billing for the department. Completing a fellowship or advanced degree can be one way to obtain these desired skills. Though departments will always need staff to fulfill clinical responsibilities, the expert panel forecasted that having training in only clinical service may not be sufficiently competitive in the future EM job market.

## LESSON 2

***The COVID-19 pandemic exacerbated our nation's underlying health inequities. EM health policy needs to respond to these gaps in healthcare access.***

Over the next decade we should expect the scope of practice for EM physicians to include *population health* as a paradigm of care. Not all of what we do during our EM shifts are critical resuscitations. Much of our time is spent managing chronic disease and lower acuity health concerns. As a result, EM physicians will be increasingly incentivized to work towards improving patients' overall health outcomes and well-being. This can take many forms, such as coordinating care with outpatient team members (therapists, social workers, and primary care physicians), to having an awareness about the financial implications of ED care on underinsured patients, to advocating for better out-of-hospital social programs that provide equitable health resources to all individuals. EM trainees are well-positioned to provide an informed view of barriers to care for society's most vulnerable patients.

One such mechanism for reducing barriers to care is telehealth. Telehealth practice rapidly expanded during the COVID pandemic.<sup>6</sup> Now that more patients have grown accustomed to this health care interaction, it is likely that it will remain a part of our practice after the pandemic has ended. However, in order to make its use a reasonable expectation for EM providers, future health policy and advocacy work will be needed to ensure adequate reimbursement. There is also an imperative to determine what exactly defines a “high quality” telehealth encounter. Finally, we must promote policies that mitigate disparities and ensure that all people — including those that are low-income and low-resourced — have meaningful access to these innovations.

EM physicians should also be prepared to focus more on value-based care metrics rather than the current fee-for-service model. The Affordable Care Act of 2010 and The Medicare Access and CHIP Reauthorization Act of 2015 are further transforming healthcare reimbursement into a value-based care model. Until now, EM has been relatively shielded from these changes, but there has been an increasing push to focus more on quality process measures, such as time-to-doctor and time-to-disposition metrics, through payment incentives.<sup>7</sup> An increasing number of EM employment contracts are starting to reflect this shift, requiring EM physicians to agree to productivity and

### **EM workforce supply-and-demand issues existed prior to the pandemic and were being investigated by the various EM governing bodies.**

quality-based incomes rather than flat hourly rates or annual salaries.

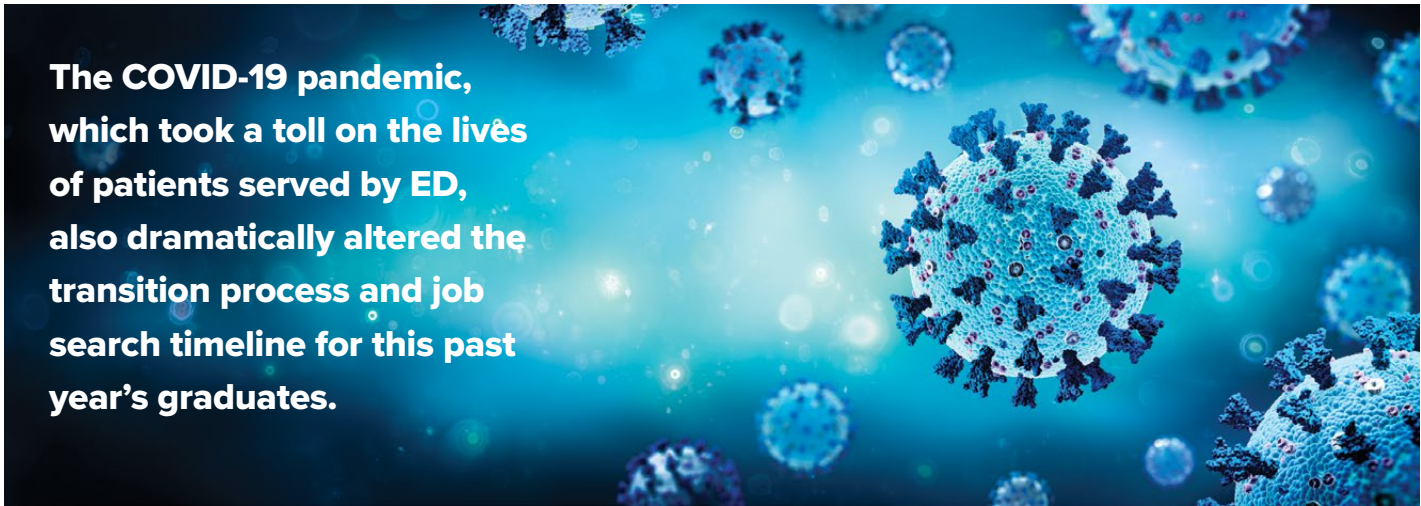
#### **LESSON 3**

***The COVID-19 pandemic exposed how mentally and emotionally difficult this field can be. To prevent burnout, EM physicians have to find what fuels their passion.***

There is a growing literature base showing that high levels of burnout exist within EM. Surveys suggest that about 65% of EM physicians will experience burnout, and the specialty often ranks within the top five of most burned-out specialties in medicine.<sup>8,9</sup> The expert panel discussed that the clinical demands of working through COVID-19 have had substantial mental health effects on EM providers, and the added layer of uncertainty for secure job placement only further adds to mental strain. The panelists advised that trainees should seek roles where they feel they are thriving in an environment that fits their personality and future goals. Financial compensation should not be the sole consideration. Applicants should also think about the following when assessing whether a position is the right fit for them: a) Does the job have an employment model (democratic group, contract management group, etc.)

that you find acceptable to your clinical practice preferences?; b) What is the employer’s governance model and how are decisions made for the group?; c) What are the market trends in the job’s location (e.g, whether or not the Medicaid expansion took place, patient demographics, ancillary support services, wellness initiatives); and d) Does the department have a vision that aligns with your own passions and interests?

The expert panel also recommended cultivating a set of interests outside of clinical EM in an effort to maintain work-life balance. Therefore, when agreeing to a job, candidates should speak candidly with future employers about the details of protected time to ensure that interests outside of clinical work can be completed as part of the contract. For example, if someone expresses an interest in quality improvement research, they should seek out positions that can offer protected time or funding to complete these tasks. Alternatively, individuals with an interest in medical education should seek out departments that have this as a core mission. To be compensated for a passion project, it must align with the values of the department. ★



**The COVID-19 pandemic, which took a toll on the lives of patients served by ED, also dramatically altered the transition process and job search timeline for this past year’s graduates.**



# Pandemic PTSD and Protecting Our Mental Health

**Crystal Pun**

Western University School of Medicine

**Brian Le, DO**

Emergency Medicine Resident  
Adventist Health

A 55-year-old male presenting with acute abdominal pain, an 11-year-old female with a twisted ankle, a 90-year-old male complaining of shortness of breath. What do all these people have in common? They are all ED patients with COVID-19.

After months of working on the front lines, attendings, residents, and medical students are all familiar with the routines of the COVID-19 pandemic. With each patient encounter, the once familiar setting of sitting down at eye level with patients and taking the time

## After months of working on the front lines, attendings, residents, and medical students are all familiar with the routines of the COVID-19 pandemic.

to build rapport has been replaced by a new routine: layers of PPE and a sense of urgency to provide rapid and effective care to COVID-19 positive patients, while limiting the exposure of all workers in the emergency department. Despite attempts to optimize patient and staff safety, exposure to symptomatic and asymptomatic patients with COVID-19 is inevitable.

Medical students, limited by hospitals and medical schools, are frequently prohibited from seeing suspected or confirmed COVID-19 patients. Despite these restrictions, exposure may still occur and comes at the cost of the medical student's education and ability to meet academic requirements. Residents, whether they be new interns or upper levels, are typically the first providers to see these infected patients. Juggling the weight of their responsibilities as new doctors alongside learning to care for critically sick patients, residents consistently question and examine their efforts and depth of knowledge in providing effective patient care. Attending physicians support the residents, medical students, and patients. Regardless of personal hindrances, they must display strength, knowledge, and tenacity to propel their team forward in the care of patients with COVID-19. Regardless of each individual's role in the Emergency Department, the underlying threat is the risk of exposure and the fear that contracting COVID-19 may impose imminent danger to one's immediate family and friends. Whether we consciously or subconsciously recognize these fears, the negative impact of COVID-19 on our mental health is undeniable.

**Despite attempts to optimize patient and staff safety, exposure to symptomatic and asymptomatic patients with COVID-19 is inevitable.**

Post Traumatic Stress Disorder (PTSD) is commonly associated with victims of combat and trauma. With the upsurge of emotional turmoil and strife associated with the COVID-19 pandemic, PTSD has now become a prominent and pressing issue among healthcare workers. Post Traumatic Stress Disorder is defined as “persistent, distorted cognitions about the cause or consequences of the traumatic event(s) that lead the individual to blame himself/herself or others.”<sup>1</sup> Diagnostic criteria include “negative alterations in cognition and mood associated with the traumatic event(s)” and “marked alterations in arousal and reactivity.” While these manifestations may be subtle, variation in sleeping habits, increased irritability, problems with concentration, and hypervigilance can all suggest PTSD. What may seem to be a normal conversation in the ED break room regarding exhaustion and sleeping difficulty may be a red flag that a coworker is struggling with their mental health.

During the early peak of the pandemic in late March to early April of 2020, Norway<sup>3</sup> conducted a study on the prevalence of PTSD, depression, and anxiety in healthcare workers. They conducted a cross-sectional survey from 1,773 healthcare workers and public service providers throughout Norway from March 31 - April 7, 2020, using a checklist of questions to screen for psychiatric manifestations. Of all individuals surveyed, 28.9% of that population was found to have clinical or subclinical PTSD symptoms. Out of that group, 36.5% of individuals were known to be working directly with COVID-19 patients. A similar study<sup>4</sup> was done

surveying 97,333 healthcare workers across 21 countries for symptoms of depression, anxiety, and PTSD. Among the data collected, the prevalence of moderate PTSD was found to be 21.5% with individual study estimates ranging from 2.9% to 49%. Despite the variation in numerical data, it is evident that signs and symptoms of PTSD are a pervasive issue among healthcare workers facing the COVID-19 pandemic regardless of geographic location.

The manifestations of PTSD may vary in symptoms and severity. While there are no strictly defined methods to prevent PTSD, certain protective factors have been identified. Utilizing an online survey<sup>2</sup> of 1,092 healthcare workers specifically in high COVID-19 infection rate locations, Hennein *et al.* explored the various socio-ecological predictors that impacted their mental health outcomes. Of the various components assessed, the only definitive protective factor against developing PTSD was an increased perception of team cohesion. Team unity in the ED has the power to combat mental illness and can be readily employed by all members of the healthcare team.

Working in the ED during the COVID-19 pandemic, there will always be an underlying fear and uncertainty as to what we will encounter at any point during our shift. Whether it be COVID-19, a new variant of the virus, a needlestick injury, or another pathogen entirely, the risks we face while serving in the emergency department are a reality that must be faced. While PPE and isolation protocol are vital to staff and patient safety, it is also just as important to protect our mental wellness. The psychological impacts of this pandemic will evidently weigh on many healthcare workers' lives for years to come, but the way we choose to respond and care for one another will have the most lasting impact. ★



# How to Get Back into the ED Groove

## Hajirah Ishaq, DO, MS

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## Meenal Sharkey, MD

Clerkship Director  
Doctors Hospital/OhioHealth  
@MdSharkattack

It happens to all of us: you've enjoyed a restorative vacation or you're finishing an ultrasound rotation or even coming back after your wedding... and now you must return to the emergency department.

The last time you were here, you felt confident. You ran the department like a boss, but now you feel rusty. Things are not running as smoothly. Sound familiar?

These tips can help you get back into the swing of things.

### Before Shift

- **Visualize:** Use return travel time or even the drive into work to your advantage. Imagine yourself running a code or critical resuscitation. Picture the room, the patient, the staff. Start from the beginning when EMS arrives. Go through all the steps. What medications are you requesting? What are you doing if the patient is in ventricular fibrillation, or you are concerned for an aortic dissection? It is helpful if you can hear the voice you would use to call things out. This builds your confidence. Daydream about the simpler cases as well. For example: You pick up a 43-year-old male patient with a chief complaint of chest pain. Come up with a list of differentials you are concerned about in the ED, then imagine the questions you would be asking the patient, the tests you would order, and the treatments you would initiate.
- **Reflect:** Recall your past few shifts in the ED. What cases stood out? Why? Were there any "great saves" by you or your teammates? Were there any "textbook" cases? Was there a procedure that went right, start to finish? Recalling the cases that

invigorated you can hopefully lessen any negative feelings for returning back to work after time away.

- **Refresh:** Reading or listening to any of the numerous EM-related blogs and podcasts the night before or right before heading to your shift can help shift your brain back into the EM mindset. While listening or reading, imagine yourself caring for a patient with that problem, or imagine yourself performing that procedure, step by step.
- **Create a to-do list:** Create a list of things you tend to forget on shift, and refer to that list every time you go back to the ED after a break. The list can include anything from updating Tdap on patients with lacerations to providing crutches for an ankle sprain or even more dynamic items, such as the most recent changes in the admission process.
- **Confidence:** If you are the type of person who needs to look into the mirror to tell yourself "I am strong, confident, and smart," do it! You are! You have been through so much training. You know what you are doing. Confidence is built through preparedness. If you review familiar concepts and ideas, you will start to regain your confidence.

### On Shift

- **Brainstorm:** When you pick up a patient, before seeing them, generate a list of differentials you would be concerned about in the ED. For example, a 52-year-old male with chest pain would bring to mind MI, PE, aortic dissection, pneumothorax, etc. Identifying your concerns will help you tailor your questions appropriately and you'll be less likely to gloss over, say, the PERC criteria.
- **Flow:** When returning to the department after a break, a common challenge involves managing patient flow. You may realize you are being slower than normal to disposition patients.



- **Be more cautious:** Spend extra time reviewing labs and imaging before dispositioning your patient to make sure you are not missing anything. You do not want to forget the pregnancy test on the 32-year-old female being admitted for a non-intractable headache.
- **Start slow:** Patient care is more important than trying to move the department. If you need to spend some extra time in a patient's room to avoid missing a pulmonary embolism, it is worth it.
- **Confidence:** This bears repeating, because it is so central to how we feel about ourselves and our abilities. Your confidence can feel crushed when your peers or attendings notice you are not on your A-game. Throughout your shift, visualize a time when you were running a code proficiently or having a positive discussion with a patient. Think of why you felt that way and try to work toward achieving that feeling again.
- **Relax:** After shift, give yourself some grace. Acknowledge that you did your best and there is always another chance tomorrow. Find time to unwind with co-residents (who are likely feeling much the same way).  
As you advance in training, many of these techniques will become second nature. You may find it gets easier every time you transition back. Believe in yourself; you do know what you are doing! ★

# The Intersection of Administration and Health Equity Panel

## A REFLECTION

### Christina Brown

Rush Medical College

### Joe Gannett, MD

Chief Resident

LSU Spirit of Charity Emergency Medicine

### Tehreem Rehman, MD, MPH

Administration, Operations, and Quality Fellow

University of Colorado School of Medicine

Department of Emergency Medicine

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### Nicholas Stark, MD, MBA

Chief Resident

University of California San Francisco

Emergency Medicine

@NickStarkMD



**Anthony Mazzarelli, MD, JD**  
Cooper University Healthcare



**Anisa Jivani, MHSA**  
Rush University System for Health



**Jesse Pines, MD**  
US Acute Care Solutions

Emergency physicians treat everyone, regardless of social position, race, ethnicity, gender, religion, sexual identity, or abilities. However, are we treating everyone *equally*?

No matter how mission-driven we are, we cannot effectively and sustainably address the social determinants of health without ensuring the financial viability of the healthcare system. EMRA's Social EM Committee partnered with the Administration and Operations Committee to host an "Intersection of Administration and Health Equity" panel discussion to focus on the crucial role that leaders and administrators play in addressing disparities within the emergency department and hospital system. This recap of that conversation is intended to stimulate discussions on equity and help us identify opportunities for improvement in our own emergency departments.

### Meet the Experts

The health equity experts who joined for the panel included:

- **Anisa Jivani, MHSA**, Rush University System for Health
- **Jesse Pines, MD, MBA, FACEP**, US Acute Care Solutions
- **Anthony Mazzarelli, MD, JD, MBE**, Cooper University Healthcare

**EMRA's Social EM Committee partnered with the Administration and Operations Committee to host an "Intersection of Administration and Health Equity" panel discussion to focus on the crucial role that leaders and administrators play in addressing disparities within the emergency department and hospital system.**

### Creating a Culture

Dr. Pines expressed optimism that many organizations are focusing more on health equity, highlighting efforts of employee recruitment and the establishment of Chief Equity Officers at many institutions. Dr. Mazzarelli emphasized the importance of culture for addressing health equity issues, noting "culture eats strategy." He encourages emergency physicians to think about how reducing disparities can be incorporated into everyday work. He used the example of how social workers and community health workers are often available throughout the week but might be less available on weekends or overnight shifts. In many EDs, there may be a cultural norm of not wanting to bother social experts while on call or otherwise less available; however, what if it became the norm to activate those resources when needed? This could help connect even more patients to vital community resources, regardless of the day of the week.

### Managing the Business Side

Ms. Jivani addressed the impacts of the business model of healthcare. It is important to keep in mind the financial drivers while attempting to create long-term solutions for health equity. Often, patients seen in the ED could have been better cared for with augmented primary care resources. By focusing on initiatives that improve long-term outcomes and ultimately reduce costs, it can be easier to propose new ideas for health equity from an administration standpoint.

Dr. Pines discussed how the private sector in EM is also becoming increasingly incentivized to advance health equity in the setting of a more favorable political and resource landscape. Dr. Mazzarelli discussed how every administrator has a role to play in diversity and equity. If each of us consistently thinks about these issues and incorporates them into daily work, it will not only drive the

system's culture but also create an environment that fosters new health equity initiatives.

### Collecting the Data

Dr. Mazzarelli shared how everyone must be willing to look for disparities. Ms. Jivani mentioned that most medical record systems have the ability to filter data based on social determinants of health. Training physicians and empowering them to collect their own data can be a great start. Dr. Mazzarelli suggested looking at current research on disparities within a specialty and starting to look for that data in our own departments. Dr. Pines stressed the importance of making this data usable for clinicians via the creation of dashboards, and creating an appropriate context for patient care to drive home the "why" of social equity in the ED.

### Finding the Solution

Once your ED collects more data, Dr. Mazzarelli suggested protocolization of patient care interventions. He cited, as an example, pain management protocols for long bone fractures, aimed at addressing disparities in analgesic dosing and time to administration. Ms. Jivani discussed how the same methodology for other quality improvement initiatives also applies to health equity interventions such as Plan-Do-Study-Act. These interventions require a multi-disciplinary approach, including clinical practice along with community engagement and education. It is also important to put effort into training students with a health equity curriculum to establish long-term effects.

### Looking Forward

Without a doubt, the COVID-19 pandemic has greatly impacted initiatives for health equity. Ms. Jivani highlighted how COVID drew attention to health disparities, which led to people being more willing to innovate. This greatly sped up change in medicine, making people realize initiatives such as telehealth do not take as long to implement as previously

thought. She also noted this opened the door more for collaboration with community leaders and public health officials.

Conversely, the panel also noted that pandemic-related financial constraints and staffing shortages have strained staff to take on additional work of addressing health equity. The panelists were encouraged, however, because they felt that most healthcare workers are mission-driven and want to be part of something bigger than themselves. Dr. Mazzarelli cited the increase of state and federal funding for innovative solutions to addressing health equity, leading to more effective community COVID testing and vaccinations.

### Final Thoughts

The panel discussion concluded with advice on incorporating health equity

over the course of a career. Ms. Jivani urged medical students and residents to be open to changes and lead change when they see gaps. Dr. Pines reinforced that EM trainees have the skills and perspective to effect meaningful change. Dr. Mazzarelli encouraged each of us to show intentionality with our actions, to put our passions at the forefront, and to create a culture of positive change.

The panel highlighted the position emergency physicians are in to witness disparities and novel ways for us to combat them. It is our duty to find interventions that improve health equity for our communities, and then bring this mindset to the rest of medicine. ★



**No matter how mission-driven we are, we cannot effectively and sustainably address the social determinants of health without ensuring the financial viability of the healthcare system. It's time to start discussions on equity and help identify opportunities for improvement in our own emergency departments. It is our duty to find interventions that improve health equity for our communities, and then bring this mindset to the rest of medicine.**

# A Last-Minute Swerve into EM

## Megan Ladd, DO

Emergency Medicine Residency  
Mercy Health St. Vincent's Medical Center  
@LaddsBands

I had a midlife crisis during my fourth year of medical school. Choosing a specialty was daunting, but I thought I'd finally figured it out. My ERAS application was submitted, and I began interviewing. Then I had my emergency medicine rotation and loved it.

I fought the feeling. Maybe it was just one great rotation, or maybe it was the residents I worked with. But it didn't go away. How could I switch now? How could I risk being unemployed with all this debt? It was late in the season when I committed to making a change, and committed myself to the SOAP, which is how I matched a preliminary surgery position.

Now, after a second interview season, I'm an intern in emergency medicine watching as EM-bound students and reapplying residents make their way through this year's match. This is what I learned about taking the scenic route.

### Be true to yourself.

The first hard question an unmatched EM-bound medical student must answer is why they didn't match. It was not only brought up by interviewers, but more importantly, it helped me grow. I hesitated for half of an interview season before committing to reapplying because I doubted myself. I doubted that I had enough experience, letters of recommendation, a personal statement, or a clue what to do. So, I hesitated. It took a lot of reflection to accept that

my passion was in EM, and that I wouldn't be happy in another specialty. This helped me commit to the SOAP, pursue a challenging year as a surgery intern, and build myself into the kind of EM doctor I wanted to be. Whether you spend your reapplication year as a preliminary resident, researcher, or take another course, you should seek out rewarding opportunities that challenge you to grow.



### Be true to your story.

There is no reason to hide why you didn't match, and most likely programs will know you are a reapplicant. I brought up why I didn't match in my personal statement, so interviewers were often prepared to ask follow-up questions. Why a year of surgery? What have you learned as a surgery resident? This gave me the opportunity to discuss work experiences I had as an intern that would set me apart from medical student applicants. In interviews, reapplicants should be prepared to share insights on the personal and professional growth they've had in their first months since medical school.

### Take care of yourself.

I got lucky in not having to travel for interviews, since time and money are scarce for an intern. My program was not familiar with prelims having to spend time reapplying, as most prior prelims had already secured categorical spots. To attend virtual interviews I was required to use what little vacation and time off I had, so I also did five interviews while post-call on a month of night float.

This was, in short, a nightmare and 9 out of 10 doctors would not recommend doing this. It was physically and emotionally draining, and I did not perform to the best of my ability. In making your work schedule during interview season, be direct with your chief residents or faculty about the time you need in order to do well. Your career is at stake and must take priority.

### Don't worry.

Initially, I thought being a reapplicant was a dark mark on my application that everyone would care about. Instead, I found almost every program already had other residents who were reapplicants, and I was far from alone. There were residents, fellows, and even attendings who told me they too did not match into EM initially. Emergency medicine celebrates applicants with prior work experiences, especially in other fields. Rather than being a detriment, my year of general surgery was beneficial in many ways and praised in interviews. Though the reapplication process initially feels like you've fallen down, know that you will soon be valued for your ability to get up and try again. ★



# Earning Patients' Trust by Respecting Pronouns

**Not everyone has had the basic training on gender-affirming care that my medical school provides.**

**Susan Mari**

Medical Student, Rush Medical College  
@SusanMari13

**M**y name is Susan Mari. I'm a fourth-year EM-bound medical student in a large Midwestern city, and my pronouns are *she/her*. My name holds a lot of privilege. Although I often nag my parents about being the only Susan under the age of 55, the traditionally female name assigned to me at birth does align with my gender identity. When strangers assume my pronouns based on my outward appearance, they're usually right. Not everyone has this privilege.

A few weeks into an internal medicine rotation at my local county hospital, I was on call with my team when a new patient was admitted from the ED for abdominal pain. Her symptoms sounded pretty classic for cholecystitis (*great* for medical student teaching purposes), so my senior resident assigned me to the case. I bounded upstairs to meet the patient and complete an overly thorough history and physical, as only a third-year medical student does. My patient good-naturedly endured all of my questions, pokes, and prods, but she was clearly

anxious and uncomfortable. Half an hour later, I glanced back over my notes on my way out the door, satisfied that I knew everything there was to know about my patient — except how to pronounce her name.

"Hey, how do you pronounce your last name?" I asked. She clarified.

"And what do you like to be called?" I ask most patients this to avoid the whole John vs. Mr. Smith debacle.

I saw the first hint of a smile as she gave me a nickname and then a chosen name to use in place of her legal one.

Catching on, I asked, "What pronouns do you use?"

"*They, them,*" they beamed, anxiety dissipating. "Thank you. You're the first person to ask me that."

Counting the multiple staff members, nurses, techs, interns, residents, and attending physicians, I must have been at least the 10th person to interview this patient — but the first to ask their name and pronouns. That unfortunately didn't surprise me. Not everyone has had the basic training on gender-affirming care that my medical school provides. Medical students also generally have more free

time to sit and get to know our patients. Everything that happened next, however, did surprise me.

I went straight to my supervising intern to let her know our patient's preferred name and pronouns and asked if we could add the information to the EMR so other members of the care team could see it as well. She said she didn't understand my question. That was foreboding, but I chalked it up to cultural differences and moved on. A quick search through the demographics tab on the system's EMR didn't show a field for pronouns, so I sent the same question to the whole team in our secure chat. I explained that it would be nice for them to have their preferred name and pronouns in the EMR so they wouldn't have to repeatedly explain it to everyone they met.

One resident let me know that wasn't a possibility with the software the hospital uses. Another resident responded, "But isn't her full name (—)? That's all we need to know," with a crying laughing emoji. I didn't know where she saw the humor in this situation, but I certainly wasn't laughing and didn't think my patient

would be, either. I looked helplessly down at my phone, an icy wave of dread washing over me as I realized just how difficult the next few days were going to be for my patient.

The next morning, I emphasized my patient's name and pronouns in front of the whole team throughout my oral presentation. Thankfully, I didn't witness anyone on the team use the wrong pronouns (or any pronouns at all) in front of them, but they all continued to do so in private. Every time I gave my team updates on my patient, my *they/them* was met with *she/her*, and no one could seem to remember who I was talking about when I used their chosen name. After a handful of reminders, I'm ashamed to say I started letting it slide. I couldn't figure out where the disconnect was, and it was an awkward situation to be in as a student.

I was in the room multiple times when nursing staff misgendered my patient, and the way they visibly shrunk whenever it happened broke my heart. With their permission, I informed the nurses of the right pronouns. It didn't stick. We even wrote their name and pronouns in big, bubble letters on the room's whiteboard; that didn't help either. At one point, I apologized that no one was respecting their pronouns.

"It's okay," they said. "I'm used to it."

"It's not okay," I said simply.

I didn't understand how I could be the only person on this patient's care team who thought such a fundamental piece of caring for them mattered. How can we expect patients to trust us to diagnose them, treat them, even operate

on them when we don't get their names right? The short answer is that we can't. We need to do better.

I invite my colleagues in all corners of the medical field to join me in advocating for our transgender and nonbinary patients through clear and decisive action. First, I believe every hospital needs a dedicated field in their EMR to acknowledge a patient's preferred name and pronouns. Not only would this have facilitated easier communication between the different care teams (IM, GI, general surgery, etc.), but it also would have been a clear reminder for every RN, resident, tech, student, and attending who pulled up the chart before walking into the patient's room. Simply put, the burden of having to inform and remind every single staff member of a patient's name and pronouns should not fall on the patient themselves.

Second, we must address the culture of ignorance and indifference surrounding gender identity and expression among healthcare providers through advocacy and education. While we all come from different backgrounds and experiences, the expectation of a basic level of competency in caring for some of our most vulnerable patients is long overdue. I trust that the vast majority of us want to do right by our patients. If we can start bridging the gap with practical training, we can empower providers to feel more comfortable using the language, advocating for their patients, and speaking up when pronouns aren't respected. It's time we hold ourselves and our colleagues accountable, ask the uncomfortable questions, and

put in the work individually to create structural change.

This kind of change won't come easily, and it won't happen overnight. Even as we graduate entire classes of medical students who have received training in gender-affirming care, there are still many generations of physicians in practice today who haven't had as much experience caring for openly transgender and nonbinary patients. As a recovering perfectionist, I understand the fear and hesitancy involved in trying something new, but just like any skill, asking for pronouns and using them fluently takes dedication and practice. It's okay to start small: add your pronouns to your Twitter bio, order a pronoun pin for your lanyard, or ask your next patient what they like to be called. The more visibility we bring to pronouns, the more second-nature they'll become. As clinicians, we need to leave personal opinions and egos at the door and get comfortable being uncomfortable. Trying and making mistakes along the way is still more respectful to our patients than not trying at all.

There has never been a more critical time for the healthcare community to stand up for our trans and nonbinary patients. Using a person's chosen name and pronouns isn't difficult. It isn't radical. It's human decency. I hope you'll join me in creating a future where members of the trans and nonbinary community can come to see hospitals not as places of ignorance and trauma, but as havens of acceptance filled with their fiercest allies. ★



# HUMAN TRAFFICKING

Raising Awareness January 2022

## HUMAN TRAFFICKING IS...

Exploiting a person through force, fraud, or coercion

Anyone under the age of 18 involved in a commercial sex act

Sex trafficking, forced labor, and domestic servitude

A highly profitable crime

Exploitation-based and does not require movement across borders or any type of transportation

## THERE ARE DIFFERENT TYPES OF HUMAN TRAFFICKING

### SEX TRAFFICKING

Victims are manipulated or forced against their will to engage in sex acts for money.



## HUMAN TRAFFICKING IS HAPPENING IN THE UNITED STATES



SUBURBS



RURAL TOWNS



CITIES

### FORCED LABOR

Victims are made to work for little or no pay. Very often, they are forced to manufacture or grow products that we use and consume every day.



### DOMESTIC SERVITUDE

Victims are hidden in plain sight, forced to work in homes across the United States as nannies, maids, or domestic help.



VICTIMS OF HUMAN TRAFFICKING MIGHT BE AFRAID TO COME FORWARD, OR WE MAY NOT RECOGNIZE THE SIGNS, EVEN IF IT IS HAPPENING RIGHT IN FRONT OF US.

## IT CAN HAPPEN TO ANYONE

NO MATTER AGE, RACE, GENDER IDENTITY, SEX, ETHNICITY, NATIONALITY, IMMIGRATION STATUS, AND SOCIOECONOMIC CLASS



## RECOGNIZE AND REPORT HUMAN TRAFFICKING

- To report suspected trafficking to federal law enforcement, call 1-866-347-2423 or submit a tip online at [www.ice.gov/tips](http://www.ice.gov/tips).
- Get help from the National Human Trafficking Hotline by calling 1-888-373-7888 or text HELP or INFO to 233733 (BEFREE).
- Call 911 or local law enforcement if someone is in immediate danger.

## WHAT YOU CAN DO

- Visit the Blue Campaign website to learn more about the **indicators** of human trafficking: [DHS.gov/BlueCampaign](http://DHS.gov/BlueCampaign).
- Use Blue Campaign **materials** to raise awareness of human trafficking in your community.
- Follow @DHSBlueCampaign on **Facebook**, **Instagram**, and **Twitter**.

**Identifying Victims of Human Trafficking:  
What to Look for in a Healthcare Setting**

Healthcare providers may come into contact with victims of human trafficking and have a unique opportunity to connect them with much needed support and services. Anyone in a healthcare setting may be in a position to recognize human trafficking – from clerical staff to lab technicians, nursing staff, ambulatory care, radiology staff, security personnel, case managers, and physicians.

The following is a list potential red flags and indicators that medical providers may see in a patient who may be a victim of human trafficking. Please note that this list is not exhaustive. Each indicator taken individually may not imply a trafficking situation and not all victims of human trafficking will exhibit these signs. However, the recognition of several indicators may point to the need for referrals and further assessment.

**Red Flags and Indicators**

<b>General Indicators of Human Trafficking</b>	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Shares a scripted or inconsistent history</li> <li><input type="checkbox"/> Is unwilling or hesitant to answer questions about the injury or illness</li> <li><input type="checkbox"/> Is accompanied by an individual who does not let the patient speak for themselves, refuses to let the patient have privacy, or who interprets for them</li> <li><input type="checkbox"/> Evidence of controlling or dominating relationships (excessive concerns about pleasing a family member, romantic partner, or employer)</li> <li><input type="checkbox"/> Demonstrates fearful or nervous behavior or avoids eye contact</li> <li><input type="checkbox"/> Is resistant to assistance or demonstrates hostile behavior</li> <li><input type="checkbox"/> Is unable to provide his/her address</li> <li><input type="checkbox"/> Is not aware of his/her location, the current date, or time</li> <li><input type="checkbox"/> Is not in possession of his/her identification documents</li> <li><input type="checkbox"/> Is not in control of his or her own money</li> <li><input type="checkbox"/> Is not being paid or wages are withheld</li> </ul>	
<b>Labor Trafficking Indicators</b>	<b>Sex Trafficking Indicators</b>
<ul style="list-style-type: none"> <li><input type="checkbox"/> Has been abused at work or threatened with harm by an employer or supervisor</li> <li><input type="checkbox"/> Is not allowed to take adequate breaks, food, or water while at work</li> <li><input type="checkbox"/> Is not provided with adequate personal protective equipment for hazardous work</li> <li><input type="checkbox"/> Was recruited for different work than he/she is currently doing</li> <li><input type="checkbox"/> Is required to live in housing provided by employer</li> <li><input type="checkbox"/> Has a debt to employer or recruiter that he/she cannot pay off</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Patient is under the age of 18 and is involved in the commercial sex industry</li> <li><input type="checkbox"/> Has tattoos or other forms of branding, such as tattoos that say, "Daddy," "Property of...," "For sale," etc.</li> <li><input type="checkbox"/> Reports an unusually high numbers of sexual partners</li> <li><input type="checkbox"/> Does not have appropriate clothing for the weather or venue</li> <li><input type="checkbox"/> Uses language common in the commercial sex industry</li> </ul>



## Health Indicators and Consequences of Human Trafficking\*<sup>i</sup>

### Physical Health Indicators

- Signs of physical abuse or unexplained injuries
  - Bruising
  - Burns
  - Cuts or wounds
  - Blunt force trauma
  - Fractures
  - Broken teeth
  - Signs of torture
- Neurological conditions
  - Traumatic brain injury
  - Headaches or migraines
  - Unexplained memory loss
  - Vertigo of unknown etiology
  - Insomnia
  - Difficulty concentrating
- Cardiovascular<sup>ii</sup>/respiratory<sup>iii</sup> conditions that appear to be caused or worsened by stress, such as:
  - Arrhythmia
  - High blood pressure
  - Acute Respiratory Distress
- Gastrointestinal conditions that appear to be caused or worsened by stress<sup>iv</sup>, such as:
  - Constipation
  - Irritable bowel syndrome
- Dietary health issues
  - Severe weight loss
  - Malnutrition
  - Loss of appetite
- Reproductive issues
  - Sexually-transmitted infections
  - Genitourinary issues
  - Repeated unwanted pregnancies
  - Forced or pressured abortions
  - Genital trauma
  - Sexual dysfunction
  - Retained foreign body
- Substance use disorders
- Other health issues
  - Effects of prolonged exposure to extreme temperatures
  - Effects of prolonged exposure to industrial or agricultural chemicals
  - Somatic complaints

### Mental Health Indicators

- Depression
- Suicidal ideation
- Self-harming behaviors
- Anxiety
- Post-traumatic stress disorder
- Nightmares
- Flashbacks
- Lack of emotional responsiveness
- Feelings of shame or guilt
- Hyper-vigilance
- Hostility
- Attachment disorders<sup>v</sup>
  - Lack of or difficulty in engaging in social interactions
  - Signs of withdrawal, fear, sadness, or irritability
- Depersonalization or derealization<sup>vi</sup>
  - Feeling like an outside observer of themselves, as if watching themselves in a movie
  - Emotional or physical numbness of senses
  - Feeling alienated from or unfamiliar with their surroundings
  - Distortions in perception of time
- Dissociation disorders<sup>vii</sup>
  - Memory loss
  - A sense of being detached from themselves
  - A lack of a sense of self-identity, or switching between alternate identities
  - A perception of the people and things around them as distorted or unreal

### Social or Developmental Indicators

- Increased engagement in high risk behaviors, such as running away or early sexual initiation if a minor
- Trauma bonding with trafficker or other victims (e.g. Stockholm syndrome)
- Difficulty establishing or maintaining healthy relationships
- Delayed physical or cognitive development
- Impaired social skills

*\*This list of physical and mental health indicators of human trafficking is not exhaustive. Trafficking survivors may experience one or more of these indicators, none of these indicators, or health indicators not on this list. This list is intended to help you assess if a patient's condition may be a result of a trafficking-related trauma and should be considered in context.*

# Join **EMRA** at **CORD**

M a r c h 2 7 - 3 0

## First Things First: Awards

### **WINTER NOMINATIONS DUE JAN. 9**

- Chair, Program Director, APD, Coordinator of the Year
- Fellow, Chief Resident, Resident, Medical Student of the Year
- Travel scholarships, excellence awards, and more

### **APPLY AT [WWW.EMRA.ORG/AWARDS](http://WWW.EMRA.ORG/AWARDS)**

Join us in San Diego to celebrate the very best in emergency medicine!

- 2021 25 Under 45 honorees
- 2021 Summer Awards recipients
- 2022 Winter Awards recipients



# Academic Assembly 2022

San Diego, California

## On-Site with EMRA

### PROFESSIONAL DEVELOPMENT, COMPETITION, AND FUN

- EMRA Quiz Show! (*Team sign-up at [emra.org/cord](http://emra.org/cord)*)
- SIMWars
- EMRA/ACEP Leadership Academy
- Representative Council Spring Meeting
- Committee leadership changing of the guard

**DETAILS: [WWW.EMRA.ORG/CORD](http://WWW.EMRA.ORG/CORD)**



## New EMRA Video Resources: Telemedicine Tips, Exam Pearls

By now we're all familiar with video conferencing — and telehealth visits are becoming more common in emergency medicine.

EMRA is proud to partner with Cornell/Columbia EM and the Weill Cornell Medicine Center for Virtual Care to offer telemedicine appointment tips, virtual physical exam pearls, and a downloadable checklist for telemedicine visits. Find the two videos and the downloadable checklist at [www.emra.org/videos](http://www.emra.org/videos). \*



## Nominate for an EMRA Award

EMRA wants to help you recognize the brightest stars in your circle — nominate them for one of our many awards!

The next round of nominations, due Jan. 9, encompasses a range of scholarship opportunities plus the ever-popular Resident of the Year, Chief Resident(s) of the Year, program leadership spotlights (Chair, PD, APD, Coordinator), and more. Nominate yourself, your mentor, or your mentee. **Anyone can nominate — just submit the nomination form by Jan. 9.** Find the forms at [www.emra.org/be-involved/awards/#winterawards](http://www.emra.org/be-involved/awards/#winterawards). \*

## Managing Ischemic Stroke

Emergency physicians must be continually educated on the imaging technology and guideline recommendations to best care for their Ischemic Stroke patients. This course will offer an update of the new Ischemic Stroke Guidelines, imaging techniques, image requirements in reperfusion therapies, required transfer images for EVT, and describe the regional stroke center concept.

Sponsored by an educational grant from Genentech, a member of the Roche Group. This activity has been approved for *AMA PRA Category 1 Credit*™. Approved by the American College of Emergency Physicians for ACEP Category I Credit. \*

## EMRA and ACEP Leadership Academy

Looking for professional growth, personal improvement, and forming bonds with national and international like-minded leaders? Apply for the EMRA and ACEP Leadership Academy now. This 10-month leadership development track, supported by Vapotherm, will boost your confidence and presence in a clinical setting and beyond. Take a smart step in your career — **apply by Jan. 4** at [www.emra.org/be-involved/events--activities/leadership-academy](http://www.emra.org/be-involved/events--activities/leadership-academy). \*

## Work Continues on No Surprises Act

On Nov. 5, Reps. Tom Suozzi (D-NY), Brad Wenstrup, DPM (R-OH), Raul Ruiz, MD (D-CA), and Larry Bucshon, MD (R-IN) sent a letter to HHS Secretary Xavier Becerra, Labor Secretary Martin Walsh, and Treasury Secretary Janet Yellen, **urging their respective departments to follow the letter of the law and amend the IFR.**

The letter was cosigned by 152 bipartisan members of the House of Representatives — more than 1/3 of the entire chamber. In total, 2,540 ACEP members sent 5,297 messages to Congress sounding the alarm about this disastrous rule and asking House members to sign the letter. \*

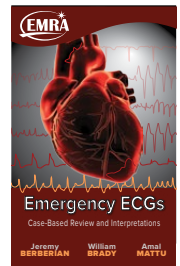
## New ECG Book by Berberian, Brady, and Mattu

ECG interpretation is an essential skill in emergency medicine, and EMRA's newest guide — a Kindle exclusive — will become one of your favorite ECG resources.

"This collection will knock your socks off," said reviewer **Judith Tintinalli, MD, MS**. "Clinicians who want to stay sharp (at least as sharp as their residents) will find it interesting and challenging! It's just never too often to test your ECG wits."

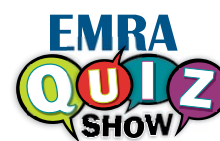
The guide features 400+ high-resolution images, all backed by expert discussion and teaching points. Work through the cases randomly or by topic (regular wide-complex tachycardias, T-wave alternans, lead reversal, biventricular paced rhythms, syncope, etc.). Be sure to check out the surprise features!

Access this book at [www.emra.org/amazon](http://www.emra.org/amazon), and view it on your phone, tablet, desktop, or Kindle device. \*



## Get Ready for Quiz Show 2022!

Keep an eye out for the upcoming call for teams to participate in EMRA's annual medutainment/board prep



extravaganza, the **EMRA Quiz Show!** This competition will be held as part of EMRA's events

in conjunction with CORD Academic Assembly, March 27-30 in San Diego.

Quiz Show is your chance to compete for bragging rights (does any other prize even matter in EM?) as they practice for board exams. The EMRA Education Committee, in conjunction with Rosh Review, sets the tone for this dynamic learning event. Send your best and we'll have fun!

Watch [@emresidents](https://twitter.com/emresidents) on Twitter and Facebook for details of how to register your team. \*

# ECG Challenge

**Garrett M. Snipes, MD**

University of Florida College of Medicine  
@GarrettSnipesMD

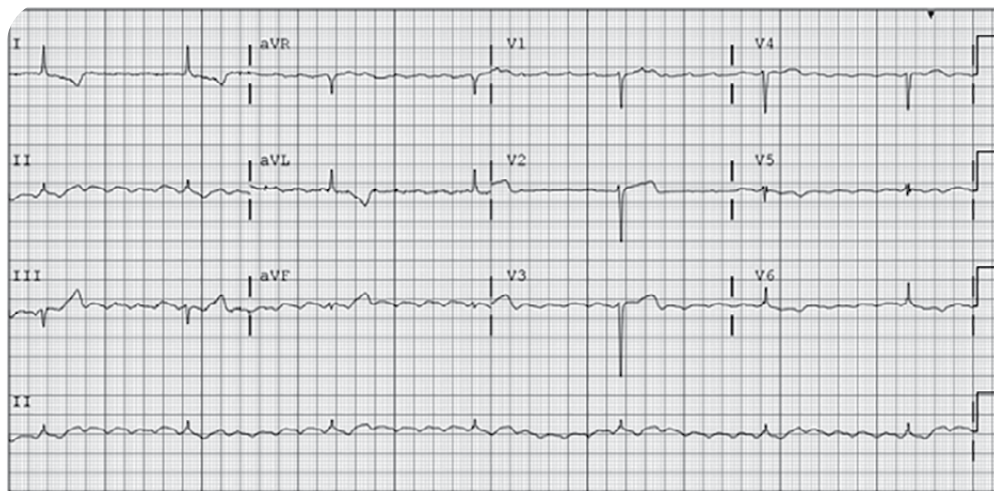
**Jeremy Berberian, MD**

Associate Director of Emergency Medicine Resident Education  
Dept. of Emergency Medicine, Christiana Care Health System  
@jgberberian

**CASE.**

A 70-year-old male presents to the emergency department with syncope and lightheadedness. His past medical history is significant for heart failure with reduced ejection fraction, CAD status post percutaneous coronary intervention, hypertension, and paroxysmal atrial fibrillation on apixaban.

**What is your interpretation of his ECG?**



See the ANSWER on page 52



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# ECG Challenge

**This ECG shows atrial flutter with 6:1 conduction and a ventricular rate of ~42 bpm, normal axis, normal QTc interval, poor R-wave progression, and ST-segment and T-wave abnormalities in leads I, aVL, and V1-V3 suggestive of LVH with strain pattern.**

This ECG shows flutter waves, also called F-waves, best seen in the inferior leads, that are diagnostic of atrial flutter. Atrial flutter is typically due to a re-entry circuit around the tricuspid ring in the right atria. It is classified as a macro-reentry tachycardia because it revolves around a large obstacle, the right atrium, as opposed to a small obstacle like the AV node. The concerning finding in this ECG is the bradycardic ventricular rate which is likely the cause of the patient's symptoms. Important intrinsic causes to consider include fibrosis/sclerosis of the conduction system, MI, ischemic heart disease, and infiltrative/inflammatory disorders (eg, cardiac amyloidosis, myocarditis). Important extrinsic etiologies to consider include antidysrhythmic medication toxicity (eg, digoxin, beta-blockers, CCB, etc.) and electrolyte abnormalities (eg, hyperkalemia).

Regarding the findings suggestive of LVH, it is important to note that none of the many diagnostic ECG criteria for LVH have great sensitivity, so while anatomic LVH can lead to characteristic changes seen on ECG, it is ultimately an echocardiographic diagnosis. ECG findings that are characteristic of the LVH strain pattern include a large S-wave with STE and a concave upward ST-segment in leads V1-V3, and a large R-wave with STD, TWI, and a concave downward ST-segment in leads I, aVL, and V4-V6.

## Atrial Flutter Learning Points

- Due to a re-entrant circuit in the right atrium
- Stereotypical "sawtooth pattern" of P-waves seen best in the inferior leads
- Atrial rate is 250-350 bpm and typically fixed over time
  - Ventricular rate is a fraction of atrial rate (i.e., for an atrial rate of 300 bpm, 2:1 conduction produces a ventricular rate of 150 bpm, 3:1 conduction produces a ventricular rate of 100 bpm, 4:1 conduction produces a ventricular rate of 75 bpm, etc.)
  - Consider atrial flutter when ventricular rate is consistently around 150 bpm
- Vagal maneuvers or adenosine will affect the ventricular rate but not the flutter waves
- The risks of thromboembolism and recommendations for anticoagulation are the same for atrial flutter and atrial fibrillation<sup>1</sup>
- The American College of Cardiology (ACC) provides a Class I recommendation for elective synchronized cardioversion in stable patients pursuing a rhythm control strategy<sup>2</sup>

## LVH Learning Points

- ECG is only suggestive of anatomic LVH, and echocardiography is the superior diagnostic modality
- ECG findings in LVH are manifested primarily by the increased voltage of the QRS complexes, hence the term "LVH by voltage criteria"
  - No criteria are recommended for use exclusive of other validated criteria
  - Diagnosis of LVH in the presence of intraventricular conduction abnormalities (eg, fascicular blocks, bundle branch blocks) should be made with caution as they may impact the accuracy of the ECG criteria for LVH
- LVH with strain pattern can confound the ECG's ability to detect ACS, particularly anteroseptal MI, and mimics ACS findings

## Case Conclusion

The patient was successfully cardioverted to normal sinus rhythm then admitted to the cardiology service for placement of a permanent pacemaker. The patient's slow ventricular response was suspected to be caused by atrioventricular node dysfunction secondary to age-related fibrosis of the conduction system. ★

# Board Review Questions

PEERprep for Physicians is ACEP's gold standard in self-assessment and educational review.

For complete answers and explanations, visit the Board Review Questions page at [emresident.org](http://emresident.org), under "Test Your Knowledge"

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- 1. A 23-year-old diabetic woman presents with confusion, palpitations, and nausea. She can follow simple commands but gets agitated when questioned too much. She admits to using cocaine recently. Her vital signs include BP 165/89, P 130, and R 28; bedside glucose is 440. In addition to fluids and insulin, what medication should be given?**
  - A. Chlorpromazine
  - B. Haloperidol
  - C. Lorazepam
  - D. Metoprolol
- 2. An otherwise healthy 19-year-old man presents with "attacks" of lower abdominal pain, anorexia, and blood-tinged diarrhea that started 1 day after hosting a pig roast. He denies recent travel, has no known sick contacts, and has no surgical history. A physical examination reveals tenderness to palpation at the right lower quadrant without rebound or guarding. His vital signs are BP 119/77, P 101, R 19, and T 38.6°C (101.5°F); SpO<sub>2</sub> is 98%. Urinalysis is unremarkable, and ultrasound examination of the right lower quadrant reveals a normal appendix. Which study is the best choice for making the diagnosis?**
  - A. Abdominal x-ray, flat and upright
  - B. Abdominal-pelvic CT scan
  - C. Exploratory laparotomy
  - D. Stool culture
- 3. In a patient who has HIV/AIDS and suspected pneumocystis pneumonia, which finding is an indication to administer steroids?**
  - A. Batwing opacities on chest x-ray
  - B. CD4 count less than 100
  - C. Elevated serum LDH
  - D. PaO<sub>2</sub> less than 70 mm Hg
- 4. During an imminent delivery in the emergency department, the infant's head is easily delivered but the body does not progress despite downward traction. Which maneuver will help alleviate this fetal presentation?**
  - A. Adducting the anterior fetal shoulder, then rotating the head and shoulders 180 degrees
  - B. Displacing the fetal head back into the birth canal
  - C. Hyperflexing and abducting the mother's hips
  - D. Palpating the abdomen externally in four positions
- 5. A 24-year-old man presents after sustaining a stab wound to his left chest. He loses vital signs on arrival, making bedside thoracotomy necessary. Which structure must be avoided when incising the pericardium?**
  - A. Internal mammary artery
  - B. Phrenic nerve
  - C. Sympathetic chain ganglia
  - D. Vagus nerve ★

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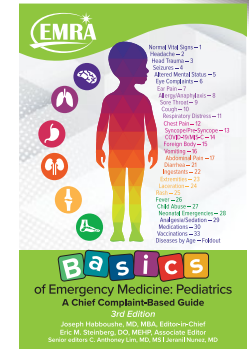
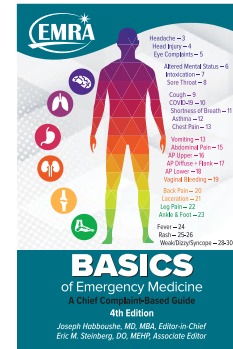
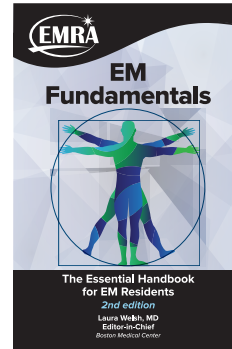
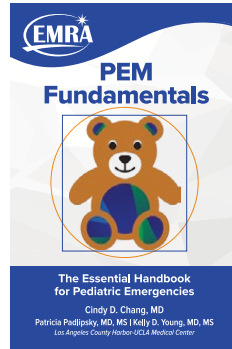
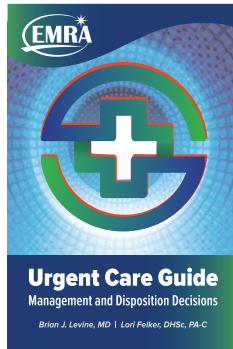
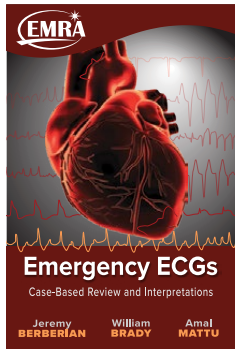


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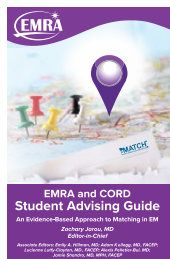
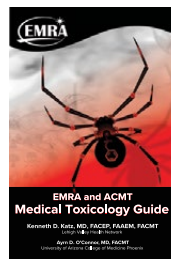
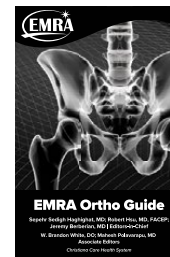
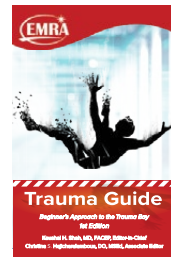
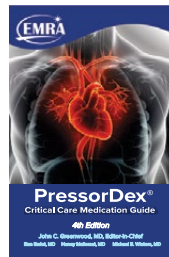
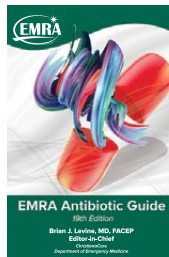


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# EM Resuscitation Research Fellowship

## Two-year Emergency Medicine Resuscitation Research Fellowship seeking applicants for the 2022-2023 Academic Year

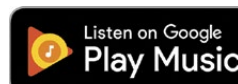
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Contact Austin Johnson, MD, PhD - [Austin.Johnson@hsc.utah.edu](mailto:Austin.Johnson@hsc.utah.edu)  
<https://medicine.utah.edu/surgery/emergency-medicine/fellowships/>



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