

# EM Resident

Official Publication of the Emergency Medicine Residents' Association

June/July 2015

VOL 42 / ISSUE 3

**Short of Breath  
Short List  
*Can't Miss Causes***

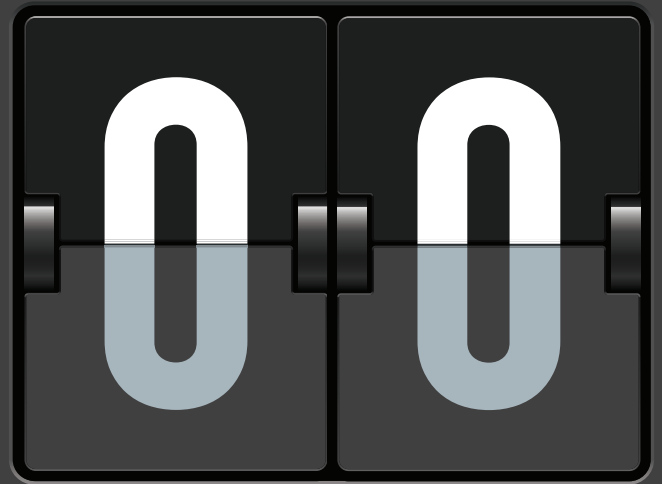
**Toughest  
Choice  
*Thrombolytics  
for PE in Pregnancy***

**Under the  
Breath  
*Laryngoscopy***





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The Emergency Medicine Residents' Association is the voice of emergency medicine physicians-in-training and the future of our specialty.



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In my seven years as an EMRA member, I have seen our association grow in size, strength, and influence. We've added not just members, but also accomplishments such as the documentary *24/7/365: The Evolution of Emergency Medicine* and blockbuster publications like our *Antibiotic Guide* and *PressorDex* (stay tuned for even more exciting publications soon to be announced!). We have been fortunate as an organization to enjoy a healthy relationship within our specialty, and within the house of medicine. We have collaborated closely with ACEP, CORD, SAEM, AMA, AAMC, and others. Investing in medical students has become a central focus for EMRA, and we actively exhibit at AMSA and SNMA conferences, as well as offer medical student symposia to help medical students interested in EM gain the knowledge they need to excel in their EM rotations and land in their dream residency programs.

Serving on the EMRA Board of Directors for the past four years, my experience has been that EMRA has continually added to our robust offerings, with perhaps

our greatest challenge being the critical reevaluation of our older processes and offerings to reflect the needs of our members today (and tomorrow). We have seen tremendous organizational growth, and we now represent 13,000+ members. So, how do we stay relevant, forward-thinking, and up-to-date? Our policy compendium (the policies of our organization as adopted by the Board and Representative Council) is on an automatic five-year review cycle, is actively reviewed by the Board, and is shared at our council meetings.

In addition to reviewing our policies, the EMRA Board of Directors also critically looks at our publications, products, and meetings. The Board has worked diligently to increase our transparency and efficiency as an organization — **we want to maximize the value of your EMRA membership.** In particular, the development of the EMRA Awards Committee has given us the capacity to handle an expanded array of fall and spring awards, while giving the applicants the thorough review and consideration

they deserve. The quality and number of applicants has risen substantially over the past few years, and it is a true challenge to select the final recipients. Beyond awards, EMRA has also created a finance committee, tasked with actively reviewing the entire EMRA budget to ensure we remain responsible stewards of our organization's resources, investing in the future of EMRA and its members.

So how are we doing? Are your needs as an EMRA member being met? Are we living up to our mission as the voice of emergency medicine physicians in training and the future of our specialty? Your Board needs your input and feedback to ensure we are attuned to your needs. If you have ideas on how EMRA can improve as we (and the specialty of emergency medicine) evolve, please let us know. Write a resolution, run for the Board, or just email your Board members. We need your ideas on what is working and where we can improve. Thank you for challenging EMRA to continue to serve its members better. ★

# National Movements and Local Roots

## EMRA Continues to Represent its Members on the Largest Stages

**H**ello EMRA members! It has been so exciting serving as your Vice Speaker. I joined the now 13,000+ members of EMRA for the same reasons you did – because I believe passionately in advancing emergency medicine.

So much has already happened since the New Year! An entirely new group of residents matched into emergency medicine in March, and the Sustainable Growth Rate (SGR) formula was repealed in early April. As your Board of Directors, we participated in the Legislative Advocacy Conference and Leadership Summit (LAC) this past May in Washington, DC. There we learned how to be the best possible advocates for our specialty and for our patients. As every year, physicians from around the United States stormed Capitol Hill to advocate for our specialty and patients regarding several different topics:

- ✓ Funding regionalization of emergency care pilot projects, trauma systems planning grants, trauma care center grants, and trauma service availability grants.
- ✓ Supporting legislation to provide resources for patients with mental illness, including training for emergency medical and law enforcement personnel to recognize individuals with mental health.
- ✓ Supporting legislation that would reduce the practice of boarding psychiatric patients in the ED.
- ✓ Supporting the “Health Care Safety Net Enhancement Act of 2015,” which provides physicians, both EM and on-call, who perform EMTALA services temporary protections.

After LAC we all traveled cross-country for a fantastic meeting at SAEM in San Diego. We had an awesome EMRA Quiz Show (congrats to our tying winning teams UCSD and Texas A&M-Corpus

Christi), mingled with academicians, and of course danced until the early hours at an epic EMRA party. Additionally, the Representative Council passed four new resolutions:

- A resolution honoring Dr. Saadia Akhtar, CORD President, for her dedication and service to EMRA and her contributions to emergency medicine resident education.
- A bylaws change reinstating the fellowship membership category. At ACEP14, the EMRA Board of Directors was tasked with investigating the membership needs of fellows. Some fellows desire full active membership, including EMRA benefits, while others preferred being EMRA alumni members while pursuing FACEP via ACEP membership. The resolution that passed allows fellows to participate in EMRA as either alumni or fellows, depending on their needs.
- A bylaws revision clarifying international membership.
- A policy compendium addition, encouraging the development of curricula in public health.

After voting on our official business, the council had the most robust town hall discussion ever! The main discussion topics centered on how to make the representative council sessions better for our program reps and how to increase leadership opportunities for EMRA members. Your reps overwhelmingly told us that they value the in-person aspect of two council sessions, and we brainstormed many ways on how to continue to improve those sessions. We explored ways to disseminate more information about what occurs in the council sessions, and more on what is happening within EMRA overall. We had a hearty discussion on the report on affiliate membership in ACEP. Most



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voiced concerns about expanding ACEP membership to affiliates, and we will represent those concerns when the ACEP report is published in June. We will continue to represent your voice and the voice of your reps when it comes to these large topics that affect not just our organization, but our specialty, and sometimes medicine as a whole.

With our discussion, our members asked, and we listened! At the rep council meeting at ACEP15, not only will you vote on resolutions and elect new board members, but you will find out what’s happening in EMRA. The committee and division chairs will update you on not only what is hot in EM right now, but also what great programming and opportunities there are for you to take back to your programs. One highlight includes the Education Committee’s 20 in 6 Resident Lecture Competition that will debut at ACEP15. Presenters are given six minutes and 20 PowerPoint slides to lecture on any topic that is relevant to emergency medicine; the best presenter wins. Application deadline is July 1, 2015. We anticipate that this will be a landmark competition and set the mark for EMRA programming for years to come. We hope to continue to provide quality national programming that can be brought back to your local residency. So many of the great EMRA activities and offerings come from our members; if you have more awesome ideas, let us know, and we will continue to work towards making our organization better.

We are all looking forward to seeing you in Boston this fall! ★

wish I were perfect. At least I wish I were a perfect doctor. As a human I'm willing to accept that I make errors and sometimes fall short or make missteps in life. But, when others are involved, it seems that perfection is demanded. And it isn't just me demanding it of myself, but it seems to be the public perception that all physicians must be perfect in their care. **As people we may be flawed, but as doctors, flawlessness is required.** Perhaps it is this dogmatic cultural belief that creates the angst we feel when we make a mistake.

I've been in residency three years now, and I don't think I've had as many shifts where I could say that everything went completely as planned, or that I did everything correctly. Each day there is something I do wrong. Sometimes it's a medical error, sometimes it's in the way I address a patient or coworker. Mistakes may be large or small, but they're always present. But now nearing the end of training it's becoming more and more evident that despite steady improvement, I will not graduate a purified physician bereft of defects. Despite the best of efforts or intentions, my human nature of imperfection will always spill over into my career as a caretaker for others. And it will for all of us. Speak with the most senior physician you can find and they're nearly guaranteed to readily admit that they still make mistakes after 20, 30, or even 40 years of practice.

But as time marches on, and litigation increases, the pressure to perform becomes increasingly stiff. How do we reconcile what is demanded of us by society with our limits as fallible individuals? Even more, **how do we reconcile our faults with our own demands of ourselves?** Too little contemplation of our mistakes leads to unwarranted self-complacency and the arrogance often noted in the villainization of physicians by the media. Too much contemplation leads to feeling

the consternating burn of the job. It makes you think you may have been better off selling sandwiches for a living. Somewhere in between is a healthy balance, but finding it is the tricky part. As physicians, and especially as emergency care providers, we've picked a profession that reveals the imperfections of others and lays bare their weaknesses in a way no other job does. That probably plays a part in the jadedness and burn out we experience: different day, same stuff. Same imperfect people... just like us.

It seems that many times we just pass over how readily we criticize others for their mistakes, yet not realizing that we would do the same thing if we were in their position. There is sometimes created an "us versus them" mentality in the department, and part of that stems from a perceived relatively higher morality. The truth is, there is no partition between us. We are all human, we're just as imperfect as each and every one of our patients, but we're expected to be perfect in our care.



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And even though we never will be, maybe we should be. **We are the healers.**

Despite all of the emphasis on our performance outcomes, and all of the build-up surrounding Press Ganey, our shortcomings may just fall to the wayside — **sometimes, perfection ultimately just doesn't matter.** There are patients who will die no matter what your actions are on their behalf. There are patients who will get better and do just fine, no matter how you treat them; or if you even treat them at all. Many times it's not about the "art" or "practice" of medicine, and no degree of astute diagnostic skill or depth of knowledge will make the difference. And that's just life.

So placing all of our efforts into being perfect physicians may not be the best or most gratifying way to live our professional lives. While nurturing the idealist within us that tells us we can be perfect is a healthy way to progress, realism tells us that some goals can't be achieved. We shouldn't feel let down or below the calling when we fail, because if we are focusing on improvement, that will keep us honest as physicians. **It's not the attainment of perfection, it's just the pursuit.** ★

**Placing all of our efforts into being perfect physicians may not be the best or most gratifying way to live our professional lives.**



THE  
**PURSUIT**



# Cutting The Check



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## The Money Trail in the ED

**H**as a patient ever asked you, “How much will this visit cost me?” Have you ever wondered the same thing? The world of billing is complicated, but it’s extremely important to incentives in healthcare and also to your bottom line. Let’s go over some basics. To make things more tangible and slightly easier to understand, we’ll use the following scenario to guide the discussion: a patient, Goldie, presents to your emergency department with chest pain.

### The Front End: What’s the Deal with Copays, Co-Insurance and Deductibles?

Private insurance plans nearly always incorporate some form of *cost-sharing* into their plans. This can come in the form of *copayments*, *co-insurance* and *deductibles*. *Copayments* are a fixed amount paid by the insured for certain services (like visiting the emergency department). *Co-insurance* on the other hand is the idea that patients are still responsible for a certain percentage of the cost of services – for example, insurance covers 80% of ED visits and the patient is responsible for 20%. A *deductible* is a set dollar amount that must be paid by the patient before insurance coverage “kicks-in.” Of note, **one of the components of the Affordable Care Act is that cost-sharing for emergency services must be the same regardless of whether a patient visits an in-network or out-of-network provider** (more on networks later). Assuming our patient, Goldie, has private health insurance, there

is likely a standard copayment amount for any emergency department visit. Let’s pretend it’s \$150.

### The Back End: How do You Get Paid and What Will the Patient’s Bill Look Like?

Figuring things out from here gets a little complicated. An emergency department bill is divided into facility fees and physician fees. We’ll examine both. Before we start, let’s define a few more terms and review some background. When looking at billing, it’s important to recognize the difference between *cost*, *charge*, and *payments*. *Cost* refers to the actual expenses incurred by a hospital for providing care to a patient. *Charge* is the price of services set by a hospital. *Payment* is the amount of money that a hospital/provider actually receives for the care provided. Every hospital has a “chargemaster,” or a list of prices for each service offered. Likewise, providers have prices they charge for services.

**Insurance companies negotiate with hospitals and providers to establish discounted, “in-network” rates for its enrollees.** This means a hospital or provider might charge \$400 for a service but is willing to accept \$200 as payment if they are contracted with the insurer. In order for the hospital and physician to stay in business, the payments they receive must be equal to or greater than the true cost of providing care.

Back to our scenario. We’ll assume Goldie has risk factors for coronary artery disease

and has a decent chest pain story. Her visit includes serial ECGs and troponins, a chest x-ray, administration of aspirin and your medical decision-making. She is eventually discharged home. The charges for her care will come from two sources: provider fees and facility fees.

Provider fees will come from you, the radiologist reading the chest x-ray, and the cardiologist reading the EKG. To simplify things, we’ll just consider your reimbursement as an emergency medicine physician. It’s hard not to get lost in the weeds when discussing coding and billing, so bear with me. Physician billing is based on CPT codes and RVUs. What are CPT codes? What are RVUs? Current Procedural Terminology (CPT) codes are numerical descriptors of the complexity of your medical decision-making for a given case. They are established by the American Medical Association (AMA) and are determined by coders who review your charts for elements of complexity. Relative Value Units (RVUs) are the mechanism by which physician services are quantified relative to one another. They are established by the AMA’s Relative Value Update Committee (RUC) and then adopted by the Centers for Medicare & Medicaid Services. Each physician service represented by a CPT code is assigned RVUs based on three components of the service: (1) physician work, (2) practice expense, and (3) the malpractice cost associated with the service. The total RVUs are then multiplied by a conversion factor. CMS sets its conversion factor annually. When providers contract with private



insurers, they establish their own conversion factor, which may or may not be based on CMS's number. Lastly, coders use ICD-9 codes, which signify the diagnosis for the visit, to justify the services provided and the charges incurred.

So what the heck does that mean? Here's what it would look like in practice. When you complete Goldie's care, your documentation in the chart determines the level of complexity of the visit (Levels 1-5, with higher numbers indicating a higher level of reimbursement). In this case, we've decided it's a level 4. A level 4 chart corresponds to the CPT code 99284. The three components of RVU reimbursement are each assigned a certain value by the RUC (physician work, practice expense, and malpractice cost) as follows:

<sup>1</sup>Total RVUs = Work RVU + Practice expense RVU + Malpractice RVUs

Total RVUs = 2.56 + 0.53 + 0.21 = 3.3

The total RVUs are then multiplied by the conversion factor. For this example, your practice uses a conversion factor of \$100 per RVU (this represents your typical charge), but your in-network rate with the private insurance company is \$50 per RVU.

<sup>2</sup>Your charge: Total RVU × Conversion factor = 3.3 × 100 = \$330

Your received payment: Total RVU × Conversion factor = 3.3 × 50 = \$165

Hospitals charge a facility fee to cover the overhead for the ED and the hospital, as well as for the supplies and equipment used to provide emergency care. **Much like physicians, the hospital must code a patient's visit according to predetermined criteria and then charge the insurance company or patient based on their coding.** The coding system "reflects the volume and intensity of resources utilized by the facility to provide patient care."<sup>3</sup> This is very different from how physician services are coded, and as a result, **there is not a strong correlation between RVUs for a visit and the facility fee.** In fact, though there are CMS guidelines for how a hospital should determine facility fees, each hospital is supposed to create its own fee schedule. In general, there are two types of codes used

for determining facility fees:<sup>4</sup> Ambulatory Payment Classification (APC) and Diagnosis-Related Groups (DRGs). APC are used for outpatient care (when a patient is discharged from the emergency department), while DRGs are used for inpatient care (when a patient is admitted from the ED). In the case of Goldie, APC codes would be used and according to ACEP guidelines, the highest category of facility fees would be met, APC 616. Like was the case for physician fees, your hospital determines the charge associated with that code but their payment from the insurance company is based on their negotiated discount rate. Let's pretend that the facility fee charge was \$2,500 but the payment is \$1,250.

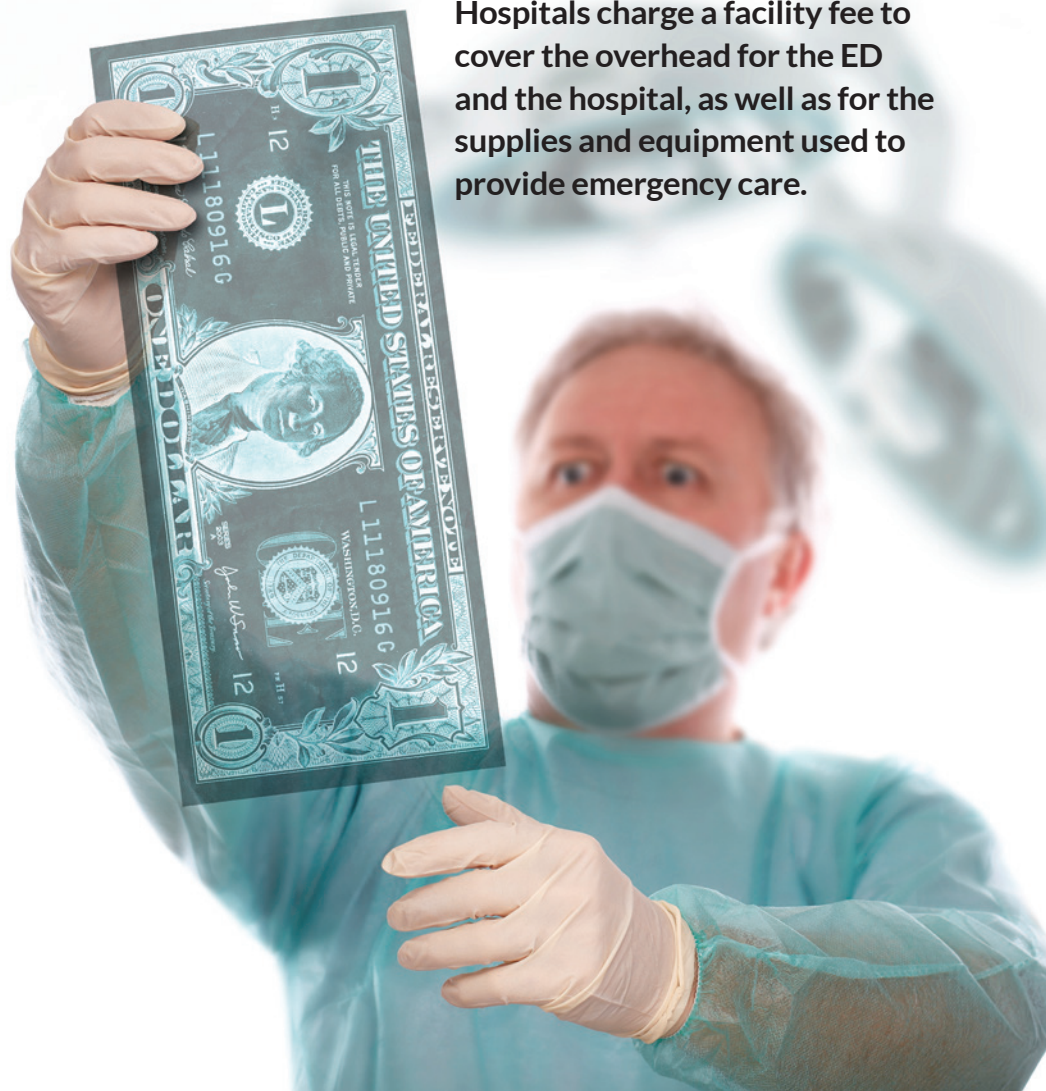
## The End Result

Provided Goldie has no deductible and no co-insurance, her out-of-pocket cost would be \$150. She would receive a statement that said you charged a \$300 physician fee but she received a discounted rate of \$165 and her bill was paid in full by her insurer. Likewise, she was charged a \$2,500 facility fee but received a discounted rate of \$1,250 that was also paid by her insurance company. Ultimately, the total charges were \$2,800 and the total payments made by the insurer were \$1,415. How much did the care actually cost? Well, that's a good question... ★

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*You can also join the ACEP 911 Network and stay involved at [www.acepadvocacy.org](http://www.acepadvocacy.org)*

*For more on health policy topics, check out EMRA's Emergency Medicine Advocacy Handbook at [www.emra.org/publications/books](http://www.emra.org/publications/books)*



**Hospitals charge a facility fee to cover the overhead for the ED and the hospital, as well as for the supplies and equipment used to provide emergency care.**

The knowledge base required for clinical expertise in emergency medicine is immense. Even after decades of practice, it is still routine to hear seasoned emergency physicians make comments on novel case presentations. Whether you're a medical student on your first emergency medicine rotation, a newly anointed intern, or a recent residency graduate, the fund of knowledge necessary for successful clinical practice is daunting. While podcasts, lectures, textbooks, journals, and academic

snakebites and altitude sickness to sickle cell disease and malaria. **Regardless of the training you receive in residency, you will graduate having never encountered hundreds of clinical disorders you are expected to recognize and treat.**

Currently I work in four different emergency departments — an adult and a separate pediatric emergency department at a tertiary care, level one trauma center; an emergency department at the only VA hospital in the state; and a single-

diseases, such as congestive heart failure, COPD, and diabetes. A typical workday in this emergency department involves diagnosis and management of arrhythmias, sepsis, and many other “bread and butter” fundamental competencies that define emergency medicine as a specialty. Separate from these experiences, the patients I treat at my rural, community job run the gamut in their severity of illness. While these patients may lack the medical complexity of a typical patient seen at the university or VA hospitals, there is often a high level of acuity.

**Equally important to the diversity of pathology is the variation in clinical practice.** While an elbow dislocation typically results in the involvement of an orthopedic consultant at the academic medical centers, both sedation and orthopedic management are routinely performed by the sole emergency department practitioner in the community setting. **Each clinical setting affords the chance to improve the way we practice emergency medicine.** From working with different EMRs, to managing patients independently or as a part of a larger interdisciplinary team, to learning the art of transferring patients or working with consultants, diversifying your clinical portfolio will make you a stronger physician.

It is important not to overburden yourself during your first years after residency. The larger paychecks often incentivize young physicians to work more shifts to help pay off debt, yet inevitably the stress and fatigue of the emergency department catches up with us all. While there is no magic number of shifts to work per month to reduce burnout, we all have our own idea of what feels comfortable.

**Graduate residency.** Take your dream job and work there for a few months. However, once you've settled in I encourage you to push past your comfort zone and moonlight at a hospital that exposes you to a completely different clinical setting, be it rural, urban, community, or academic. The breadth of emergency medicine is larger than what is experienced at any single emergency department. Increasing the variety of your experience will make you a more competent and confident emergency physician, and will lead to a more fulfilling career. ★

# The Value of Variety

**The breadth of emergency medicine is larger than what is experienced at any single ED.**



**David Diller, MD**  
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blogs supplement your education, there is no equivalent to clinical practice.

The vast majority of emergency medicine residency programs are affiliated with major academic medical centers, yet most residency graduates are employed at community hospitals. The experience with which residents are exposed to community medicine, in addition to other non-required rotations such as orthopedics and toxicology, during graduate medical education training is variable. Inevitably, the geographic location of a residency program will also predispose its trainees to a unique breadth of pathology, from

coverage emergency department in a rural community. While the scheduling and maintenance of credentials at each hospital can be cumbersome, as a recent residency graduate, the educational benefits are immeasurable. The clinical pathology I encounter at each site is unique. At the tertiary care referral center, I see a larger volume of trauma, and I routinely manage complex medical and surgical patients who ultimately require sub-specialty care. While the management of these patients is intellectually challenging, it is inherently different from the clinical practice experienced at the VA hospital emergency department, where much of this unique population presents in acute exacerbations of often poorly-controlled chronic

# Beyond the Non-Con

# STROKE ALERT

A 60-year-old female presents to the ED with altered speech and decreased responsiveness that began less than one hour ago. Outside of a resolving hypoxia, all vital signs are stable. She has a noticeable right-sided facial droop, is non-verbal, is unable to follow commands but withdraws from pain, and has an up-going Babinski reflex on the right. A stroke alert is called and a non-contrast computed tomography scan (CT) of her head is obtained. This reveals a dense middle cerebral artery (MCA) sign on the left without any sign of hemorrhage as seen in Image 1. The patient is treated with IV tPA and transferred to a tertiary care center where she undergoes computed tomography angiography (CTA) and CT perfusion scans, followed by endovascular thrombectomy. She is continued on anticoagulation and undergoes rehabilitation, after which her only residual symptom is a slight delay in her right hand when playing the piano.



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**A**cute ischemic stroke is a common life threatening condition seen in the ED every day. In the United States, **approximately 795,000 people experience a stroke annually; 87% of these are ischemic.**<sup>1</sup> After the physical exam, the standard of care is that a non-contrast CT be the next step in diagnosis of a potential stroke. Although its greatest value is in ruling out a hemorrhagic stroke, emergency physicians should be familiar with findings on non-con CT that provide evidence for an ischemic stroke. Additionally, we are on the prepuce of an era in which endovascular therapies could potentially replace current treatment algorithms. In these new testing protocols CTA and CT perfusion scans, in addition to the non-con CT, are the tests of choice for selecting patients that would benefit from interventional therapies.

**Image 1.** Non-contrast computed tomography scan revealing a hyperdense middle cerebral artery (MCA) sign on the left, without any sign of hemorrhage.



## Discussion

**The ability to interpret non-contrast head CTs in the evaluation of stroke is a necessary skill for all emergency providers.** It is an essential test for all potential stroke patients when intervention is time sensitive and can determine patient outcome. Obtaining a non-contrast head CT for all potential stroke patients as early as

**Table 1. Early Signs of Ischemic Stroke on Non-Contrast CT<sup>3,4</sup>**

Hyperattenuation of a large vessel (ex. hyperdense MCA sign)
Hypoattenuation of 1/3 or more of the MCA territory
Loss of the insular ribbon
Loss of gray-white matter differentiation
Cortical sulcal effacement
Focal parenchymal hypoattenuation
Obscuration of the lentiform nucleus
Alberta Stroke Programme Early CT Score (ASPECTS)

possible determines our management and is the most cost-effective imaging strategy to improve their survival and quality of life.<sup>2</sup> An emergency physician should not limit their reading of a non contrast head CT to only evaluating for presence or absence of hemorrhage. There are several early signs of ischemic stroke that are often present, as seen in Table 1.<sup>3,4</sup>

The hyperdense MCA sign in particular is a marker of a thromboembolic occlusion of the M1 segment of the MCA. This sign is usually associated with large territory infarcts and is present in 17-50% of MCA strokes.<sup>5</sup> One prospective study of 443 patients with cerebral vascular accidents found the hyperdense MCA sign to be only 30% sensitive, but 100% specific for large territory infarction.<sup>6</sup> **Despite its strong association with large territory infarcts, its association with poor outcome is controversial.** Part of this ambiguity may be explained by the pseudohyperdense MCA sign, or mimickers of the hyperdense MCA sign. The pseudohyperdense MCA sign looks

similar to the hyperdense MCA sign, but it is caused by an unrelated mechanism such as intravenous contrast medium, vascular calcification, or an elevated hematocrit. The two signs can be distinguished by measuring the attenuation of the sign compared to the same artery segment on the contralateral side, or by observing resolution of the sign on repeat CT (depending on the cause for the finding).<sup>5,7</sup>

A systematic review of 15 studies and 3,468 patients found the prevalence of the signs in Table 1 to be only about 61% (+/-21%), with a mean sensitivity of 66% (range of 20-87%), and mean specificity of 87% (range of 56-100%).<sup>3</sup> In this study, the presence of one of these signs elevated the risk of a poor outcome (odds ratio of 3.11); however, there was no association in outcome when IV thrombolysis was given to a patient in whom a sign was present.<sup>4</sup> Another study found a similar lack of association between outcome and the presence of these signs in patients receiving IV alteplase (tPA).<sup>8</sup> Therefore, despite these signs being associated with

poor outcomes, in our current treatment algorithm of IV tPA vs no IV tPA, early CT signs of acute ischemic stroke should not play a significant role in decision making and management.

**The utility of the hyperdense MCA sign is found when it is used as a representative of a proximal thromboembolic occlusion of the MCA.**<sup>5</sup> This finding then justifies further studies. Endovascular clot retrieval therapy may play a role; in select patients it has been shown to improve functional outcomes compared to standard therapy with or without IV tPA. Three recent randomized controlled studies (EXTEND-IA, ESCAPE, and SWIFT PRIME trials) demonstrated a benefit to clot retrieval in selected patients.<sup>9,10,11</sup> These trials utilized either CTA or CT perfusion scans to select patients with relatively small irreversible infarct territories and a proximal occlusion of the internal carotid or an intracerebral artery (i.e., the MCA). The ESCAPE trial included patients up to 12 hours after symptom onset, providing endovascular clot retrieval long after IV tPA becomes contraindicated (at 3 or 4.5 hours, depending on the patient and existing protocols).<sup>10</sup> A hyperdense MCA sign on the non-contrast CT may prompt the emergency provider to consult a stroke specialist and obtain one of these additional scans or further intervention.

**An emergency physician should not limit their reading of a non-contrast head CT to only evaluating for presence or absence of hemorrhage.**

**Conclusion**

At this point, there is no evidence that associates the hyperdense MCA sign or any early sign of ischemic stroke on non-contrast CT with endovascular therapies and improved outcomes. But, as more literature is published on these new therapies, it may be even more important for the emergency provider to correctly identify proximal cerebral artery strokes to hasten endovascular intervention. ★

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**David Reid, DO**  
 Past EMRA Medical Student Council Chair  
 UT Southwestern Medical Center  
 Dallas, TX

# Tackling TRANSITIONS

## The Pace of Medical Training and Practice

**A**t this time of year, nearly everyone on the physician's path is in a state of transition. For many, the beginnings of medical school, residency, or independent practice are on the horizon; while others are growing from first year to second, second to third, third to fourth, etc. The process has become so standardized and structured, however, that from the moment undergraduate students make the decision to pursue a career in medicine, rigid milestones are laid before them and preparation for the next step begins.

Milestones are becoming ever more ubiquitous during our training. For residents, "milestones" now signifies a road map towards board eligibility, just as the shelf and Step exams marked the road towards matching. The competition and demand

gets tougher every year, and constant preparation is required to excel at the next benchmark. But when we achieve the goal in front of us, too often there is no time to reflect on it, revel in it, or recover from it. The next milestone is immediately within sight, and our learned reflex is to resume preparation and dominate the next exam or evaluation — whatever the next obstacle may be. It's a relentless pursuit of "the next."

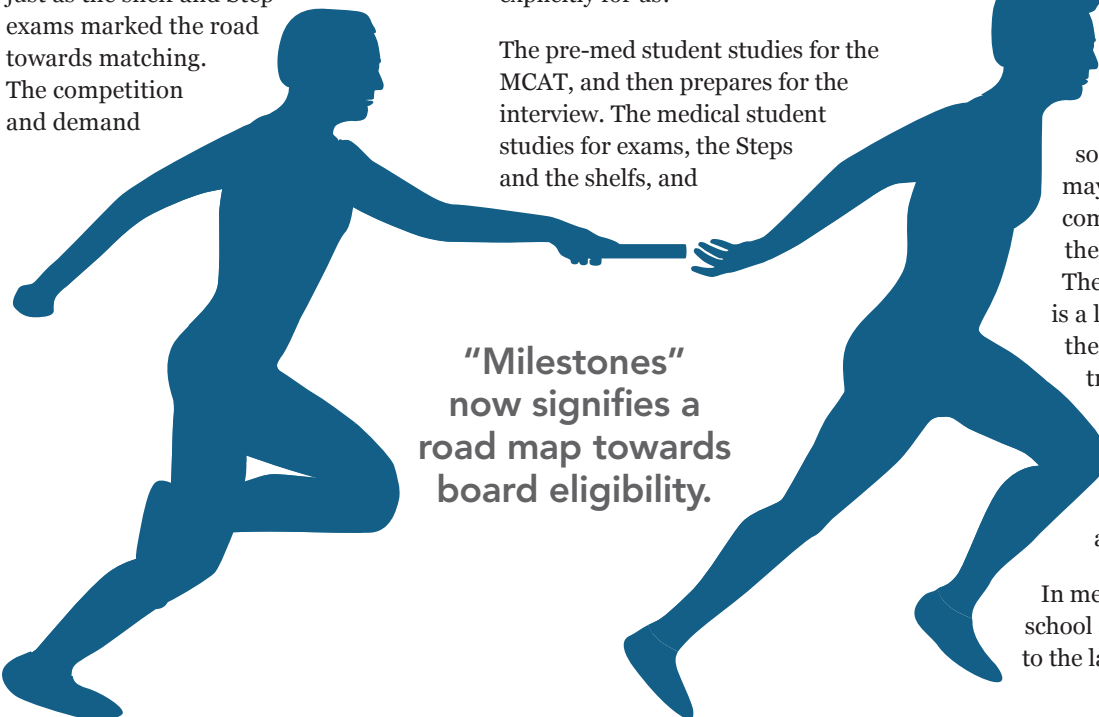
But when does it stop? When can we be satisfied? What happens when the next test is so far away we can't see it? Or when it's not clear anymore what the next one will be? Will we know how to live for the now instead of the next? Will we be able to identify the next if it's not laid out explicitly for us?

The pre-med student studies for the MCAT, and then prepares for the interview. The medical student studies for exams, the Steps and the shelves, and

then prepares for the interview again. The resident studies for the in-service, theboards, the oral, and of course, prepares for the interview again. Even the attending prepares for recertification, sometimes another interview, and soon after, retirement. It's no wonder we burn out! We don't have the training for longevity or contentment. As it turns out, **the course from pre-med to attending is not a single marathon; it's 26 one-mile sprints with no breaks in between**, and we may be disappointed to find out the finish line isn't as clearly marked as we thought.

A few of my medical school classmates strategized their schedules by back-loading vacation at the end of clinical years. They decided to not take time to rest or recharge with friends and family after Step 1 and Step 2 so they could be "done" sooner. Done... with what? That may have been one step closer to completion of medical school, but there is no "done" on this road. The choice for a career in medicine is a lifelong commitment, and from the very beginning we should be training ourselves on how to take the strides of a marathon, speeding up when we're falling behind pace, and slowing down when we're ahead.

In medicine the demarcation between school and a real job is often unclear to the layperson, and can leave us



**"Milestones"  
 now signifies a  
 road map towards  
 board eligibility.**

## MEDICAL STUDENT CHAIR

confused as well. Certainly you have had some form of the following discussion with non-medical family and friends:

*“Well, in medical school I saw patients and did procedures, but someone was always watching me. And in residency you’re a doctor, but you’re kind of still in school. No, you don’t go to class – well, sometimes, I guess. Yeah, you get paid, but not very much, and someone is still watching you. And fellowship is more training, but it’s not residency. You make more money, kinda, but not really. Yeah, you’re more of a doctor, but you were already a doctor, just not as much. But you’re still a full doctor if you don’t do a fellowship.”*

From the moment students enter medical school, they should be able to recognize they have begun a lifelong commitment. They have started on a path that doesn’t allow for weekends, holidays, or vacations like other professions do. Day one of med

school is day one of their job-for-life. Graduation, residency, and fellowship are just parts of the job, parts of the choice. Certainly there’s a great sense of completion when a major milestone has been reached, but to work only towards the fastest route from beginning to end will inevitably at some point leave everyone of us wondering where the end really is and where the now has gone.

There is perhaps no greater moment of the journey than residency when we should endeavor to live in the now, to make sure we appreciate each day for the lesson and experience it brings. Residency is the most critical time during which our skills and talents as practitioners are honed, and therefore when it is most important for us to avoid exceeding our pace. We’ll look back and wonder how it all flew by so fast no matter how we approach it, so a slow and steady pace may make it all the more beneficial and meaningful. Slow and steady may also give us the chance to remember that **the family, friends, and life we have**

**outside the hospital walls are as real as what we have on the inside.** But the outside life is the only one that will follow us from step to step and from place to place — as long as we remember to give it what it needs in return.

Emergency medicine has a long and documented history of stress and other hazards that make EM physicians more susceptible to exhaustion and burnout. Do what you can now — at whatever stage you are in today — to teach yourself how to meet the milestones the profession requires, while also maintaining a balance and pace you can sustain. Residency may be the time when we learn to think independently as clinicians, but it is also the time when we have to prepare for our independence from the path. **In order to be successful at forging our own way, we have to start understanding how to live for today as much as tomorrow.** And like any other skill we will learn, it takes patience and practice to perfect. ★

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# WAKE-UP

## Fear and Empathy in Emergencies

# Call



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of the many ED nurses and techs who had gathered to unstrap him from the backboard, cut off his clothes, and hang bags of IV fluid. His face was young and handsome. Several days of stubble covered his square jaw, and it was accented by neatly trimmed brown hair.

### It was at that moment that I registered my husband's face.

I could not move. Frozen in shock, I remembered that he always awoke early at 4 a.m. and drove to work at about this time. I pictured him tired, nodding off, then falling asleep at the wheel, and finally crashing violently against a tree. I pictured him lying on the side of the road in the early-morning fog, lifeless. I pictured him helplessly being intubated by the paramedic. My heart sank. My head felt light. I was suddenly flushed, and my knees almost gave out. **"Do something,"** I said to myself, but I could not.

I walked only a single step closer and the face of my husband mercifully faded away and became the face of another young man, so similar in appearance that I had to look long and hard to be certain. I felt a wave of relief as tears rose to my eyes. I turned toward the wall and continued writing, trying to forget the intense and very real fear I had just experienced. I felt a second pang of sadness for this other young man, realizing that the feeling of dread I felt would soon be shared and intensified with his family. That morning, I drove home in silence; I was exhausted, grateful, but also fearful.

Fortunately on that day, I did not have to truly experience such loss. All who work in the emergency department have seen true defeat, sadness, and despair. **All of us have also, at times, become cynical and unsympathetic.** It is easy

to become complicit, to make sarcastic remarks, to brush off the sadness that we have just experienced. **We get jaded.** While it is important that we are able to reflect and to let off steam, it is easy to forget why we are in residency: to become the best physicians we possibly can be. **We must learn medicine, but also learn sympathy.**

When I reflect back on this moment, the fear feels as real as it did at that time. If it had been my husband on the side of the road and on the gurney that day, I believe that the ED team would have done their very best to care for him. But with guilt I wonder, do I always do *my* very best? Even in the small things that seem to be annoyances, do I take the extra moment to comfort the worried mother, to listen and actually hear what the patient has to say, to put a hand on the elderly woman's shoulder and provide comfort? Do I study with the intent of delivering the best patient care? Am I deliberately developing and practicing my skills to be the kind of physician that I would want taking care of my mother, my grandfather, my sister, or her children?

I know that I will not learn everything during these three short years. I know that I will make mistakes and have to continually adapt, learn, and develop. I believe that is why we call it *practicing* medicine. But I certainly hope that I never stop trying to improve, never stop working to be better, and more importantly, that I never cease to care. **Sometimes we must face our greatest fears in order for us to be the greatest we can be.** ★

The shrill sound of my pager rang me out of my early-morning stupor at 5 a.m. The small screen indicated that a Level 1 trauma was heading our way soon – this overnight shift wasn't quite over. Near the end of my month long rotation with the trauma service I was tired, hungry, and hoping to get off on time at 6 a.m., for once. I groaned back at my pager in response as it beeped. Semiconsciously dragging my feet a little, I walked into the trauma bay. Just a handful of minutes earlier that morning there had been a single-vehicle crash involving a young adult male. The tele-EMS report stated that he may have fallen asleep at the wheel, veered off the road, and struck a tree. He was unresponsive and intubated on-scene. I was scribing for that particular case, so I positioned myself off to the side of the room in preparation for the patient's arrival. We waited for about 15 minutes. "Why can't they ever estimate the correct ETA?" I complained to myself.

The EMS crew finally arrived with the patient, who was immobilized, intubated, and being bagged. I caught a glimpse of the man from the side, through the arms



# The Toxidrome

Through close monitoring and timely intervention, it is possible to minimize the morbidity and mortality associated with MDMA use.





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**A** 24-year-old female is brought into your ED by friends for “not acting right.” They report she ingested ecstasy and alcohol at a party the night before, and when they went to see her this morning, they found her on the floor of her apartment with a laceration on her right forehead, and “not making sense.” Her vitals on presentation are: BP 118/58, P 52, R 16, T 99.4, O<sub>2</sub> Sat 100% on RA.

**Epidemiology**

3,4-Methylenedioxymethamphetamine (MDMA, ecstasy, molly) is a euphoric and hallucinogenic drug commonly used in the US and in Europe. Originally synthesized in 1912, the compound was explored for psychiatric applications in the 1970s prior to classification as a Schedule I drug by the FDA in 1985. In the mid- to late-80s, recreational MDMA use was common across Europe; use in the US increased rapidly from the mid nineties to today, with **annual new users estimated**

**at 751,000 in 2013.**<sup>1</sup> In particular, use among younger age groups has been on the rise, from 1.9% of children in the US aged 12-17 having used MDMA in 1999 to 2.2% in 2008.<sup>2</sup> Purity of the compound remains an issue, with reported adulterants including amphetamine, cocaine, heroin, lysergic acid diethylamide, ketamine, and cocaine.<sup>3</sup>

**Pharmacokinetics**

MDMA is commonly ingested orally and/or through nasal inhalation. It interacts with monoamine transporters to stimulate the release of serotonin, dopamine, and norepinephrine in the brain. Other hormones released include cortisol and ADH. Hallucinogenic effects of the drug, including increased appreciation of lights and music, are due to direct serotonin 2A receptor stimulation.<sup>4</sup> The half-life of MDMA and its toxic metabolites is estimated to be 8-9h for a single dose, but multiple doses autoinhibit its metabolism, further complicating the treatment of toxic ingestions.<sup>5</sup>

Adverse effects of MDMA include anxiety and panic attacks, which represent extensions of its more desirable effects. Other negative effects include hyperpyrexia, rhabdomyolysis, or serotonin syndrome. Hyponatremia can occur from free water uptake in the collecting tubules due to the effects of increased ADH release. Furthermore, MDMA’s active metabolites act as neurotoxins over the short and long

term, in addition to inducing liver injury at elevated doses.<sup>6</sup>

**Context and Use**

MDMA is taken by its users to elicit feelings of euphoria, increased sensation, interpersonal closeness, extroversion, and mild perceptual disturbances with regard to light and sound. Users often ingest multiple doses to enhance its desired effects; this can be dangerous due to variability of dose and purity in tablet and powder forms, in addition to the resulting unpredictable pharmacokinetics. Use commonly takes place in warm environments with high levels of sustained physical activity, potentially increasing its hyponatremic and hypovolemic effects.

**Clinical Signs and Symptoms**

**Classically, MDMA ingestion manifests itself as a sympathomimetic toxidrome**, as noted by restlessness, agitation, diaphoresis, mydriasis, tachycardia, bruxism, and hypertension. While these may be mild in intensity for modest ingestion, **larger ingestions can lead to confusion, aggressive behavior, muscle tension, psychosis, hyperthermia, tachyarrhythmias, and seizures.**<sup>7</sup> The sequelae of these initial signs and symptoms contribute significantly to the morbidity and mortality associated with this drug. Hyperthermia and muscle rigidity can lead to significant rhabdomyolysis, of which is renal failure is a consequence. Additionally,

**MDMA TOXIDROME AND INTERVENTIONS**

System	Intermediate Toxicity	Severe Toxicity
Cardiovascular	S/Sx: Tachycardia, hypertension, palpitations Recommendations: EKG, fluid bolus if needed; avoid beta blockade	S/Sx: Tachydysrhythmia, coronary vasospasm, ischemic or hemorrhagic stroke Recommendations: Cardiac monitoring, treat as indicated
Renal	S/Sx: Hyponatremia, prerenal failure, mild rhabdomyolysis Recommendations: Fluid boluses, CPK measurements, correct & replete electrolytes as needed	S/Sx: Symptomatic hyponatremia; SIADH-like syndrome, acute kidney injury secondary to volume depletion/ rhabdomyolysis Recommendations: Identify cause of renal failure and treat accordingly; dantrolene, hemodialysis
Neurologic	S/Sx: Hyperactivity, confusion, aggression, psychosis Recommendation: Frequent neurologic exams, benzodiazepines and antipsychotics for sedation	S/Sx: Delirium, coma, seizures, serotonin syndrome, intracranial hemorrhage, cerebral hyperthermia Recommendation: Correct electrolyte abnormalities, advanced imaging, maintain airway control and support vital signs
Hemodynamic	S/Sx: Flushing, sweating, dehydration, hypertension Recommendations: Serial electrolyte monitoring, IV fluids as needed, cooling measures to maintain core temperature <102°F	S/Sx: Fever, hyperthermia, hypotension, disseminated intravascular coagulation Recommendations: IV fluids, dantrolene, cryoprecipitate, platelets, plasma, and clotting factors as needed

tachyarrhythmias can cause marked hemodynamic instability resulting in death.

*The now agitated and uncooperative patient is given haloperidol 5 mg IV and lorazepam 2 mg IV for acute agitation. An EKG is negative for ischemic changes and a CT head is negative for intracranial or intraventricular hemorrhage. Serum chemistry yields: Na 116 mmol/L, K 4.4 mmol/L, Cl 83 mmol/L, CO<sub>2</sub> 22 mmol/L, BUN 8 mg/dL, Cr 0.50 mg/dL, Glucose 110 mg/dL, and Mg 1.2 mg/dL.*

## Clinical Management

**Start with the basics.** Ensure these patients are protecting their airway, and provide support as needed. If initial vital signs are abnormal or the patient appears to be severely intoxicated after obtaining a history, keeping them on the monitor is prudent. Most will likely be volume depleted, and will benefit from intravenous fluid administration. Be sure to obtain an accurate account of any co-ingestants, if able. Patients who report a small ingestion and are exhibiting mild signs and symptoms may not require any laboratory workup. **For any patient showing signs of severe toxicity, however, a laboratory workup for electrolyte abnormalities, renal function, and rhabdomyolysis is warranted.** A screening EKG is beneficial when faced with marked tachycardia or hypertension; cardiac function tests may be indicated, based on the patient's history and comorbidities.

**Temperature.** Hyperthermia can be pronounced, and may even lead to heat stroke in more severe circumstances. Temperature monitoring and regulation is vital to preventing the dreaded complications of heat-related injury, such as disseminated intravascular coagulation, and kidney injury. Hyperthermic patients should be kept at a temperature below 102°F; initial cooling measures may include ice baths or cooling blankets; advanced cooling measures include sedation and neuromuscular blockade in addition to IV administration of dantrolene.

**Salt.** Hyponatremia is the most common electrolyte abnormality encountered in MDMA toxicity, and can be attributed

to an increase in antidiuretic hormone secretion induced by MDMA. This is often exacerbated by excessive free water intake due to warm environments and increased physical activity.<sup>8</sup> Normal saline boluses are usually all that are required; however, if sodium is less than 120 mmol/L and especially if the patient develops seizures, hypertonic saline may be necessary. Boluses may be repeated until a target increase of 5 mmol/L has been reached. Although hyponatremia associated with MDMA use is most likely acute (<48h), it remains prudent to prevent Na from rising more than 10 mmol/L in the first 24h period, and then 8 mmol/L per 24h period thereafter to prevent osmotic demyelination syndrome.<sup>9</sup>

**Rhabdomyolysis.** Patients should also be monitored for signs of rhabdomyolysis. Creatine phosphokinase (CPK) levels should be surveyed. Following correction of electrolyte abnormalities, elevated CPK levels should be addressed with aggressive saline infusion to prevent renal injury. In the most severe and life-threatening cases, veno-venous hemofiltration may be used.

**Protect the kidneys.** Kidney injury occurs through multiple mechanisms, particularly volume loss, hyperthermia, and rhabdomyolysis. Usually, however, identification of the underlying cause of renal failure, and treating it accordingly, is the ideal way to manage AKI in the setting of MDMA toxicity.

**Watch the heart.** MDMA use induces an alpha-adrenergic response similar to cocaine and methamphetamine administration, and so is frequently accompanied by palpitations and tachycardia. There are several reports of cardiotoxicity and cocaine-like vasospasm. Accordingly, beta blockers should not be used, as they can increase coronary vasospasm and myocardial ischemia. Tachydysrhythmias are usually managed as indicated based upon the rhythm.

*Following initial laboratory and imaging studies, the patient is transferred to the ICU. She is administered 100 mL of 2% hypertonic saline IV at 50 mL/hr. A repeat Na (7h after initial study) is 129 mmol/L. Her urine sodium is 160 during her first*

*night in the ICU, with a FeNa at 1.9%, consistent with SIADH. The patient is then placed on 1/2 normal saline, correcting to 135 over the next 24h with gradual improvement in mental status. Her CPK trends upward to 13,630 on day 2, but her neurological status continues to improve.*

## Disposition

Patients suffering from acute MDMA toxicity should be managed with respect to the severity of intoxication. Those with severe hyponatremia or altered mental status, as in this case, should be monitored in a setting where frequent neurologic checks and chemistry results are accessible to evaluate the effectiveness of any interventions taken, such as the ICU. **In the setting of decreasing symptoms and the absence of cardiac or electrolyte abnormalities, patients may be safely discharged after observation for 4-6 hours.** After returning to baseline, patients should be counseled and screened for sexual assault, as memory and judgment can be impaired by MDMA or associated adulterants. Users should also be cautioned against the dangers of consuming such substances in the future, especially in unfamiliar or unsafe environments.

*On day four of her hospital stay, the patient's CPK is 6,047 and her creatinine is within normal limits. Her mentation is at baseline, she consents to a sexual assault screening exam, and is subsequently discharged to home.*

## Conclusion

MDMA toxicity frequently has favorable outcomes with relatively limited intervention, but severe episodes of toxicity or overdose can lead to marked neurologic, hepatic, or cardiovascular damage. Due to the frequently limited and unreliable histories common to this type of ingestion, serial evaluations of these patients are recommended to ensure initial interventions are progressing appropriately and that no new findings are discovered. Through close monitoring and timely intervention, it is possible to minimize the morbidity and mortality associated with MDMA use. ★

Over the past 20 years, I have had the opportunity to work with thousands of different financial situations, encompassing many different practice and income models, as well as many different demographics. I don't claim to have "seen it all," but I have certainly seen a lot.

In all this time, two things remain true with saving and investing:

- I have never had anyone say they regretted saving money.
- I have had many people say they wished they had started saving earlier.

The reality is the earlier you begin to prepare for something, particularly when it comes to saving and investing, the higher your likelihood of success and security.

While it may seem trivial, there is a clearly identifiable success pattern that often starts with \$50 per month to a savings account during internship, evolves to \$500 per month into a retirement plan throughout training, and then matures to \$5,000 per month into savings and investment programs once established in practice.

It is difficult on a house-staff budget, but it is not impossible in most situations. The following is intended to provide broad guidance. Please recognize that while many residency situations are similar, all have unique characteristics, and this article is intended to provide informative guidance to a wide range of readers.

Here are three pearls to get you on the right track:

### Discipline

As a resident, savings will rarely happen if you do not make it a priority. Identify a budget, pick an amount you feel you should be able to save, and set up a monthly bank draft from your checking into your savings. Start conservatively

(small) and get used to the change. Gradually increase every three months. Allocate this initially to cash savings. Don't get fancy or creative until you have at least one month of living expenses saved in cash.

**As you develop a reserve of cash, allocate a portion of your money to funding a Roth IRA or your house staff 403(b) program,** depending on your tax situation. If you need help figuring this out, seek a CPA or financial planner who understands residency, as well as the financial implications of medical training.

### Asset Allocation

There are limitless resources dedicated to understanding investing, investment management, portfolio modeling, and every mundane or esoteric aspect of the financial markets. If you are new to investing with limited dollars, skip them all and find a target date fund. These are

available in most retirement plans such as 403(b) and 401(k)s, IRAs, and Roth IRAs with most major investment sponsors and also for non-retirement investments. These types of funds provide diversification, professional management, and require no maintenance. If using this approach, choose one target fund with an appropriate date and put 100 percent of that account into that fund. Do not mix-and-match target funds for diversification. You will make a complete mess.

### Account Structure

There are many types of accounts to use when developing a savings and investment program. **To keep this simple, as well as broadly applicable, I recommend using a simple savings account for savings.** If your bank offers a money market account or high yield account that is liquid (money is available when

**PAY  
YOURSELF  
FIRST.**

# It's Never Too Early



**M. Shayne Ruffing**  
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## MONEY MATTERS

you want it), and offers a higher interest rate than a common savings account, use that one. Remember this is not typically much money, so do not overthink it. In most cases, ease of use is as important as the specific type of account.

As you get beyond cash savings, consider investing in retirement accounts first, and fully fund them before looking for non-retirement investments accounts. **Most GME programs offer or sponsor a 403(b) or 401(k) plan that will allow you to invest up to \$18,000 per year** (in 2015) often in a pre-tax or post-tax (Roth) environment. You may also choose to use an individual Roth IRA for the tax benefits of paying taxes now at house staff tax rates, and making withdrawals later in life at attending tax rates.

**If you are moonlighting and have 1099/self-employment income, look at the advantages of using a SEP IRA to put aside approximately 25 percent of your moonlighting**

**income on a pre-tax basis**, reducing your federal, state (if applicable), and self-employment tax liability. Following training, you can combine this with other retirement plans of the same tax status to streamline your portfolio.

This article will likely be ready at the perfect time to put it to use. New interns will be receiving their first paychecks, house staff who are advancing in post graduate year will receive a nominal increase in pay. and residents and fellows who are completing their training will be transitioning to a real paycheck.

Make effective use of the new dollars: **Pay yourself first.** Pay everyone else after.

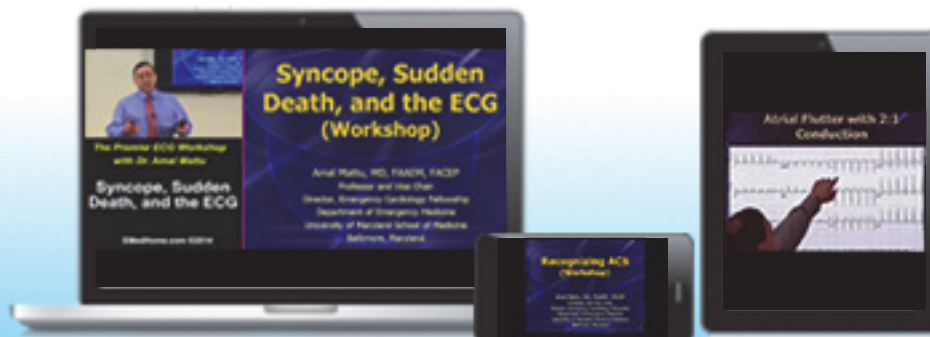
I wish you the very best in your endeavors. ★

**Don't get fancy or creative until you have at least one month of living expenses saved in cash.**



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# Thrombolytics for Pulmonary Embolism in Pregnancy

## The Toughest Choice

A 32-year-old pregnant woman at 30 weeks gestation is brought to the emergency department. Earlier in the day she had a sudden onset of shortness of breath, followed by an episode of syncope. She denies cough, fever, palpitations, sweating, or leg swelling/pain, but did recently travel to Europe, and is a smoker.

Her heart rate is 106 beats/min, her blood pressure 98/64 mm Hg, and her respiratory rate 22 breaths/min with an O<sub>2</sub> sat of 86% on room air. She has distended neck veins and a new right bundle branch block. With high concern for pulmonary embolism (PE), intravenous unfractionated heparin is started immediately. Shortly thereafter, the patient's blood pressure begins to drop and she becomes increasingly obtunded. Rt-PA is considered, but ultimately it is not given because its adverse effects in pregnancy are not well understood. The patient continues to deteriorate, and unfortunately passes away despite resuscitative efforts.



**Mohammed Alomani, MD**  
Research Fellow  
University of Maryland  
Medical Center  
Baltimore, MD

approved for use in response to ischemic stroke, myocardial infarction, PE, and thrombosis of cardiac valve prosthesis, but no randomized controlled trials have examined their use in pregnant patients.

### Introduction

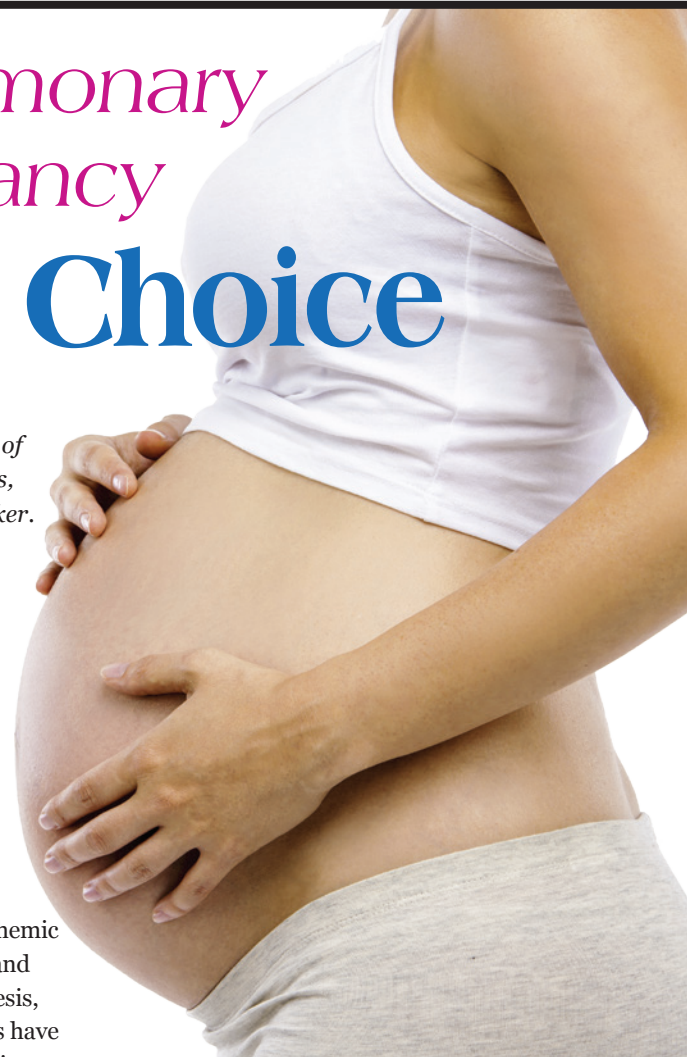
The hypercoagulable state that is inherent during pregnancy increases the risk of pulmonary embolism (PE), which is responsible for 11-20% of maternal deaths.<sup>1,2</sup> PE is considered the most common cause of direct maternal mortality, but its true incidence during pregnancy is unclear; in many suspected cases, the path to a definitive diagnosis is clouded by fears about exposing the fetus to radiation and the dearth of treatment options. The presence or absence of specific clinical symptoms should not be relied upon to diagnose or exclude PE. **About 40% of asymptomatic pregnant patients with deep vein thrombosis (DVT) might actually have PE.**<sup>3</sup> The incidence is spread throughout the nine months of pregnancy, but more than half of cases occur during the first five months. Systemic thrombolytic drugs are

### Discussion

Massive PE is one of the most life-threatening emergencies that can arise during pregnancy. In its more extreme form, an acute episode can be accompanied by persistent hypotension (systolic blood pressure <90 mm Hg), requiring inotropic support. Other findings in severe PE may include pulselessness or persistent profound bradycardia.<sup>4</sup> However, other causes of the patient being in extremis should be ruled out, including arrhythmia, hypovolemia, sepsis, or left ventricular dysfunction. Intravenous unfractionated heparin (UFH) is the conventional ideal treatment in PE. However, **in massive PE with hemodynamic instability, where there is virtually complete obstruction of the pulmonary blood flow, UFH cannot reduce the blockage, and therefore cannot restore pulmonary circulation.**

Thrombolytics are extremely valuable in such situations, and an infusion of UFH can then follow. The lung receives the entire cardiac output and all of the administered thrombolytic agent, no matter which vein is used to administer the drug. As a result, PE is exceptionally sensitive to thrombolysis, even at lower-than-standard doses, which adds to its safety profile.

During pregnancy, the hazards of thrombolysis lie in the risks of fetal and maternal bleeding, fetomaternal death, teratogenicity, and placental abruption. Several literature reviews have found no documentation of placental abruption associated with thrombolytic therapy. **The maternal hemorrhage complication rate has been reported at approximately 6%, equivalent to the rate among non-pregnant patients receiving thrombolytic therapy.**<sup>5-8</sup>



## CRITICAL CARE

Thrombolytics have been used only rarely during pregnancy. Leonhardt and associates found only 28 reports of the use of rt-PA in pregnant women at the time of their literature review, published in 2006. Their collected data showed that thrombolytics had been used during all three trimesters for various indications: cerebrovascular accident (10); PE (7); cardiac valve thrombus (3); DVT (3); and MI (1). Two patients died (7%), as did 6 of the fetuses of the 26 surviving mothers (23%).

Five of the fetuses of the seven women who received thrombolytic therapy for severe PE were delivered as healthy newborns at term. The other two died of causes other than thrombolysis: one as a spontaneous abortion stemming from the mother's hemodynamic instability, and the other as a result of neonatal respiratory distress syndrome at two weeks postpartum.<sup>7-14</sup>

A subsequent review of the use of thrombolytic therapy in pregnant patients with PE, published in 2009, identified 13 cases. No maternal deaths occurred, although major bleeding (30.8%; 95% CI 9.1–61.4) and fetal deaths (15.4%; 95% CI 1.9–45.5) were significant complications.<sup>15</sup>

A meta-analysis of randomized controlled trials (RCT) of thrombolysis in massive

and submassive PE published prior to 2004 reported a risk of major bleeding of 9.1% and intracranial haemorrhage (ICH) of 0.5% while a recent large RCT of tenecteplase in submassive PE (PEITHO) observed rates of major bleeding of 6.3% and ICH of 2% (compared with 1.5% and 0.2% respectively for heparin alone).<sup>16</sup> Another recent review identified 189 pregnant patients receiving thrombolysis for venous thromboembolism. Major bleeding occurred in 2.6%, with no maternal mortality.<sup>17</sup>

The successful use of streptokinase during pregnancy has been reported,<sup>18,19</sup> but so have complications. Turrentine, *et al* reported that complications like pregnancy loss (5.8%), preterm delivery (5.8%), and hemorrhage (8.1%), ensued recurrently with the use of streptokinase.<sup>20</sup>

Current guidelines recommend the use of rt-PA because it is fibrin-specific and non-antigenic, and has a short half-life. Thus, it is preferred over streptokinase and urokinase, which are used infrequently in most developed countries. Although **the administration of systemic thrombolytics is considered a high-risk approach in pregnant women**, several reports have described

their lifesaving and efficacious use in the management of massive PE and hemodynamic instability.

### Conclusion

Since massive PE is a life-threatening condition and management options are limited during pregnancy, thrombolysis is considered a valuable choice. It has a prompt effect, it is readily available in nearly every hospital, it has no reported teratogenic or fetomaternal toxicity, and it minimizes the risk of post-thrombolytic pulmonary hypertension.<sup>21</sup> Recent data from a large unselected national registry demonstrated that thrombolysis in normotensive patients with acute PE was associated with increased mortality,<sup>22</sup> therefore **the use of thrombolytics (particularly rt-PA) should be reserved for pregnant women who have life-threatening PE with hemodynamic instability. Pregnancy should not necessarily be cited as a reason for withholding thrombolytics**, especially when alternatives are lacking, despite the fact that ACC/AHA lists pregnancy as a “relative” contraindication in their STEMI 2014 guidelines.<sup>23</sup> Further studies and analyses are warranted to elucidate the safety of thrombolytic administration during pregnancy. ★

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Written with assistance from  
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# Short of Breath

## SHORT LIST

The diagnosis of cardiopulmonary pathology in a pregnant patient presenting with dyspnea and/or chest pain can be an arduous task given the physiologic changes of pregnancy. Pregnancy leads to decreased pulmonary functional reserve and increased oxygen consumption by the placenta, fetus, and maternal organs. Maternal hypoxia may not be well tolerated by a mother or her fetus due to the reduced partial pressure of oxygen in the fetal umbilical vein and decreased oxygen-carrying capacity of women who develop anemia in pregnancy.<sup>1</sup> Additionally, fetal hypoxia is detrimental to fetal development and can actually alter myocardial structure and cause a decline in cardiac performance, among other damaging sequelae.<sup>2</sup> Thus, **dyspnea in pregnancy has the potential to result in negative outcomes, particularly when it is due to an unanticipated or uncommon etiology.** The article on page 19 discussed PE, a potentially deadly cause for dyspnea in pregnancy, but here are discussed two more potentially devastating pathologies you don't want to miss.

### Case One

*A 32-year-old, 36-week pregnant female with a history of intermittent asthma presents with one week of worsening right-sided, pleuritic chest pain and shortness of breath. Albuterol and beclomethasone have provided no relief. A chest x-ray in the ED reveals a large right-sided pneumothorax. An ultrasound-guided chest tube is placed and she is admitted. Three days later her pneumothorax has resolved, and she later goes on to have an uncomplicated vaginal delivery.*

Spontaneous pneumothorax in pregnancy is rare, but has been documented in at least 56 published case reports. A review of these cases revealed that the

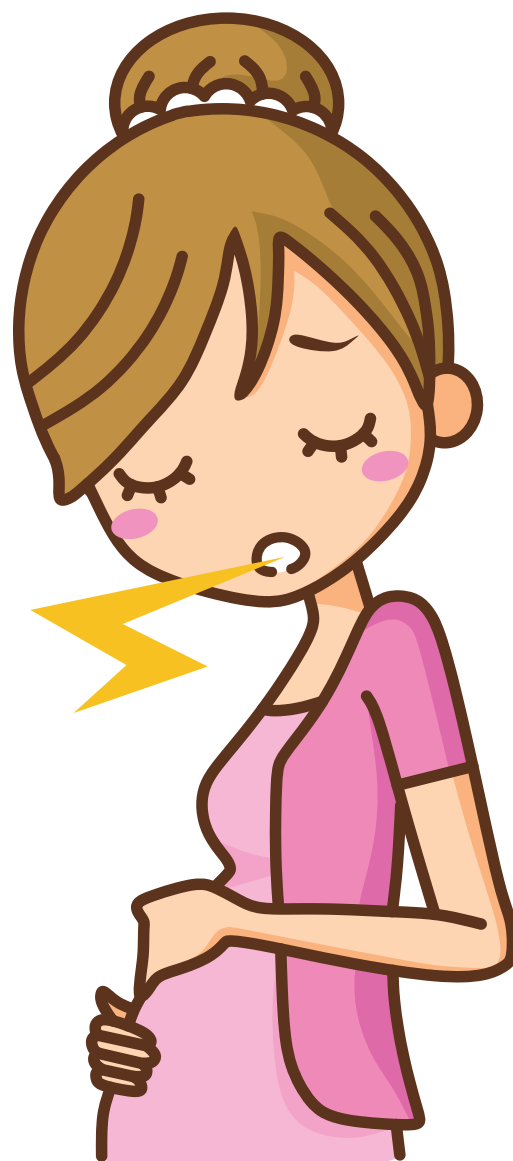
average age of pregnant patients with a pneumothorax was 26.4 years (similar to the age of non-pregnant females with a pneumothorax). In about half of cases, pneumothorax occurred in the first or second trimester, the other half occurring during the perinatal period. The same review showed that risk factors in pregnant patients included a prior pneumothorax (40%), underlying infection (30%), asthma, cocaine use, and hyperemesis gravidarum.<sup>3</sup> A pneumothorax may occur due to rupture of small subpleural blebs when alveolar intrathoracic pressure increases, such as during labor.<sup>4</sup>

**Treatment of an acute pneumothorax in pregnancy is to be approached similarly to that in a non-pregnant patient.** For a small pneumothorax, admission and close observation is an appropriate option. A large pneumothorax, on the other hand, should be treated with tube thoracostomy. It is important to note that total lung volume in pregnancy is decreased due to upward displacement of the diaphragm.<sup>5</sup> In the second and third trimesters, **a thoracostomy tube may need to be inserted higher than would be necessary in a non-pregnant patient, to ensure that it is not inadvertently placed in the trans-hepatic or trans-splenic space.**

Some experts suggest inserting the tube in the intercostal space between the third and fourth ribs in obstetric patients.<sup>6</sup> When uncertain, ultrasound can be an extremely useful aide for ensuring safe placement.

Thoracotomy or thoracoscopy (e.g., VATS) may be indicated in cases of recurrent, persistent, or bilateral pneumothorax.<sup>2</sup> In the case reports mentioned previously, half of the patients ultimately required a thoracotomy for recurrent or persistent pneumothorax. Among the 56 women, obstetric outcomes were generally

## Additional Can't-Miss Causes of Shortness of Breath in Pregnancy



favorable; 80.8% had vaginal deliveries, 17.3% had cesarean deliveries, and one fetal loss occurred. No other adverse outcomes were reported. In women who have had a pneumothorax, positive pressure ventilation should be avoided during delivery to prevent recurrence. Pneumothorax is not an indication for cesarean section, and these should be performed only for the usual obstetric indications.<sup>7</sup>

Pneumothorax in pregnancy is believed to be underreported, as chest pain and dyspnea are frequently attributed to diagnoses such as paroxysmal tachycardia, neuralgia, physiologic dyspnea of pregnancy, or asthma exacerbation.<sup>8</sup> If a pregnant patient presents to your ED with these symptoms, a thorough history and physical exam should be performed. Inquire about history of pneumothorax and other risk factors. Physical exam findings may include dyspnea or tachypnea, hypoxia, tachycardia, cyanosis, or unilaterally decreased breath sounds. A chest radiograph with an abdominal shield is required for definitive diagnosis, however, and a shielded CT is not unreasonable if an operative intervention is being considered. Pulmonary ultrasound can also be useful in making the diagnosis. Just as in the non-obstetric patient, **prompt, accurate diagnosis is crucial, as sudden death or respiratory collapse can occur without appropriate intervention**, and even brief episodes of maternal hypoxia can have devastating effects on a fetus.

You may counsel pregnant patients that smoking cessation and avoiding major changes in ambient pressure such as going to high altitude, skydiving, and flying in unpressurized aircraft are good preventive measures.

### Case Two

*A 27-year-old female who is three weeks postpartum presents complaining of increasing fatigue and dyspnea with even slight exertion. She has developed a cough, and has recently had several brief episodes of chest pain. Physical examination reveals basilar crackles in the lungs, pedal edema, and a new cardiac murmur. A chest radiograph is obtained and shows pulmonary edema. An echocardiogram shows cardiomegaly*

*and an abnormal left ventricular (LV) systolic function with an ejection fraction (EF) of 35%. She is placed on oxygen, given furosemide, nitroglycerin, and digoxin, and cardiology and obstetrics are consulted. She is admitted for treatment and management of peripartum cardiomyopathy (PPCM).*

PPCM is an idiopathic form of dilated cardiomyopathy presenting with heart failure (HF) secondary to LV systolic dysfunction. It occurs towards the end of pregnancy or in the first several months following delivery and diagnostically requires that no other cause of HF be identified.<sup>9</sup> PPCM is a rare complication of pregnancy that affects approximately 1:3,200 live births in the U.S.,<sup>10</sup> but is a major cause of maternal morbidity with a mortality rate of 2-27%.<sup>11</sup>

**Risk factors are believed to include increased age, high parity, preeclampsia or hypertension of pregnancy, use of tocolytics, twin pregnancy, obesity, and low socioeconomic status.** Still, approximately one-third of cases occur in young, primigravid patients.<sup>12</sup> Incidence is significantly higher in developing nations, but in the United States is 16-times higher among African-American women.<sup>13</sup> The etiology and pathogenesis of PPCM is not well understood. Available studies posit that myocarditis, malnutrition, high sodium intake, viral infections (e.g., EBV and CMV), autoimmunity, genetic predisposition, and/or oxidized prolactin may be contributing factors to the development of this disease process.<sup>12</sup>

Rapid diagnosis and treatment are essential. PPCM is a diagnosis of exclusion, and other causes of cardiomyopathy and heart disease must be ruled out. Presenting signs and symptoms are the same as those of heart failure in non-obstetric patients. Chest radiograph with abdominal shield should be ordered in pregnant patients presenting with dyspnea, tachycardia, or hypoxia, as radiographically-evident pulmonary edema may be present. Patchy infiltrates in the lower lungs fields with vascular cephalization (indicating high pressures), cardiomegaly, and pleural effusions suggest congestive HF. ECG results may be normal, or demonstrate

sinus tachycardia, low voltage, left ventricular hypertrophy, non-specific ST-segment and T-wave abnormalities, or, more rarely, atrial fibrillation. **A prompt echocardiogram is key for diagnosis of PPCM and should be performed in all women for whom the diagnosis is suspected.** In PPCM, the EF is nearly always less than 45%.

Treatment for pregnant women with systolic dysfunction typically consists of supplemental oxygen, digoxin, loop diuretics, vasodilators (hydralazine and nitrates), and beta blockers (carvedilol or metoprolol), all of which may be initiated in the ED depending on how symptomatic the patient is. Anticoagulation with heparin or low molecular weight heparin should be administered for an EF less than 30% to reduce the risk of venous and arterial thrombosis.<sup>12</sup> Consults cardiology and obstetrics are warranted, and in acute cases you should consider admission or transfer to an ICU for continuous maternal and fetal monitoring.

Prognosis is dependent on recovery of ventricular function. Studies have shown that half of patients show significant improvement with regard to symptoms and ventricular function within six months, and one-third return to baseline cardiac function in that time.<sup>14</sup> Causes of death in patients with PPCM include progressive heart failure, arrhythmia, or thromboembolism. Women with low EFs in pregnancy are at high risk of developing worsening cardiac function and developing HF in subsequent pregnancies,<sup>15,16</sup> making perinatal counseling imperative for these patients.

### Conclusion

Causes of dyspnea and chest pain in pregnancy include, but are not limited to, pulmonary embolism, amniotic fluid embolism, noncardiogenic or cardiogenic pulmonary edema, myocardial infarction, pneumonia, asthma exacerbation, aortic dissection, and preeclampsia. Be sure to get a detailed past medical and obstetric history from pregnant patients with concerning symptoms and perform a thorough physical exam so these diagnoses are not missed. Don't be afraid of using appropriate radiographic studies when indicated. **A healthy fetus requires a healthy mother, and our pregnant patients are a special population that deserve the best care we have to offer.** ★





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# The Approach to Pediatric Sepsis

## SHOCK

"It is crucial that the emergency provider be well-versed in pediatric sepsis."

### Introduction and Sepsis Review

Whether in a pediatric or adult patient, the physiologic process of sepsis remains the same.

**Sepsis is a systemic inflammatory host response to infection, which can progress to acute organ dysfunction and death.**<sup>1</sup> It is the endpoint of a complex series of steps on the part of a host and invading organism that results in a dysregulated inflammatory response.<sup>2</sup> Sepsis is a spectrum of disease starting with SIRS, progressing to sepsis, septic shock, and lastly to severe sepsis with multiorgan system dysfunction (*Table 1*). The incidence of pediatric sepsis is 0.56 per 1,000 population per year, with a mortality ranging from 2% to 10%, resulting in nearly 4,500 deaths per year in patients under the age of 19.<sup>3</sup> **Mortality is reduced by early recognition and therapeutic intervention:** thus, it is crucial that the emergency provider be well versed in pediatric sepsis.<sup>4,5</sup>

### Pediatric Assessment

The key to pediatric sepsis in the emergency department is identification of the septic child. Many hospitals have initiated pediatric sepsis triage screening protocols to assist with early recognition of sepsis to improve outcomes.<sup>6</sup> Age-based vital signs are the first step in assessment. Tachycardia, tachypnea, and hypotension are based on age, and should clue the provider in to a possible illness (*Table 2*).<sup>1</sup> **In the pediatric patient, tachypnea and tachycardia are early findings;**

**if hypotension is present it is an ominous sign that the patient is already far down the sepsis path.** Vitals are age dependent and should ideally be referenced during evaluation on a quick card or application.

Hypothermia or fever may indicate an infectious process, while delayed capillary refill, changes in mentation, cool extremities, decreased peripheral pulses and decreased urine output all indicate

poor end organ perfusion. Finally, a complete physical exam to identify the underlying cause of sepsis is crucial in source control.

### Initial Resuscitation – The Surviving Sepsis Campaign<sup>7</sup>

As in adults, initial management of pediatric sepsis is goal-directed and algorithmic-based. Goals of care are based on improvement of perfusion, including normal capillary refill, normal peripheral

**Table 1. Definitions within the Spectrum of Sepsis<sup>1</sup>**

#### SIRS – Systemic Inflammatory Response Syndrome

- Temp >38.5°C or <36°C PLUS one of the following:
- Age specific leukocytosis or leukopenia or >10% bands
- Tachycardia >2 SD above age normal OR Bradycardia <10th percentile for age (<1 years old)
- Tachypnea >2 SD above age normal

#### Sepsis – SIRS plus suspected infection (viral, bacterial, fungal, parasitic)

#### Septic Shock – Sepsis plus cardiovascular dysfunction:

- Hypotension <5th percentile for age, SBP <2 SD below age normal
- Need for vasoactive drugs to maintain normal BP
- Two of the following:
  - Unexplained metabolic acidosis: base deficit >5 mEq/L
  - Increased arterial lactate >2 times upper limit
  - Oliguria: urine output <0.5 mL/kg/hr
  - Prolonged capillary refill: >5 sec
  - Core to peripheral temperature gap >3°C

#### Severe Sepsis – Sepsis plus acute respiratory distress syndrome (ARDS) OR Cardiovascular Dysfunction OR ≥2 organ dysfunctions:

- Respiratory – hypoxemia, hypercapnea
- Neurologic – altered mental status
- Renal – increase in creatinine
- Hepatic – elevated ALT or bilirubin
- Hematologic – thrombocytopenia, elevated INR

pulses, warm extremities, improved urine output to >1 mL/kg/hr, improved mentation, and resolution of tachycardia and hypotension. These measures should be continually reassessed to ensure the effectiveness of interventions and to further direct therapy. You may note that the goals of care do not address lactate.

**While lactate should be measured and trended, it is not an effective marker of sepsis in the pediatric patient**, and furthermore, a normal lactate may give the provider a false sense of security when looking for end organ dysfunction.<sup>8</sup>

The first step in pediatric sepsis management is providing supplemental oxygen and establishing intravenous (IV) or intraosseous (IO) access. The Surviving Sepsis Campaign recommends that access and the first bolus should be initiated within the first five minutes of presentation, thus after two unsuccessful attempts at IV access a provider should go straight to the IO.

While the goals of care are targeted at patient assessment and not laboratory values, additional testing will assist in fine tuning management and targeting antibiotics. A source of infection and signs of end organ damage should be investigated in pediatric patients with SIRS criteria. Initial studies should include point of care blood glucose, complete blood count, blood culture, urinalysis, urine culture, chemistry with calcium, and a chest radiograph. Hypoglycemia should be addressed immediately, and trended as septic pediatric patients may spuriously drop their blood sugar. The pediatric myocardium is exquisitely sensitive to calcium imbalance, resulting in decreased inotropy in the setting of hypocalcaemia. Thus, during the first few minutes of resuscitation hypocalcaemia should be corrected to support adequate cardiac output. Within the first 15 minutes an isotonic saline bolus should be completed via a push method. Within the first hour up to three 20 mL/kg push boluses should be administered via manual push until perfusion is improved or the patient develops signs of fluid overload, such as hepatomegaly or rales. If the patient remains hypotensive after adequate fluid resuscitation and/or with signs of fluid

overload, a second peripheral or central line should be established to initiate vasopressor therapy.

When focusing on resuscitation it is important not to neglect early administration of antibiotics. Empiric broad-spectrum antibiotics should be given within one hour of presentation.<sup>7</sup> Antibiotic selection is based on the suspected source and your local resistance patterns. For example, a patient with a central line or neutropenia may require additional antimicrobial coverage. If there is difficulty obtaining enough venous access, an alternative is to give the first dose of antibiotics intramuscularly.

### Inotropic and Vasopressor Therapy

In the adult patient, the vasoactive therapy of choice has clearly become norepinephrine to improve systemic vascular resistance and improve cardiac output.<sup>9,10</sup> However, **the physiology of pediatric sepsis has led to the preferential use of dopamine and epinephrine over norepinephrine.**<sup>4,7</sup> In the pediatric patient, sepsis may be marked by profound hypovolemia with an inability to accommodate via increased cardiac output. In contrast to adults whose cardiac output is dynamic and affected by both stroke volume and heart rate, **cardiac output in the pediatric patient is primarily determined by heart rate, as stroke volume is relatively fixed.**<sup>11</sup> Furthermore, systemic vascular resistance in the pediatric patient increases in response to hypovolemia and relatively decreased cardiac output, which decreases peripheral perfusion and increases myocardial workload. This leads to a vicious cycle resulting in cold shock. What does this mean to the emergency care provider?

**Initial vasoactive therapy selection should be targeted at improving cardiac output over optimizing systematic vascular resistance.**

Historically, vasoactive therapy in the pediatric patient was targeted at either cold shock or warm shock depending on presentation. As most pediatric patients have increased systemic vascular resistance and decreased cardiac output, resulting in cold shock, the initial preferred agents are dopamine or epinephrine. Despite emerging

**Table 2. Modified Normal Systolic Blood Pressure by Age.<sup>1</sup>**

#### Normal Systolic Blood Pressure by Age

>60 mmHg for term neonate  
>70 mmHg in infants <1 year  
>70 mmHg + (age x 2) in children <10 years  
>90 mmHg in children >10 years

literature that indicates epinephrine may be preferable to dopamine, in current practice either is considered appropriate as a first-line vasopressor for fluid-refractory shock in the pediatric patient.<sup>11,12</sup> For the rare pediatric patient with warm shock, indicated by normal capillary refill and warm extremities with persistent hypotension, norepinephrine should be considered as a second-line vasopressor.<sup>11</sup>

### Additional Management Principles

When a patient fails to improve in spite of appropriate and aggressive therapy, consider additional etiologies of shock including pneumothorax, pericardial tamponade, adrenal insufficiency, and profound anemia.<sup>7</sup> In fluid- and vasopressor-refractory shock, consider empiric hydrocortisone to treat a potential relative adrenal insufficiency. Further, involvement of the pediatric intensive care unit team early may facilitate initiation of additional therapies in the critically ill patient, such as additional vasoactive agents like milrinone and extracorporeal membrane oxygenation (ECMO).<sup>11,13,14</sup>

### Summary and Key Points

1. Early recognition of pediatric sepsis is crucial in reducing morbidity and mortality. Hypotension is a late finding of hemodynamic instability in pediatrics.
2. Initial goals of therapy in the first hour are to establish vascular access, provide oxygen supplementation, push isotonic crystalloid fluid boluses, correct hypoglycemia and hypocalcaemia, provide broad-spectrum antibiotics, and initiate inotropic therapy as indicated.
3. Consider additional etiologies of shock – adrenal insufficiency, pneumothorax, pericardial tamponade, or anemia. ★

# LARGER ASPIRATIONS



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## Support for Organizational Resident Involvement

**W**hen program directors review applications for potential candidates for the incoming intern class, one of the aspects assessed is the presence of extracurricular activities and leadership roles. This involvement can indicate that the applicant is a well-rounded person and someone who can add value to the residency. Senior medical students are often aflame with excitement at the prospect of achieving their many ambitious goals. But when starting residency training, new residents find themselves in a novel environment, adjusting to the role of a resident, integrating into a new system, meeting many new colleagues, and just focusing on striving to be the best emergency physician they can be. Not uncommonly their previously burning focuses are shifted elsewhere. These are challenges faced by all residents, and often may limit their involvement outside of the quotidian.

So, how does the same individual who was highly involved as a medical student continue their extracurricular activities and integrate themselves into emergency medicine at the regional and national level during residency? There are certain aspects that need to be considered when trying to achieve this goal, many of which are regarded as major obstacles for the resident. Lack of support from program leadership, and schedule and financial constraints may deter residents from taking the steps needed to get involved.

**Program leadership has to be supportive of resident involvement in emergency medicine organizations. Their actual,**

**or even perceived, support can either nurture or extinguish a resident's aspirations.** On their part, residents should identify their interests early on in their training program if possible. Often by doing so their program director and faculty mentors can facilitate involvement for the resident. A number of programs have specialty tracks within their training curriculum, and program directors can assist by allocating a specific track to the resident based upon their interests.

Limitations of the clinical schedule can be a real issue preventing residents from being involved in regional and national organizations. **While a clinical education is the primary purpose of residency, few would argue against the idea that it is the only responsibility of residency training.** Programs can develop strategies that can overcome the barriers to outside involvement and assist in creating rounded residents. When making the annual rotation schedule for residents, programs can purposefully schedule residents on off-service rotations or elective blocks during the academic year when certain national meetings occur. This may increase the likelihood that residents will be able to attend these conferences. In addition, if a program would like to send a specific PGY class to attend a certain conference during the academic year, the program can try to assign additional residents from other PGY levels to the emergency department rotations in order to ensure adequate resident coverage.

Financial constraints can also impede resident involvement in regional and national organizations. Residency programs have limited budgets and may not be able to pay for the expenses of registration, lodging, and travel for the resident to attend a specific national conference. However, programs can implement creative mechanisms to increase the financial resources for the program. Establishing an alumni fund for residency educational activities is one option. Programs can contact alumni on a regular basis identifying

Several emergency medicine organizations provide opportunities for residents to become involved in our specialty.



## GUEST FEATURE

various educational initiatives and request a donation of funds towards achieving these goals. In addition, residents should take advantage of the various scholarships and grants for national meeting attendance available through emergency medicine organizations. Most national organizations provide a handful of disbursements to provide some financial assistance to residents to attending conferences.

Several emergency medicine organizations provide opportunities for residents to become involved in our specialty. These include the American Academy of Emergency Medicine (AAEM), the American Academy of Emergency Medicine Resident and Student Association (AAEM-RSA), the American College of Emergency Physicians (ACEP), the Council of Emergency Medicine Residency Directors (CORD), the Emergency Medicine Residents' Association (EMRA), and the Society for Academic Emergency Medicine (SAEM). **Through joining and becoming active in these**

**Lack of support from program leadership, and schedule and financial constraints may deter residents from taking the steps needed to get involved.**

**organizations, residents gain not only knowledge about our field and the medicine we practice, but can also further their academic goals, network and find jobs, participate in advocacy, and gain a greater understanding of the medical landscape.** To further define and settle into their niche, residents can also become members of specific academies, committees, communities of practice, interests groups, sections, and task forces within these organizations.

By gaining exposure to emergency medicine organizations during training, residents can become involved in projects that are related to their specific subspecialty areas of interests. Residency programs that foster and support their residents' involvement in these

organizations will themselves become stronger training programs. Their residents will develop a sense of purpose and accomplishment by representing their program and having a role in the advancement of emergency medicine. There are so many opportunities out there available for emergency medicine residents. Our training programs should serve as the bellows – the small fire of desire for involvement inside each individual can be stoked to a raging blaze by a little assistance and encouragement from program leaders. We can make the residents today the leaders we will need tomorrow. I urge both residents and residency programs to take the next important step and commit to becoming more involved. Doing so will benefit residents, training programs, and emergency medicine as a whole. ★

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## PART 2 MSIV Reflections on Matching EM

# What I Know Now

# That I Wish I Knew Then

*From the EMRA Medical Student Council*

### Introduction

Welcome back to part two of our MSC's reflections on matching, the interview process, and settling down for residency. This issue focuses more on interviews, and we hope will be of benefit for all of the advancing medical students. We hope that you enjoyed the last article (missed it? visit [emresident.org](http://emresident.org)), and hope that you are able to glean important information from this issue's installment, as well. EMRA wishes you the best in your away rotations, interview process, and next career steps. Here's to the countdown!



**David Reid, DO**

Kansas City University of Medicine & BioSciences  
Past Medical Student Council Chair  
Matched: University of Texas  
Southwestern Medical Center, Dallas, TX

I remember looking at VSAS last year and feeling overwhelmed at the number of different away rotation possibilities. I am graduating from a DO school without a home EM program, so I felt like I was starting off at a disadvantage – which was true in many ways; but in others it was not. I don't remember my exact method of applying to and scheduling VSAS rotations, but I'm sure the things I learned while on my "aways" would have definitely redirected my VSAS efforts.

You have to recognize that there are several potential benefits of each away rotation experience you have – as well as a few dangers to consider. Don't fall into the trap of thinking, "I'm not competitive enough for that place," or even, "That would just be a backup for me." When it comes to programs offering spots to students, there are no uniform policies or rules. You'll be surprised by the opportunities you do and don't get! I'm not saying you should apply everywhere on VSAS, but definitely give yourself as wide a range of locations and dates as possible. Even though you may not get exactly what you hoped, what you really don't want is to panic in October when you only have one SLOE (standardized letter of evaluation) with no more away rotations lined up because of poor planning in the spring.



### Online Resources

Advising Resources: SLOEs: [www.cordem.org/i4a/pages/index.cfm?pageid=3743](http://www.cordem.org/i4a/pages/index.cfm?pageid=3743)

Away Rotations: [www.cdemcurriculum.org/assets/other/ms\\_primer.pdf](http://www.cdemcurriculum.org/assets/other/ms_primer.pdf)

Advice from a former Program Director:  
<http://med.wmich.edu/education/internshipresidency/emergency-medicine/advice-emergency-medicine-applicants>

Finding the Right Program:  
[http://denverem.org/index.php?option=com\\_content&view=article&id=14&Itemid=36](http://denverem.org/index.php?option=com_content&view=article&id=14&Itemid=36)

Making a Great CV:  
[www.emra.org/Content.aspx?id=774](http://www.emra.org/Content.aspx?id=774)

EM Match Advice from ALiEM: [www.aliem.com/category/non-clinical/em-match-advice](http://www.aliem.com/category/non-clinical/em-match-advice)

## MEDICAL STUDENT LIFE

And speaking of SLOEs...they are the prize at the end of every great away rotation. Unfortunately, it's also a potential let-down you get at the end of a bad rotation. What I didn't understand fully a year ago was that it's almost automatic for every EM clerkship to provide all MSIVs with a SLOE — good or bad. It's not like a traditional letter of recommendation that you have to ask for from a mentoring attending. There are variations in the policy from place to place, but most places asked me where to send my SLOE before I asked them to write one! So you should expect to get one everywhere you rotate, good or bad. Expect to be questioned during interviews if you have an away rotation on your transcript but no SLOE for them to review.

The bottom line of what I learned on away rotations is to be energetic, available, and likeable. Schedule more than three and you may be setting yourself up for exhaustion and burnout. It's hard work to put on your best show every shift for months. Interviewers want to see growth and improvement, so if you get an honors grade in August at St. Elsewhere, followed by a simple passing grade in September at County General, be prepared for more questions.

Understanding how competitive you are can be critical to building a winning match strategy. You can apply to 40 places, but if

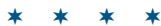
they're the 40 that get the most applications per spot, you could be in some trouble. An average EM applicant might look like a standout for some other specialties, so it's important to understand how programs will see you when all they have is your application. The NRMP (see <http://www.nrmp.org/match-data/main-residency-match-data>) provides detailed match data from previous years, and if you take the time to go over everything in the EM sections, you will be more successful in getting interviews no matter what your status.

The first few weeks of interview season can be a stressful time. Most programs start looking at applications right away — so have it ready when the ERAS submission period opens in September. Then get ready for a frustrating waiting game as you may not hear from anyone for more than a month. My first interviews didn't begin until late October, and I received offers well into January. EM has traditionally provided later interviews to applicants compared to other specialties. (Insider's tip: working the room during the EMRA Residency Fair in October was *very* beneficial... book your trip to Boston now!)

In those first few weeks, your mind can play some mean tricks on you, and at times I was pretty discouraged. I heard contacting programs directly could be seen as

overbearing. But after many conversations with program faculty, I know now that this is mostly untrue. Reaching out *politely* and *briefly* to contact programs that you are especially interested in can be a great thing to do. But you have to recognize there can be a fine line between showing interest and being too aggressive. Also, never lie to a program about your special interests — word travels easily within the EM community. Program coordinators are a good gateway to communication with a program, and they often have a lot of input as to who makes it out of the application pool and who doesn't.

The entire interview process is a fluid period for all applicants and programs, and the later in the season, the more fluid it gets. Each cancellation sets off a chain reaction, and cancellations happen ALL the time. In fact it is such a common thing that programs are typically very gracious and understanding when you cancel appropriately. But canceling too late, or even worse — no-showing — can get really ugly. Programs have been known to contact schools, SLOE writers, and other programs to let them know an applicant didn't show up and essentially wasted the opportunity for them and for another qualified student. Consider yourself warned, and don't let this happen to you.



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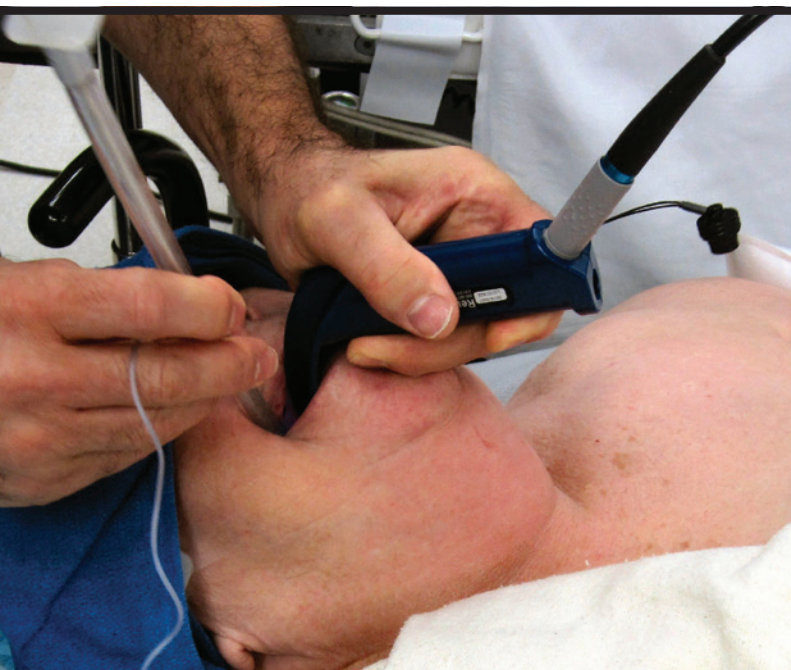
The interview trail was an incredible journey. Looking back, I wish I knew the goal of the process really boils down to finding a program that fits for you — and only you (no matter what your friends feel). I was given that advice going into it, but didn't give it much thought. What I found by the end was that many of the places I was going to writeoff turned out to be some of my top choices. The reasons were many, including being surprised at what I found, who I connected with on

interview day, or me not being sure exactly what I wanted from a program.

I entered the interview process with certain criteria in mind for an emergency medicine training program. Like most other academically-driven and ambitious people you find in this field, mine were mostly clinical criteria like volume, or clinical exposure, or something boring like that. At the end of the day, however, the programs that attracted me the most were the ones filled with intangible processes I couldn't number or label. These were things like a funny feeling I got when talking with faculty about passionate ideas on medicine and life. Or even non-medical things like how that city's streets seemed alive at night with excitement and promise. Call me a romantic, but at the end of the day it was my gut that told me the programs I loved. On paper the programs I was supposed to

fall in love with fell short in these abstract concepts and subsequently didn't capture my affections.

Keep an open mind when applying and trust your instincts. Don't listen to what others like or dislike — remember everyone has their own fit. Interviews are a growing process for the applicant, and can be a wonderful introspective experience if you let it. It forces you to question your goals, your dreams, and even your patience with airport security. The match process really does work in the applicant's favor if you just go with it (you know, if ERAS works right and allows you to submit...). All of the programs are amazing and never once did I regret interviewing anywhere. At times it will feel a lot like dating, and much like dating, you'll know you've arrived at the right place when you get there. ★



# Under the BREATH

## Opinions and History on Laryngoscopy

**A**s Kleenex® has evolved to relate to facial tissue, video laryngoscopy (VL) has become a descriptor for any use of a laryngoscope device with a video camera on it. However, this term may not be sufficient to solely describe the techniques associated with those devices. The root of this issue is traceable to the advent of the video laryngoscope. Designed by Dr. John Pacey, the GlideScope (Verathon; Bothell, Washington) was introduced as the first commercially available video laryngoscope in 2001. With this innovation, Dr. Pacey was actually introducing two new technologies simultaneously: the video laryngoscope, and the hyperangulated laryngoscope. Since that time, the use of either a hyperangulated blade *or* a video-assisted device has often been inappropriately identified as “video laryngoscopy,” even when used independently. These terms are actually quite distinct.<sup>1</sup>

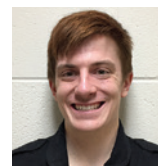
Dr. Pacey’s injection of video laryngoscopy into airway management was actually an extension of the previously defined technique of indirect laryngoscopy: the use of an optical instrument to visualize the larynx without requiring the creation of a direct line of sight. This had previously been achieved with laryngoscopes utilizing lenses and mirrors; however, this was revolutionized by the technological advances of the last 10 years. Now, the charged metal oxide

sensor (CMOS) video camera (commonly utilized in cellphones and other electronic devices) has become the most popular modality of indirect laryngoscopy.<sup>2</sup> These relatively affordable video cameras have subsequently enabled manufacturers to push the envelope, now adding cameras to the ends of both hyperangulated and standard geometry laryngoscope blades. As a result, we have fantastic new tools in our arsenal, but we ought to be more conscientious when discussing airway management with our colleagues.

### Tools

First, a two-point definition: A traditional laryngoscope is one that lacks a video camera, or any other optical aid.<sup>1</sup> A traditional laryngoscope is always used to perform the technique of direct laryngoscopy (DL — see the discussion in the next section). The two most common direct laryngoscopy tools are the Macintosh blade (curved) and the Miller blade (straight). **While varying blade shapes require slightly different procedural maneuvers, both achieve the same result: the creation of a direct line of sight from your retina to the patient’s larynx.**<sup>3,4</sup>

A video laryngoscope is one that has a video camera built into it. It can be of a shape that retains the standard geometry of the traditional laryngoscope, or be of a hyperangulated shape like the original GlideScope.<sup>1</sup> It is the shape of the blade that determines the technique required for use.



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### Techniques

Three basic techniques exist: DL, indirect laryngoscopy with standard geometry, and hyperangulated indirect laryngoscopy. When a video camera is involved, indirect laryngoscopy can be further characterized as VL. Thus, this leaves us with the following descriptors for techniques: DL, standard geometry VL, and hyperangulated VL. **It is critical to understand that the blade shape determines how you introduce the laryngoscope into the mouth and how you attempt to pass the tube, not the presence or absence of a camera.**

### Direct Laryngoscopy

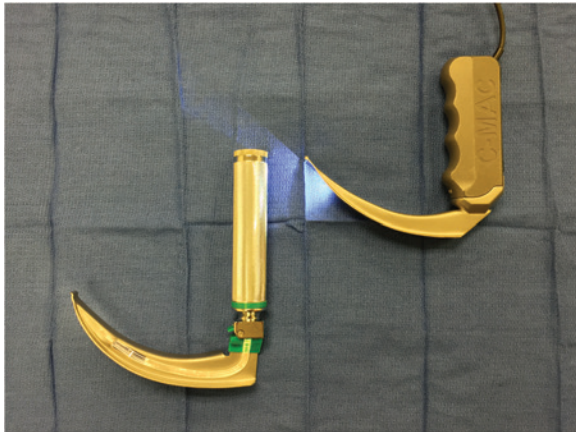
DL describes the method in which a laryngoscope is used to displace the mandible and soft tissues of the oropharynx to create a direct line of sight to the patient’s larynx.<sup>3,4</sup> The laryngoscope consists only of a handle, a light source, and a blade (most commonly Macintosh

or Miller). The procedure begins with insertion of the laryngoscope blade into the patient’s mouth and obligates adequate tongue control, which is most often achieved with a sweeping motion from right to left after entering the mouth with the blade. Once tongue control is established, the next challenge is identifying landmarks. A stepwise approach should be taken to first identify

guidance. In other words, the operator can perform DL or VL, despite the fact that the technique used to obtain the view is the same. The operator may choose when to direct his or her attention to the video monitor or simply not use it at all. Furthermore, the operator may fall back to direct visualization (i.e., DL) if the screen is conquered by copious secretions or bleeding.<sup>2</sup>

structures such as the tongue and epiglottis is key. This maneuver should require only minimal lifting force.

The major consideration of hyperangulated video laryngoscopy is endotracheal tube delivery.<sup>4,5</sup> Rigid metal stylets (with a 60° curve) are most often recommended and utilized, but if these are not available, the operator may bend a malleable stylet in a similar shape.<sup>6</sup> Novice operators should practice tube delivery in simulation, as it is not the same as with DL or standard geometry VL (i.e., the techniques in which a straight line to the glottis exists). When performing VL with a hyperangulated blade, the tube, just as the laryngoscope, must pass around the curvature of the airway.<sup>5</sup> In other words, the tube cannot simply be “pushed” into the trachea when it reaches the glottis. Most providers will withdraw their stylets several centimeters prior to advancing the endotracheal tube to facilitate easier passage through the larynx and into the trachea.<sup>4</sup>



**Image 1.** On the left is a traditional Macintosh laryngoscope, with standard geometry. To the right is a video laryngoscope device which also maintains the standard curvature.

the posterior oropharynx and uvula to ensure the midline has been located. From there, the blade is advanced while displacing soft tissues anteriorly using a mild amount of force until the epiglottis is visualized. At this point, straight blades are used to displace the epiglottis anteriorly, while curved blades generally pass anterior to the epiglottis and engage the hypoepiglottic ligament to elevate the epiglottis.<sup>3,4</sup> Use of either blade achieves the same result – exposure of the larynx prior to delivery of an endotracheal tube.

### **Standard Geometry Video Laryngoscopy**

**VL is not one homogenous technique:** The shape of the blade dictates how it must be wielded in the hand. The term VL in and of itself only means that you are passing the tube under video visualization.<sup>1</sup>

A standard geometry blade equipped with a CMOS camera should have force applied to it in exactly the same way, with the same stepwise traditional approach as direct laryngoscopy, outlined above. After these devices are introduced into the pharynx, they give the operator the option to deliver the endotracheal tube under direct visualization, or with video

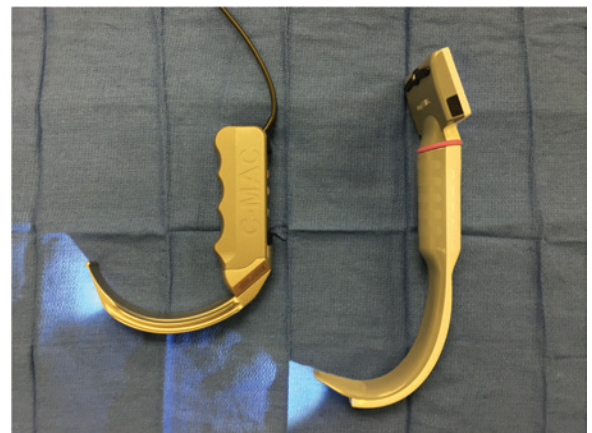
### **Hyperangulated Video Laryngoscopy**

**Hyperangulated laryngoscopy blades obligate indirect laryngoscopy** (most often video) and truly require a different technique for use than a standard geometry blade. The handle of the blade is grasped in the same manner; however, the blade should be inserted in the midline of the mouth. As soon as the tip of the blade passes the teeth, the operator’s attention should be focused on the video monitor.<sup>4,5</sup> The device should continue to be inserted so as to follow the curve of the pharyngeal structures in the midline.<sup>4</sup> Again, sequential identification of midline

### **Conclusions**

Video laryngoscopy is here to stay, and as a community, we need to be more deliberate when describing our airway management procedures. As is evidenced above, there are profound, fundamental differences in video laryngoscopy techniques. **Using a video-assisted intubating device is not synonymous with a hyperangulated blade.** It is crucial to recognize these differences and, furthermore, to impart this information to each new generation of airway management novices. Our diligence in clarity informs the practice of trainees and helps to elevate our level of patient care. ★

**Image 2.** Two examples of hyperangulated video laryngoscope devices. Note the difference in curvature of the blades when compared to the devices in image 1. Both curvatures can be used in video laryngoscopy, but the techniques are not the same.





# Resuscitation and the Humeral Intraosseous Line



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*A lethargic 56-year-old female with a history of end stage renal disease and intravenous drug use presents with hypoglycemia and severe hypotension. Despite multiple attempts from nursing staff and physicians, even using ultrasound, adequate access is unable to be obtained. Picking up your intraosseous (IO) device, you inspect the bilateral tibial plateaus, where you note a large vertical scar over each knee. Realizing that joint replacement is a contraindication to intraosseous line placement. Moving to the proximal right humerus, you successfully obtain IO access, and are able to administer D50 and normal saline. The patient's mental status begins to improve.*

**A**lthough the technique for intraosseous vascular access was first developed nearly a century ago, this approach has enjoyed only variable popularity over the years. During World War II, sternal IO placement became popular due to the ease of insertion and ability to infuse large quantities of fluid or blood following loss of limb. During the first half of the twentieth century, peripheral IVs were largely made of stainless steel, and were quite unwieldy and prone to infection due to inadequate sterilization before re-use. Disposable plastic intravenous catheters were introduced in the mid-1950s, leading to a dramatic decline in the use of IO catheters in the United States.<sup>1</sup> However, some disadvantaged countries continued to use stainless steel IO catheters long after this time, since they were reusable and cheaper than disposable plastic catheters.

In the 1980s, IO access regained popularity in the pediatric world. It was eventually incorporated into the Pediatric Advanced Life Support guidelines and then later into the American Heart Association's Advanced Cardiac Life Support difficult vascular access algorithm. Multiple studies have shown that IO placement is a quick, safe, and effective way to establish indirect vascular access.<sup>2,3,4,5</sup> In fact, IO placement is currently recommended over central venous or endotracheal drug administration in cardiac arrest when intravenous access cannot be obtained rapidly.<sup>6</sup>

**An IO can usually be placed within 30 seconds.**

Shouldering the Load

## CRITICAL CARE

Recent literature on the proximal humerus IO insertion site suggests that it may be a better resuscitative line than the proximal tibia IO site, due to closer proximity to the central circulation and higher flow rates. Despite much higher successful placement rates than any other form of vascular access, and decades of modern experience in the pediatric population, IO catheters remain underutilized in the adult ED.

### Indications for Intraosseous Placement

Intraosseous catheter placement is indicated in emergent situations in which vascular access is needed, but peripheral IV access is difficult or impossible to obtain. Examples include rapid sequence intubation, cardiac arrest, hypovolemic shock, septic shock, or other forms of unstable hypotension requiring emergent resuscitation. In all of these cases, prolonged vascular access attempts can delay potentially lifesaving interventions.

### Contraindications\*

1. Unhealed fracture of selected bone
2. Active soft tissue infection at insertion site
3. Previous attempt at the same bone within 48 hours
4. Inability to identify landmarks
5. Prosthetic bone or joint at insertion site

*\*These are contraindications to insertion at the selected site, but do not prevent insertion of the catheter at a different anatomic site.*

### Relative Contraindications

1. Abnormalities of bone strength (e.g., osteogenesis imperfecta, osteoporosis)
2. Fracture of more proximal bone within the same extremity
3. Inability to immobilize selected bone after IO catheter placement

### The Procedure – Humeral IO Placement

To avoid injury to the biceps tendon during humeral IO insertion, position the arm in one of three ways:

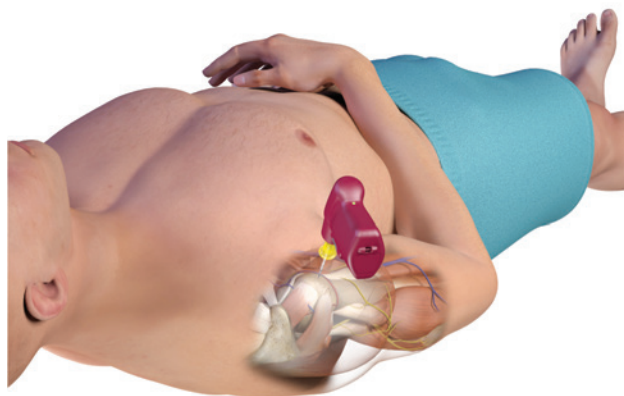
1. Flex elbow, adduct arm, and place patient's palm over the umbilicus. The arm can be placed in a sling for greater

immobilization, if needed.

2. Extend elbow, adduct, and hyperpronate the arm.
3. Flex elbow, adduct arm, and place arm behind the patient's back while the patient is supine. This technique may be especially useful during CPR.

Avoid excessive abduction of the arm over the head to prevent accidental IO dislodgement. Once you have appropriately placed the patient's arm, palpate the greater tubercle of the proximal humerus. Then locate the surgical neck of the humerus below the tubercle. The ideal insertion site is 1 cm above the surgical neck. Clean the insertion site with chlorhexidine or an alcohol swab, and prime the IO connector tubing with sterile 0.9% normal saline.

Aim the IO at a 45° angle towards the contralateral hip (*Figure 1*). Insert the needle through the skin and soft tissues until you hit the bone. Check to make sure that you have at least 5 mm of catheter still outside of the skin, to ensure that your catheter will be long enough to be used (*Figure 2*). Pull the trigger and drill the IO into place. In patients greater than 40 kg in weight, the Arrow EZ-IO driver should be loaded with a yellow 45 mm needle, which is specifically designed for the humeral insertion site.<sup>6</sup> One recent MRI study confirmed that the blue 25 mm needle length is inadequate for humeral IO access in as many as 50% of adult patients.<sup>7</sup> The standard 25 mm needle is



**Figure 1.** Note the correct positioning of the patient's arm, angle of the IO drill, and anatomical insertion site.

IMAGE COURTESY OF TELEFLEX

used for the proximal tibial IO and the pediatric humeral IO (*Figure 2*).

Even in alert patients, the actual IO insertion is usually well tolerated. However, high-pressure infusion of fluids and medications can be quite painful, due to rapid change in the intraosseous pressure. Slow infusion of 40 mg (2 mL) of preservative-free 2% lidocaine over two minutes can help reduce or even eliminate this discomfort. Be sure to **use a lidocaine formulation designed for intravenous use, rather than lidocaine intended for intradermal injection**. The pediatric dose of IO lidocaine is 0.5 mg/kg, up to a maximum of 40 mg. Let the lidocaine linger in the IO space for one minute. Then, flush the line quickly with 0.9% normal saline. If discomfort persists, consider giving half of the original dose of lidocaine again (up to 20 mg) slowly over one minute.

One of the advantages of IO placement is the ease by which it can be successfully placed. Instead of struggling with peripheral IVs, crash central lines, and ultrasound-guided lines, an IO can usually be placed within 30 seconds.<sup>8</sup> At both humeral and tibial insertion sites, landmarks can be palpated and successful insertion can occur rapidly, even with patients who are morbidly obese or have severe peripheral edema. **In one recent military study, the humeral IO was shown to have a first pass success rate approaching 96% and a second pass success rate of 100%.<sup>2</sup>**

## Humeral IO Flow Rates

The flow rate through an IO line depends upon multiple factors, including the length and width of the IO needle, infusion pressure, intrinsic resistance within the bone marrow, and the size of the IO space.<sup>6</sup> Higher flow rates will be obtained when a pressure bag or infusion pump is used for high volume fluid resuscitation. In one study, flow rates nearly doubled (from approximately 80 ml/min to 150 ml/min) when the pressure bag was used, with nearly equal infusion times for both tibial and humeral IO infusions.<sup>4</sup> This flow rate is comparable to other resuscitative lines, including large bore peripheral IVs. **More recent studies in both swine models and humans, however, have shown higher flow rates in the humeral IO compared to the proximal tibial insertion site.**<sup>9,10,11,12</sup> A 2010 study showed that the humeral mean flow rate was 5,093 ml/hr  $\pm$  2,632 ml/hr (range 828-9,000 ml/hr) and the tibial mean flow rate was 1,048 ml/hr  $\pm$  831 ml/hr (range 336-3,300 ml/hr).<sup>9,12</sup> A 2013 swine model showed nearly twice the flow rate at the humeral IO site (213 ml/min) compared to the tibial site (103 ml/min).<sup>10</sup>

## Complications

Many reasons exist as to why IO insertion is underutilized in the adult ED, including lack of familiarity with the procedure, concern for the patient's perception of pain, and uncertainty regarding the potential complications associated with IO line placement. The most common complication of IO access is extravasation of fluids. A properly placed IO line should be able to be flushed smoothly with 10ml of normal saline without evidence of extravasation. **Contrary to popular belief, it is not necessary to aspirate bone marrow to confirm placement.** However, if evidence of extravasation is seen, use of the catheter should be discontinued immediately to reduce the risk of rare complications such as compartment syndrome.

A recent retrospective study of critically ill trauma patients showed a complication rate of 1.38% with IO placement. Most of these complications were device insertion failures. In the same study, a wide variety of blood products and 32 different

medications were administered with very few complications.<sup>8</sup>

Other theoretical complications related to IO access include unintended bony injuries, osteomyelitis, vascular injury, and fat emboli. All of these complications are quite rare and can be decreased with proper anatomical knowledge, appropriate technique, and sterile practices. **It is recommend that the IO line be removed within 24 hours after placement to minimize infection risk.** The line can be labeled with the date of recommended removal to remind staff who may be less familiar with the IO when it should be removed. However, there are documented cases of IOs that have been in place for up to a month without complication.<sup>6</sup>

Peripheral IV and central venous access also have complications, including infections, air embolisms, and pneumothorax, all of which may be more likely to occur when crash lines are performed.

For the purposes of medication and fluid infusion, the IO line should be considered equivalent to a large-gauge peripheral IV catheter. All fluids and medications that

can be administered safely via peripheral IV can be given IO. As with any other peripheral vascular access device, it is recommended to refrain from using it to infuse hypertonic saline or vasopressors.

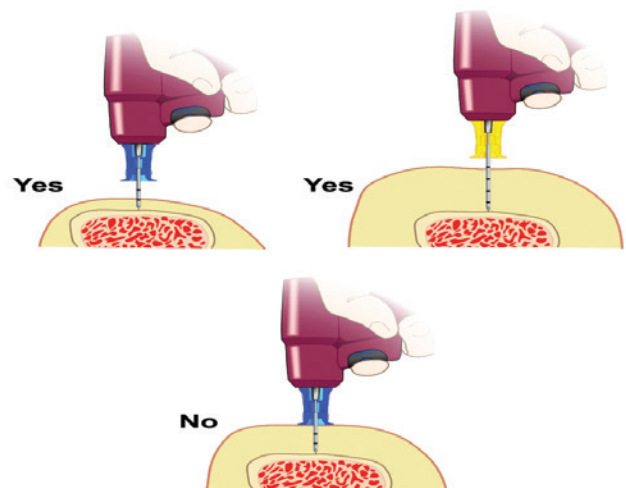
## Conclusions

Humeral IO infusion is an excellent option for critically ill patients in whom vascular access is difficult or impossible. With proper understanding of the indications and contraindications for this simple procedure, you can easily establish reliable vascular access within seconds. **Humeral IO placement is just as easy to perform as tibial IO insertion** and may be a better line for resuscitation, due to higher possible flow rates. With a pressure bag, flow rates through the proximal humerus are adequate for large volume resuscitation. As with most peripheral vascular access devices, complication rates are low with IO placement. Pain is a legitimate concern, but can be minimized with judicious lidocaine administration. Although the humeral IO line is an underutilized tool in the adult ED, it is a valuable technique that can save lives when used properly. ★

## Even in alert patients, the actual IO insertion is usually well tolerated.

**Figure 2.** To properly insert the IO make sure to choose the correct size needle. There should be at least one black line above the skin (equivalent of 5 mm).

IMAGE COURTESY OF TELEFLEX



# BUILDING

# B L O C K



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## Three-in-One The Forearm Nerve Block

*A 29-year-old carpenter rushes into your emergency department with a 6 cm laceration on the palmar aspect of his hand after mishandling a power saw. The laceration extends from the interphalangeal joint of his thumb to the base of his little finger. You know that this injury will require a significant amount of time to repair; how are you going to address his pain?*

Upper extremity injuries are commonly seen in the emergency department and can be challenging to properly anesthetize. There are various methods used by emergency physicians use to provide pain relief for upper extremity injuries including local infiltration, hematoma blocks, systemic (oral or intravenous) pain medications, and procedural sedation. The traditional landmark-based forearm nerve blocks are also frequently employed, however as ultrasound is becoming a ubiquitous tool in the emergency department, so are ultrasound-guided nerve blocks.

### Anatomy and Identification

Depending on which nerve is targeted (median, ulnar, or radial), **a forearm nerve block can efficiently provide anesthesia to the entire hand while minimizing the amount of medication administered.** Though each nerve can be anesthetized at any point along its path, we will focus on the optimal positioning for forearm nerve blocks to maximize effect.

The median nerve is responsible for the sensory innervation to the majority of the palm of the hand. It originates from the medial and lateral cords of the brachial plexus and travels proximally alongside the brachial artery. It continues down the forearm to the carpal tunnel between the flexor digitorum profundus and the flexor digitorum superficialis muscles.<sup>1</sup>

The median nerve is best identified at the carpal tunnel with the patient's arm supinated with a relaxed wrist. Using a high frequency linear probe, visualize the round, hyperechoic honey-combed appearing median nerve in transverse plane at the volar aspect of the wrist starting at the first carpal crease (*Images 1 and 2*).<sup>1,2</sup>

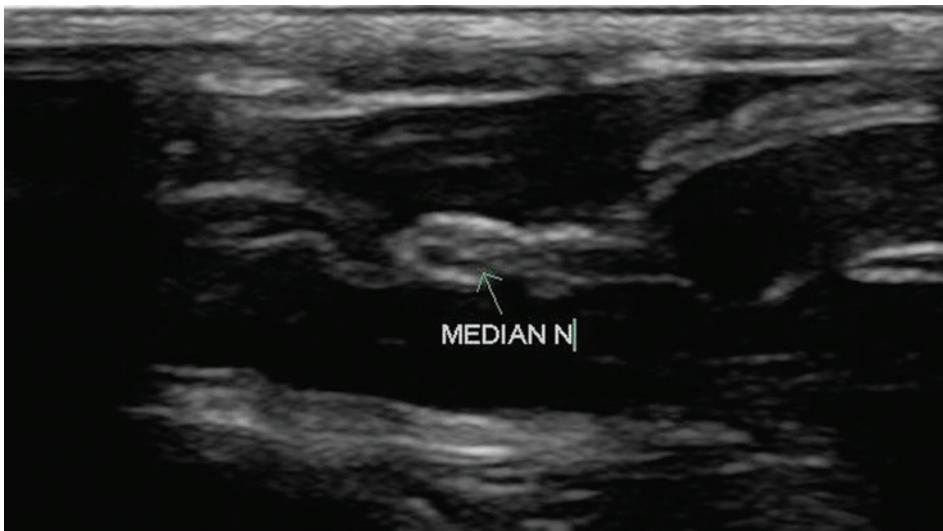
The ulnar nerve forms from the medial cord of the brachial plexus and provides sensation for the dorsal and palmar side of the ulnar aspect of the hand. It travels between the ulnar artery and the flexor carpi ulnaris tendon down the forearm.<sup>3</sup> The ulnar nerve is best identified at the medial, or ulnar aspect of the artery. Following the nerve proximally

until the nerve separates itself from the accompanying artery will provide the optimal location for anesthetic administration (*Images 3 and 4*).<sup>2</sup>

The radial nerve forms from a branch of the posterior cord of the brachial plexus and splits into its superficial and deep branches in the antecubital fossa. The superficial branch provides sensation to the radial dorsal aspect of the hand. It is best identified with the assistance of its arterial counterpart. Using the radial artery as a landmark, the radial nerve can be found coursing down the forearm parallel and laterally, or radially, to the artery.<sup>4</sup> It is best to perform the nerve block at the level of the middle third of the forearm, allowing adequate separation between the artery and the nerve (*Images 5 and 6*).<sup>2</sup>

### Materials Required

- An ultrasound with a high frequency linear probe
- Sterile probe cover
- Sterile ultrasound gel or lubricant
- Sterile gloves
- Local anesthetic



**Image 1.** Median nerve on ultrasound

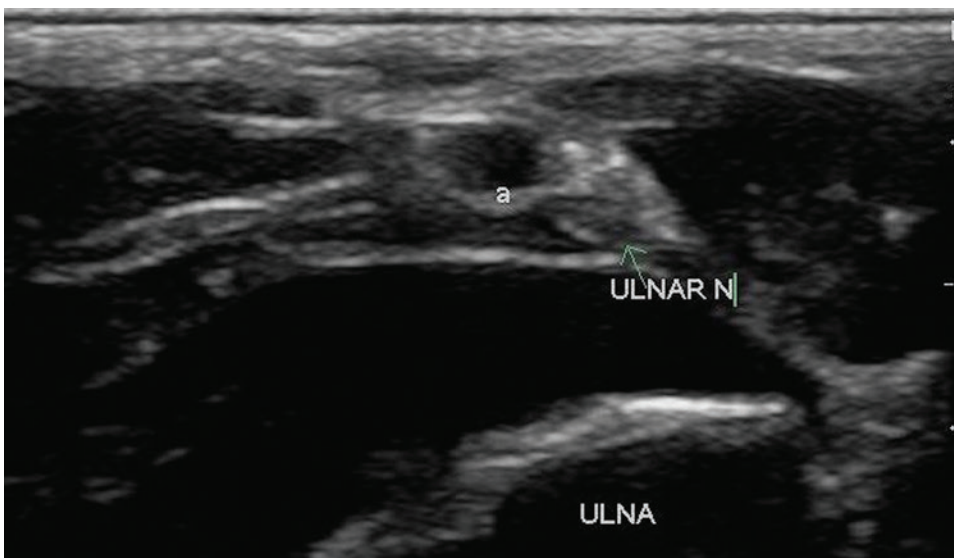
- A 20cc syringe
- 25 gauge needle (or longer needle if required)
- Betadine solution

### The Procedure

For optimal positioning, the patient's arm should be supinated, resting on a hard flat surface. Using ultrasound, identify the location along the forearm where the nerve is best visualized. Using sterile technique, confirm the site of injection and make a superficial skin wheel. With the probe held in a transverse position, one should enter just lateral to either side of the probe for a median nerve block. For the radial and ulnar nerves, the needle should enter from the side opposite the corresponding artery, thus decreasing the likelihood of vascular puncture. The needle should be visualized during the entirety of the procedure using the in-plane technique (*Image 7*). Be careful to avoid puncturing the actual nerve during the procedure. Once



**Image 2.** Approach to ultrasound-guided median nerve block



**Image 3.** Ulnar nerve on ultrasound; a = ulnar artery

**As ultrasound is becoming a ubiquitous tool in the emergency department, so are ultrasound-guided nerve blocks.**

the needle is positioned adjacent to the nerve structure, draw back on the syringe to confirm that a vascular structure has not been entered, and then introduce 1cc of local anesthetic. Anechoic fluid should be seen surrounding and enveloping the nerve. Each nerve should require approximately 3-4 cc in order to provide adequate anesthesia.

### Discussion

Studies advocating the use of nerve blocks have been positively received in the emergency medicine community because of their relative efficacy and safety compared to the alternatives,



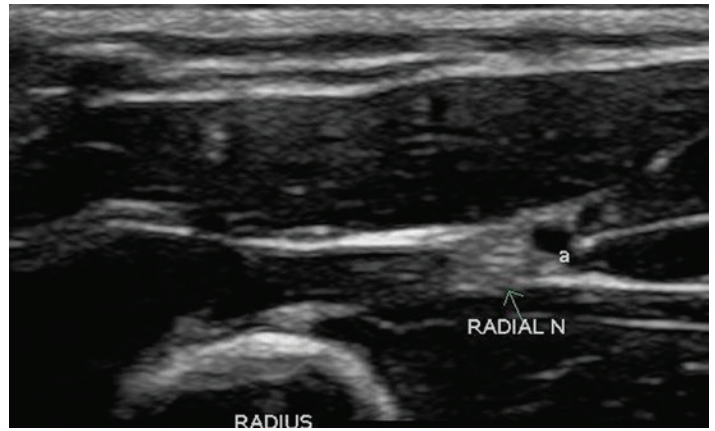
**Image 4.** Approach to ultrasound-guided ulnar nerve block

namely procedural sedation.<sup>5</sup> In 2007, Stone *et. al* published five case studies showing the feasibility of performing supraclavicular brachial plexus nerve blocks in the emergency department and the potential to avoid procedural sedation when treating upper extremity injuries.<sup>5</sup>

In a 2006 study published in *Annals of Emergency Medicine*, four emergency physicians at different experience levels performed twenty-two ultrasound-guided blocks of the hand on eleven patients with various hand injuries. After a one-hour training session and five supervised procedures on a nerve model, the four physicians were able to adequately perform these nerve blocks. Though this study was performed with no control and had a small sample size, all enrolled patients achieved adequate pain control with no need for additional analgesia. Moreover, **the median time required to anesthetize each patient, who on average required at least two of the three blocks, was only nine minutes.**<sup>6</sup>

Nerve blocks performed with the landmark technique have been utilized in the emergency department successfully for years. However, considering that the procedure is not without its own set of risks, why not enhance the efficacy of this procedure by using ultrasound? Ultrasound-guided nerve blocks have been shown to increase the rate of success from 85% to 95%.<sup>7</sup> Additionally, analgesia can be achieved without local infiltration which distorts the wound, thereby enabling easier skin closure and a more aesthetically pleasing result. ★

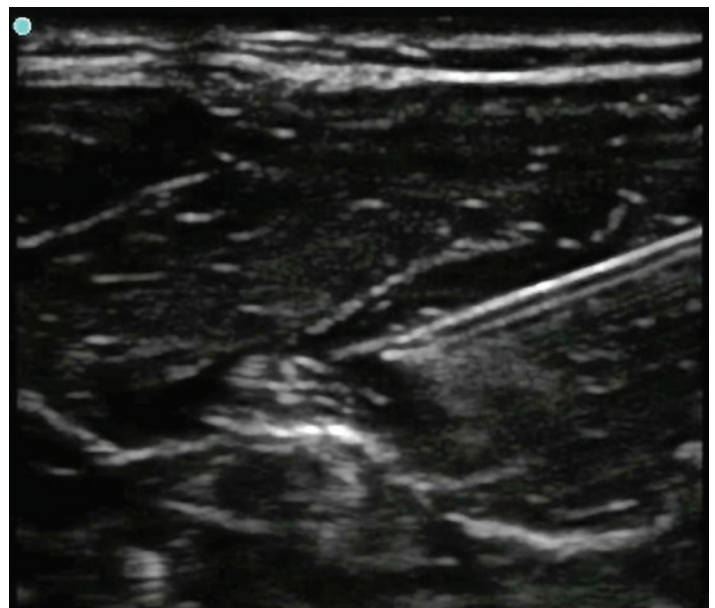
**Analgesia can be achieved without local infiltration.**



**Image 5.** Radial nerve on ultrasound (arrow); a = radial artery



**Image 6.** Approach to ultrasound-guided radial nerve block



**Image 7.** Needle tip injecting anesthetic around the nerve



# The Other Side of the *Looking Glass* Ethical Dilemmas During the Global Health Elective

*The blood will not stop flowing.*

*Marked with many of the sequelae of late-stage AIDS, my 19-year-old HIV-positive patient has just delivered a stillborn infant. Secluded at Kalafong Hospital in rural South Africa, there are only two physicians in the labor ward, and my patient is bleeding profusely. Even though it is still in the early morning hours, my colleagues are busy. The registrar (equivalent to a resident) is in the OR with an emergent case, and the intern is delivering a breech infant. Only a medical student at the time, I call for help, but am told to start treatment.*

*I am on my own.*

*I do everything I can think of: I check for clots, lacerations, and retained products of conception – the bleeding continues. I place an additional 16-gauge IV, and hang another liter of intravenous fluids – still she hemorrhages. The uterus feels atonic so I begin uterine massage and give a standard dose of oxytocin – no effect. Nothing is working; all I can do is hope someone more experienced than I will soon come to our rescue.*

While true, this scenario is an extreme example. It exposes many of the ethical and pedagogical concerns often raised about medical trainees undertaking global health electives (GHEs). Much of the current literature raises critical concerns with the GHEs,<sup>1,2,3</sup> but these electives can still be exceedingly important for medical training, and if organized well can benefit both host and trainee. Despite a progressive increase in the number of medical students and residents participating in GHEs (30.2% of all 2013 medical student graduates),<sup>4</sup> until recently there has been a paucity of comprehensive

global health education programs surrounding these electives, especially in the realm of medical ethics.

There is significant concern that medical students and trainees participating in GHEs are in positions to deliver care beyond their qualifications or without adequate guidance, potentially leading to malpractice and serious medical error.<sup>1</sup> However, **the shortage of health professionals in places such as sub-Saharan Africa leads to 3% of the world's healthcare workforce bearing 24% of the global disease burden.**<sup>5</sup> This leads to the omnipresent ethical dilemma of potentially practicing



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beyond one's medical abilities. Critics of GHEs argue that participants frequently have the perception that people who live in poverty will benefit from *any* medical care, irrespective of the provider's experience level.<sup>6</sup> **There are further concerns of exploiting already resource-limited settings and reinforcing the paternalistic views that were inherent in colonialist relationships between the global "North" and "South."**<sup>7</sup>

While these are legitimate concerns, the literature surrounding ethical dilemmas during the global health elective is really still in its infancy.<sup>8</sup> Much of the evidence appears anecdotal and revolves around egregious examples like students performing surgery and then bragging about it.<sup>7,9</sup> In the clinical vignette that opened this article, help did eventually arrive, and the patient was rushed to the operating room, where she had a partial hysterectomy. Some may argue that based on extenuating circumstances I was in a "forced to act" situation, while others might cite there was potential for me to cause more harm than good. However, in South Africa ethical dilemmas arise on a daily basis and are often not adequately addressed by Western education.

Consider these cases:

## Case One

*A prolonged government strike leads to severe staffing and resource shortage. There are no disposable gloves and many procedures are performed barehanded. One day during rounds in the labor ward, the chair of the department asks you to draw blood from an HIV-positive woman in labor as the team is presenting the patient in her room. The only remaining gloves in the hospital are a few pairs of sterile gloves reserved for emergency Cesarean deliveries.*

## Case Two

*You are a first-year medical student in a rural South African HIV/AIDS clinic: It is your first day and there are 12 lumbar punctures that need to be completed after rounds. You are tasked with performing a lumbar puncture on a dying patient in an open-air TB ward. You have never done one and have only seen it performed once previously. A senior medical student is supervising.*

## Case Three

*An HIV-positive mother whose baby you delivered is in your research study, and returns for a follow-up visit with her child. She has walked 10 miles bare-footed to come to the clinic. At three months of age the child is still the size of a one-month-old infant. He is emaciated and limp like a rag doll. You notice that the mother is feeding him a black solution from a bottle. Upon further questioning the mother states she is not able to breast-feed and cannot afford formula, so she has only been feeding her child black tea.*

Interacting with vulnerable populations who are marginalized or oppressed and who subsist in extreme poverty often drives individuals to pursue global health work.<sup>10</sup> No matter the location around the globe, this work is often fraught with ethical dilemmas that can be exceedingly difficult to manage for an inexperienced Western provider. One often prominent difficulty is how to manage local expectations, since **there is a fine line between practicing beyond one's abilities and having a "cop-out" mentality and not performing**

**anything one has not been trained to do.**<sup>11</sup>

While a seemingly trivial episode, Case one raises many global health issues such as resource allocation, cultural competency, and personal safety. Do you draw the blood barehanded? Do you leave the room and get a pair of sterile gloves? Should you refuse to perform the procedure altogether? Each decision has potential pitfalls associated with it. There are high rates of HIV-exposure and nearly half the staff is currently on post-exposure prophylaxis. Sterile gloves are a limited resource generally reserved for emergencies, and refusing to perform the procedure risks alienating the local medical team that is so graciously hosting you.

It is often assumed that ethics training in developed world settings is applicable to health situations globally. However, there are fundamental differences in both the clinical and research arenas that necessitate an alternative paradigm of analysis in the developing world. There is concern that even well-intended efforts might result in inappropriate informed consent or unacceptable risk-benefit ratio, thereby putting in jeopardy the fundamental medical principles of autonomy, beneficence, non-maleficence, and justice.<sup>1</sup> However, **the four-classic principles of health have their origins in Western philosophies and do not represent the summation of global moral language.**<sup>10</sup> **What constitutes "justice" is different in different societies, as is the standard of care.** While we often seek a universal standard of care and an irreducible set of ethics, these are both highly bound by culture and local medical practices.

With respect to Case two, in the South African medical system students perform most of the procedures. At this particular clinic there is a single intern who is supervising the entire facility. There are no senior residents, fellows, or attending physicians. Do you perform the LP with the given supervision, or do you ask for more senior supervision? Or do you refuse to perform the procedure altogether? Interestingly, in South Africa the "see one, do one, teach one" methodology for

procedures is nearly universal. *That is the standard of care.* By acquiescing to the LP, are you being a team player, or are you being complicit in patient exploitation? If you refuse to perform the LP, could you potentially be imposing Western views that were conceived in a different time and place? There are no easy answers to these questions. Each situation is unique and must be analyzed carefully.

Nevertheless, **it is important to separate these concepts from the notion of ethical relativism, or the changing of ethical values or priorities simply due to the situation.**<sup>10</sup> **We should uphold our basic ethical framework, but at the same time understand that it may be applied differently when viewed through a different cultural context.** Case three raises complex issues such as global health disparity, learned helplessness, research ethics, and respect for enrolled participants. Do you try to admit the child to the hospital even though the family will not be able to pay the bill? Do you buy the child formula? Do you avoid intervening since the child is a subject in your study? How do you choose whom to help and whom not to help?

These scenarios are difficult to navigate by any metric, and exceedingly difficult to manage for the novice GHE trainee. Preparation is the key for success. This begins with a sustained global health curriculum for medical trainees and should be supplemented by country-specific pre-departure training prior to a GHE.<sup>12</sup> As of 2005, **only 30% of North American medical schools provided some kind of pre-departure education or counseling for students pursuing a GHE.**<sup>13</sup> This has slowly improved, and we are seeing the advent of more sustained global health programs, and even a formal textbook for global health training in graduate medical education.<sup>14</sup>

This training should include principles of global health ethics that follow best practice guidelines,<sup>15</sup> and expose trainees to practical clinical scenarios they may encounter while working abroad.<sup>16</sup> Pinto and Upshur introduce trainees to the concepts of "introspection, humility, and



solidarity,” with a focus on the challenges that arise when working with individuals from different cultures who possess different concepts of health.<sup>10</sup> With “introspection” we examine our motives, become aware of our own privilege, and understand the basis for this privilege. In the midst of a prolonged strike (case one), I realized that using a valuable resource such as sterile gloves was an untenable option. I acknowledged the situation and considered refusing to perform the procedure, however I made the calculated decision (I felt proficient with this particular procedure) to draw the blood barehanded with help from the nurse. Introspection further allows us to develop a worldview that identifies multiple forms of oppression and systemic social inequality.<sup>17</sup>

“Humility” refers to trainees recognizing their limitations, being open to education from all sources, and is a general attitude that helps erode the neo-colonial underpinnings that often permeate relationships between the North and South. In case two, I quickly realized I did not have the appropriate level of training to perform the procedure. I expressed my reservations to the intern who appreciated my honesty and took time to explain the procedure in depth, and encouraged me to attempt the lumbar puncture under

supervision. I ultimately performed the procedure successfully, but the dilemma raised my awareness regarding standard of care and consent issues among vulnerable populations.

“Solidarity” emphasizes the concept of a “global commons” and is based on the belief that **the health of all people is connected, and interdependent**. Even though the patient in case three was a subject in my study, I considered it a potential gross violation of research ethics to not intervene. After reviewing the situation with my local adviser, we decided to purchase formula for the patient and exclude him from our study. We recommended admission for the child but the family refused, citing financial concerns. Solidarity is a powerful value to bring to global health work and without it, “we ignore distant indignities, violations of human rights, inequities, and deprivation of freedom.”<sup>18</sup> Even though we intervened, I still look back with some misgivings that perhaps we could have done more to change the outcome for this child.

With adequate preparation and a basic framework of global health ethics, trainees can enter the realm of global health and aim to have a positive impact. From an institutional standpoint there must be organized leadership that is accountable

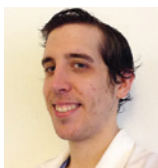
for the GHE process, focusing on long-term sustainability and development of mutually beneficial collaborations between both visiting and host sites. We must also select trainees who are adaptable, motivated to address global health issues, sensitive to local priorities, who are willing to listen and learn, and who will be good representatives of their home institution and country.<sup>15</sup> Global health electives often have a profound effect on participants. One study found that 70% of students participating in GHEs subsequently entered primary care residencies or intended to work in resource-limited settings.<sup>19</sup> These experiences lead to enhanced clinical and communication skills, humanism, cultural competency, and understanding alternative concepts of health and disease.

Global health electives are critical for trainees in fostering a deeper understanding of the global collective and how one’s own health is uniquely connected to the rest of the world.<sup>20</sup> Claude Bissell, a Canadian author and educator, understands the untapped potential of our trainees when he remarks that **they “risk more than others think is safe, care more than others think is wise, dream more than others think is practical, and expect more than others think is possible.”** ★



# Systematic Review and Meta-Analysis

## Backing Up the Evidence



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A meta-analysis or systematic review (MA/SR) can be a powerful tool to aggregate data on a specific question and arrive at a universal answer based on current literature. Meta-analyses are often used to guide best practice in clinical practice. However, **there is varying quality between different meta-analyses** – not every meta-analysis is done well. Likewise, **high quality systematic reviews do not necessarily have to be published in established review databases**, like the Cochrane Database of Systematic Reviews.<sup>1</sup> It is important to be able to

distinguish MA/SRs with high quality evidence from others to help determine best evidence-based practice.

Several guidelines have been published on how to write a quality MA/SR, including Cochrane Handbook,<sup>1</sup> MOOSE,<sup>2</sup> QUORUM,<sup>3</sup> and PRISMA<sup>4</sup> guidelines. These are tailored for the author's interpretation. This article will help to clarify what you need to know to evaluate a MA/SR.

### Is There a Clear Question?

It is important to consider if the systematic review or meta-analysis had a question that met the SMART criteria used for goal setting: Specific, Measurable, Attainable, Realistic, and Time-Bound (Table 1).

**Clear questions will help lead to more clinically and statistically relevant answers.** Studies that address

different questions from different perspectives may have variability between them, leading to statistical heterogeneity. **Too much heterogeneity between studies may make the meta-analysis results irrelevant to clinical practice.** It is also important to consider if there is enough literature on the topic to make an informed decision and whether it is realistic that the study found every article relevant to the study question.

Time frame is another factor. Several important issues related to time include new technology (ultrasound), changes in hospital systems and healthcare policy, and availability of alternative treatment or diagnostic tools. Consider, for example, that the diagnostic accuracy of a test depends on what the “gold standard” (reference test) is, but 20 years ago the “gold standard” may not have been as accurate. The same holds true for the

“standard of care” against which you may be comparing a medication or procedure.

### What is the Protocol?

It is important to consider what the study defined from the outset as its inclusion and exclusion strategy for identified studies in a PRISMA format.<sup>5</sup> You must take into consideration if they searched an adequate amount of databases and included broad enough search terms. For example, “ultrasound” could also be listed under “sonogram,” “ultrasonogram,” “sonograph,” “POCUS,” or “ultrasonography.” While it may be adequate for background literature searches, a simple search of basic keywords is not enough to meet the rigor needed for an MA/SR.

### How Did They Analyze the Data?

It is important to understand the basic statistics in a meta-analysis. One important issue is whether the results were synthesized using a “fixed” or “random” effects model. Simply, the random effect model will assume the studies are exactly the same and any differences are actually because of true differences in the question. A fixed effect model will assume the studies may have variability between them in areas such as design or risk of bias. The Forest Plot is a visual tool commonly used to summarize study results. It displays the result and effect size of each study about a solid, vertical “line of no effect.” The summarized results are generally shown at the bottom of the graph. An important note about the Forest Plot is that if the confidence bar crosses the line of no effect,

for an individual study or the summary statistic, the results are not statistically significant.

**A systematic review generally does not contain the formal statistical summation of a meta-analysis.** This is due to the design of systematic reviews: too much variability in the question, there was not enough data or studies on the subject, or synthesizing the data was not possible. It is important to look at how the review grouped the included studies and analyzed the results. There could be confounders or other methods of grouping that could yield a different conclusion. The process of combining multiple outcomes is one example. For example, it is important to know the rate of adverse drug events of a drug in addition to its effectiveness to determine if it will be beneficial.

Also, beware of surrogate outcomes. Flecainide and encainide are historical examples. These anti-arrhythmics were FDA approved based on their ability to decrease arrhythmias, but further analysis showed they actually increased mortality.<sup>6</sup>

### Of What Quality are the Studies?

It is important that the MA/SR assesses the quality of the studies analyzed, preferably with a previously validated tool. Some examples for various types of studies include the Medical Education Research Quality Instrument (MERSQI),<sup>7</sup> Quality Assessment of Studies of Diagnostic Accuracy Included in Systematic Reviews 2 (QUADAS-2),<sup>8</sup> and the Cochrane tool for assessing risk of bias in randomized controlled studies.<sup>9</sup> It can be helpful to use

an appropriate validated tool to assess the quality of the included studies compared against other similar studies. It is also best if more than one person reviewed each article to score its quality.

It is necessary to consider the level of evidence of the included studies. It is possible there were no, or few, high-quality studies on a topic. However, if the authors limited the MA/SR to only randomized controlled trials, you need to evaluate the synthesis appropriately. Also, consider if the authors acknowledge that the quality of evidence is limited.

### Do the Results make Sense?

**Possibly the most important aspect of the process is to determine if the results of the MA/SR are consistent with what you see in your current practice.** If not, think about why there are differences between them. Is the MA/SR high quality, and should it be taken at face value? Do the study question and included studies address all of the complex issues you see in practice? Make sure the results make sense to you, and, if not, discover why.

In conclusion, MA/SRs are among our best tools to determine the evidence to support our clinical practice. It is important, though, to realize that not all MA/SRs should carry the same weight in your decision-making. You should now be able to quickly critically appraise an MA/SR and identify methodologic weaknesses so you can incorporate that information and give the highest quality level of care based on current research. ★

**Table 1. Examples of Good and Bad Research Questions Based on the SMART Criteria**

Criteria	Good example	Bad example
<b>Specific</b>	Does tPA administered within 3 hours of presentation of acute ischemic stroke improve mortality?	Does tPA improve mortality for stroke?
<b>Measurable</b>	Does IV magnesium administered to status asthmaticus patients in the pre-hospital environment decrease admissions?	Should IV magnesium be administered in pre-hospital status asthmaticus?
<b>Attainable</b>	Does early aspirin administration improve mortality in patients with suspected MI?	Does [new drug X (which was just FDA approved last month)] improve mortality in patients with MI
<b>Realistic</b>	Do heart rate measurements at triage predict ED LOS?	Does any vital sign measured any time in the ED predict ED LOS?
<b>Time-bound</b>	What are the test characteristics for point of care ultrasound in diagnosing pleural effusion?	What are the test characteristics of ultrasound in diagnosing pleural effusion?



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Contributions to this article made possible through Josh Bucher, MD and the EMRA Research Committee.

## Emergency Medicine Residents’ Perspective on Research

# Researching Barriers

### Research – An Important Skill?

The Accreditation Council for Graduate Medical Education (ACGME) states that a medical “curriculum must advance residents’ knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.” The aim is to help residents develop lifelong learning and the skills necessary to engage in evidence-based clinical decision-making. The ability to understand, analyze, and critique research articles is considered an important part of training. The ACGME asserts that residents *should* participate in scholarly activity and the sponsoring program *should* allocate resources to facilitate resident involvement. Research experience is an invaluable skill for emergency medicine residents and physicians.

Residency programs promote scholarly activities through a number of means. Often the curriculum includes conference presentations on evidence-based medicine.

Journal clubs are another forum for presentations, research, and evidence-based medicine discussions. Although the ACGME promotes scholarly activity, the specific form taken by such activity varies across graduate medical programs.

Whether the end product is a case report, a rejected abstract, or an impactful publication in a prestigious journal, there are inherent skills to be gained from just the process of research. Residents learn how to perform a literature review, formulate a hypothesis, develop study methods, analyze and interpret data, and present the results.

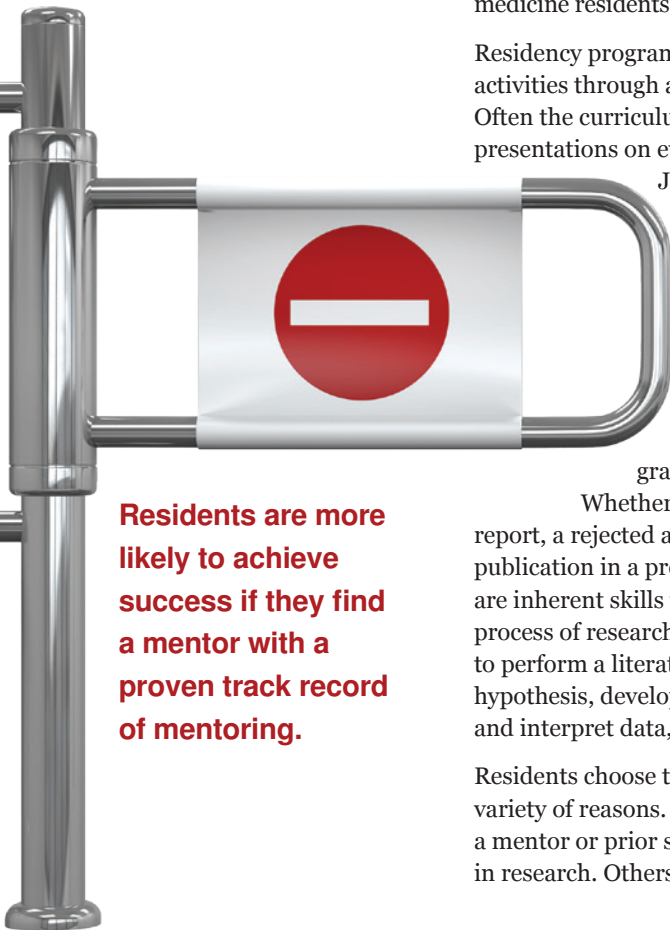
Residents choose to perform research for a variety of reasons. Some, perhaps inspired by a mentor or prior success, are truly interested in research. Others, however, may pursue

research because it is perceived as a valuable experience. Some have no interest whatsoever in research and will not pursue any beyond what is required. Performing research during residency presents its challenges. The task to complete a project from conception to publication takes dedication, mentoring, support, and some luck. To better understand barriers that residents experience when pursuing research or deciding whether or not to do so, the EMRA research committee performed a survey on the topic.

### Results

We distributed a survey to members of the Emergency Medicine Residents’ Association in December 2014. Out of the 1,668 residents to whom we sent the survey, 166 completed it. The majority (60%) of the respondents were male, and primarily in their first two years of residency – 32% post graduate year (PGY) 1 residents, 23% PGY2, 20% PGY3, 11% PGY4, and 13% fellows/others. Geographically, there were higher proportions of respondents from the Northeast (40%) and Midwest (31%). Those who completed the survey reported a decrease in research experience during residency; 84% had research experience prior to residency, compared to 75% during residency. Correlating this finding, 53% of respondents had one or more publications prior to residency, compared to 18% during residency. **Even though 83% of residents expressed interest in research, and 88% reported having adequate support from their residency programs, there were several barriers identified.**

Forty-nine percent of responding residents reported they did not have sufficient time during residency to pursue research, and 66% expressed that they wanted more time. Other barriers were a lack of financial support (49%), attending/research mentor support (42%), or lack of institutional support (40%). However, less than one percent reported that research was discouraged at their institution.



**Residents are more likely to achieve success if they find a mentor with a proven track record of mentoring.**

Qualitative responses further described the lack of institutional support. All research projects must have Institutional Review Board (IRB) review and approval. Respondents reported not having enough guidance for IRB submission and support for research methods and statistical analysis. **Residents described the IRB submission as “absurdly laborious,” and “unwieldy... which discourages research.”** In addition, a lack of mentoring in methods or statistical guidance presented a challenge. Residents described, “not enough support in terms of understanding biostatistics or helping those who have no idea how to set up a research design” and, “not enough teaching about research methodology.”

### Barriers Identified

Although we distributed our survey to EMRA members nation-wide, the respondents represent a small proportion of total residents. Given the high numbers of respondents who reported having prior research experience, it is possible that those who completed the survey did so because they have a particular interest in research. Thus our survey results may not be appropriately generalized to residents with less research interest.

There was a decrease in publication success during residency. **While a significant majority of residents had publication success before residency, only a fifth experienced success as residents.** Lack of success with publication can be discouraging. It appears there is discrepancy between perception of institutional support and actual support. Close to 90% of residents reported having adequate support from their program, but deficits in institutional support were also highly reported.

### The most commonly reported barrier to research was time.

This was somewhat anticipated, given the clinical time demands of residency training. One resident commented, “a three-year residency barely provides enough time to learn clinical medicine; to really improve research opportunities and interest, residency really needs to be four years.” There has been a recent trend for residency programs to transition to four-year programs. Overall, four-year

residency programs tend to have more elective time. Efficient time management during residency and collaboration with support staff, colleagues, and medical students on a project are important tools for success.

Even though financial support may be a challenge, there are funding opportunities available from the Emergency Medicine Foundation (EMF) and EMRA. EMF offers grants of up to \$5,000 to residents and \$2,400 for medical students. EMRA offers local action grants and research grants of \$1,000. Local action grants are designed for projects aimed at community outreach. Beyond these funding opportunities, there may be funding opportunities within local institutions and national foundations.

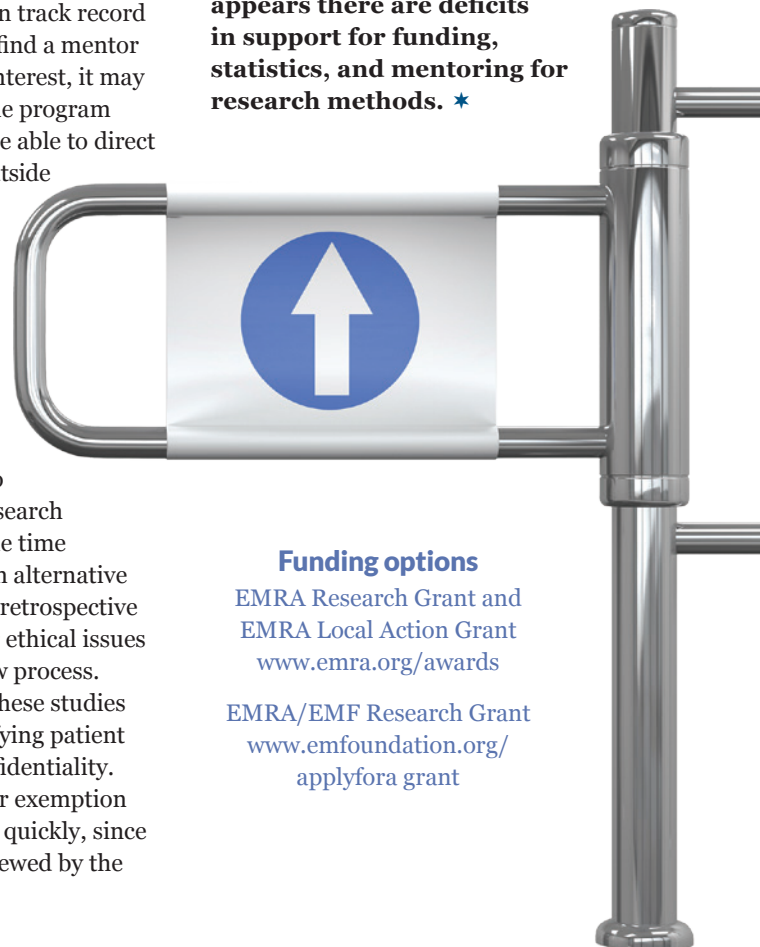
Identifying a capable research mentor is important to developing a successful project. The surveyed showed that at times, “faculty members are too busy to keep up with (resident) projects; to have it done and published in time.” Residents are more likely to achieve success if they find a mentor with a proven track record of mentoring. If unable to find a mentor or one with a compatible interest, it may be reasonable to contact the program directors, since they may be able to direct the resident to someone outside of the program.

There are opportunities for improvement in institutional support. Institutional Review Board (IRB) submission can be time-consuming. Research projects with any risk to patients need to be fully reviewed by the research ethics committee. Given the time constraints of residency, an alternative option would be to pursue retrospective chart reviews so that fewer ethical issues arise during the IRB review process. The main requirement in these studies is just to remove all identifying patient information to ensure confidentiality. Such studies are eligible for exemption and can be approved more quickly, since they do not need to be reviewed by the entire IRB.

Statistical and research methods present a barrier to successful completion of research. Statistical software such as STATA and SAS can be quite powerful, yet difficult to use for researchers without prior training. Moreover, such software is often expensive. Residency programs affiliated with academic institutions may have access to software and thus make research less expensive for residents. An alternative and capable program that is available for free download is Epi-Info, developed by the Centers for Disease Control and Prevention. The program includes data management and statistical functions.<sup>3</sup> Another option for statistics computation is the online statistical tool Open-Epi.<sup>4</sup>

### Summary

Many residents express strong interest in pursuing research, and some meet success despite competing responsibilities of clinical education and other residency requirements. **Even though a large proportion of residents report strong research support from their programs, it appears there are deficits in support for funding, statistics, and mentoring for research methods. \***



### Funding options

EMRA Research Grant and  
EMRA Local Action Grant  
[www.emra.org/awards](http://www.emra.org/awards)

EMRA/EMF Research Grant  
[www.emfoundation.org/  
applyfora](http://www.emfoundation.org/applyfora) grant

# Solo Sodium

## Emergent Management of Symptomatic Hyponatremia



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*A 62-year-old Hispanic male is brought in by EMS for altered mental status and new onset seizure. On arrival to the emergency department his initial vitals are stable with a finger stick glucose of 120 mg/dl. On exam there is no evidence of trauma. He appears incontinent of urine, post-ictal and unable to give a detailed history, but is protecting his airway. Per EMS he has no history of seizures and no pertinent medical problems. A head CT is normal, and all of his labs are unremarkable, with the exception of a serum sodium, which returns at 112 mEq/L.*

### Pathophysiology

The initial differential for new onset seizures is generally quite broad and includes hypoglycemia, drugs (alcohol/benzo withdrawal), stroke, and infections such as meningitis or encephalitis. Less often considered are electrolyte abnormalities, specifically hyponatremia.

An abnormal serum sodium is one of the most common electrolyte disturbances we encounter clinically, but typically it is mild and requires no acute therapy. Hyponatremia is usually defined as a serum sodium concentration of  $<135$  mEq/L. Symptoms of hyponatremia can vary depending not only on the degree of hyponatremia but also how acutely the drop in sodium occurred. **It is abrupt sodium changes over 48 hours that are most commonly associated with neurologic symptoms and risk of death from brain herniation.**<sup>1</sup>

Complaints and findings include lethargy, vomiting, headaches, hiccups, confusion, seizures, and even death.

When approaching the cause of hyponatremia, you must determine the volume status and urine characteristics. Knowing this information will help establish the etiology and guide future treatment. In general, all hyponatremia can be subdivided into four major categories based on the balance of total body water and sodium. These four categories are hypovolemic, hypervolemic, euvolemic and pseudohyponatremic hyponatremia.

### Clinical Clues to Diagnosis

In the emergency department, recognizing that hyponatremia is contributing to the presenting symptoms is most important. Identifying the exact etiology can be challenging in the emergent setting, but the diagnostic approach should focus around a good history and physical exam. For **hypovolemic hyponatremia** the patient's total body water is decreased with a greater loss in sodium from either body fluid (vomiting, diarrhea, sweating) or renal losses. On history any acute fluid loss could be a clue; on exam the patient may appear dehydrated, so check for skin turgor, dry membranes, and orthostatic hypotension. Blood work may demonstrate an elevated creatinine, elevated BUN/Cr ratio ( $>20:1$ ), decreased urine volume, and concentrated urine (specific gravity  $>1.015$ ).

In clenching the diagnosis for hypovolemic hyponatremia you may win extra praise from your inpatient colleagues by ordering additional lab work including urine electrolytes (Na, K, Cl), or uric acid (if on diuretics). When interpreting these urine studies it can be helpful to think of sodium and water as conjoined twins. So if the volume loss is extra-renal, the kidney will work to conserve water (i.e., salt) resulting in a decreased urine sodium concentration ( $<10$  meq/L,  $FE_{Na} < 1\%$ ). Alternatively, if hypovolemic hyponatremia is caused by the kidneys, urine sodium will be elevated ( $>20$  mEq/L,  $FE_{Na} > 1\%$ ) with a differential

including diuretics, renal tubular acidosis, or adrenal insufficiency.

Although an absolute “zebra” on the differential, adrenal insufficiency could be considered if a serum chemistry demonstrates hyponatremia with an elevated potassium. In this instance a deficiency of mineralocorticoids (specifically aldosterone) causes decreased sodium resorption and potassium excretion.<sup>2</sup> In regards to evaluating endocrine causes of hyponatremia, checking a random cortisol (excludes adrenal deficiency if  $>18$  mg/dl), and thyroid function testing can be ordered, but again will not affect ED disposition.

On the other hand, if your hyponatremic patient has a known history of poorly controlled diabetes, be sure to review the blood glucose as the cause may be **pseudohyponatremia** ( $\sim 1.5$  meq  $\downarrow$  Na per every  $\uparrow 100$  mg/dl glucose).<sup>3</sup> Just as the name “pseudo” implies, this is not a true hyponatremia but a falsely lowered lab value occurring with any osmotically active chemical including protein (multiple myeloma), lipids (hyperlipidemia), or even mannitol. So although sodium appears low, it will correct when the underlying aberrancy is corrected.

A patient with **hypervolemic hyponatremia** will often appear “wet,” with bilateral pulmonary crackles, jugular venous distention, and edema. In this disease state there is a greater increase of total body water relative to sodium, which

can occur in heart failure, renal failure, and cirrhosis.

Lastly, the fourth subdivision of hyponatremia is **euvolemic hyponatremia**, and diagnosis will be largely based on historical information from the patient, as the assessment of volume status will appear normal. In cases of euvolemia, the serum sodium is decreased in relation to increased total body water. Historical clues may include increased fluid intake during a marathon run (exercise associated hyponatremia), psychiatric disorders (psychogenic polydipsia), or even illicit substances such as ecstasy (see the article “X” in this issue). If no history of increased water ingestion is obvious, then consider SIADH as a cause with possible sources including pulmonary malignancies or intracranial pathology (trauma, stroke, hemorrhage). Lab tests to distinguish the type of euvolemic hyponatremia should include a serum osmolality (which should be low given increase in the total body water) as well as urine osmolality. In cases of acute water ingestion, urine osmolality will be dilute ( $U_{osm} < 100$ ) as the kidneys try to correct for the extra volume, versus an inappropriate ADH response (SIADH) when the serum is dilute but the urine remains concentrated ( $U_{osm} > 100$ ). See *Table 1*.

### Back to the Case

Your patient has a second seizure, but this time is increasingly altered, and failing to protect his airway. His family arrives and reports that he was recently diagnosed with a lung mass. The patient is emergently intubated, prepped for placement of a central line, and hypertonic saline is initiated.

### How to Fix It

There are two indications for treating hyponatremia emergently with hypertonic saline. First, when the sodium level is  $< 110$  mEq/L regardless of symptomatology, or second, when there is symptomatic hyponatremia with sodium  $< 120$  mEq/L.<sup>4</sup>

In this case, the acute hyponatremia was euvolemic SIADH secondary to lung malignancy. The most common malignancy to cause SIADH is ADH-producing small cell carcinoma. When caring for a seizing patient with hyponatremia you will not win any favors from staff or family by perseverating over the underlying cause.

You need to fix the sodium ASAP.

Per the updated expert panel recommendations from the *American Journal of Medicine* in 2013, a patient presenting with symptomatic hyponatremia should receive a 100ml bolus of 3% saline over 10 mins, repeated twice if needed.<sup>4</sup> Evidence has demonstrated a 4-6 meq/L increase in serum sodium over one hour is sufficient to reverse the most serious manifestations of hyponatremia (i.e., seizure, herniation).<sup>5</sup> In one prospective observational study of 58 adult patients with symptomatic severe hyponatremia, administration of 100 ml of 3% hypertonic saline resulted in a mean increase in sodium of 2 mEq/L.<sup>6</sup>

Additional **updated recommendations suggest correction of serum sodium be limited to less than 6-8 meq/L in the first 24 hours.**<sup>5</sup> However, if you work in a setting where critical patients board for long hours, a slower correction rate can be estimated by multiplying the patient’s body weight in kilograms by the desired rate of increase in serum sodium. For example, in a 70 kg patient, an infusion of 3% NaCl at 70 mL/h will increase serum Na<sup>+</sup> by approximately 1 meq/L/h, while infusing 35 mL/h will increase serum Na<sup>+</sup> by approximately 0.5 meq/L/h.<sup>5</sup> Just be sure to check the serum chemistry every two hours, and adjust the rate accordingly.

In general, a conservative infusion is recommended to avoid the feared osmotic demyelination syndrome from aggressively over correcting the sodium and osmolality. This dreaded complication leads to diffuse demyelination of neurons in the brain resulting in flaccid paralysis, dysarthria, dysphagia, hypotension and often death.<sup>7</sup> **Patients at higher risk of demyelination include known alcoholics, patients who are**

**malnourished, hypokalemic, elderly, patients with severe liver disease, or severe hyponatremia with sodium  $< 105$  meq/L.** For completeness, when treating **hypovolemic hyponatremia**, if the patient is hemodynamically unstable, then aggressive volume resuscitation with normal saline is the rule, until they become more stable, at which point they can be more gently hydrated.<sup>4</sup> In hypervolemic hyponatremia, the patient ideally needs volume removal with diuretics/dialysis, limited sodium intake, and water restriction to improve their care.

### What About the Central Line?

**For administration of hypertonic saline, the bottom line is that a large-bore peripheral vein will suffice in the emergent setting.** On review of the evidence, the maximum recommended osmolality for a solution administered into a peripheral vein is 900 mOsm/L, due to the fact that solutions with higher osmolarities may cause thrombophlebitis. In regards to 3% hypertonic saline the osmolality is 1026 mOsm/L, so central venous access is preferred, given the potential for thrombophlebitis and possible tissue necrosis if extravasation occurs.<sup>8</sup> However, remember: life over limb.

### Case Resolution

Hypertonic saline is continued through the central line once placed, and the patient is transferred to the intensive care unit. Overnight he remains intubated and sedated with a hypertonic infusion of 0.5 ml/k/hr of 3% saline. The following day his sodium improves to 120 mg/dl, and he is able to be safely extubated, and suffers no complications or neurologic deficits. ★

**Table 1. Interpretation of Lab Values in Hyponatremia.**

Classification of Hyponatremia by Plasma Tonicity/Urine Osmolality		
PLASMA OSMOLALITY (MOSM/KG H2O)	TYPICAL CAUSES	
Low ( $< 280$ ) “too much water volume” – assess urine osmo	SIADH; heart failure, cirrhosis	
– Urine Osmolality $< 100$ mOsm – appropriate water loss	Accidental/intentional water ingestion	
– Urine Osmolality $> 100$ mOsm – impaired water retention		
Urine Sodium	$< 20$ mmol/L – Conserving sodium	Dehydration, HF, Cirrhosis,
	20-40 mmol/L	Unknown needs fluid challenge
	$> 40$ mmol/L – Dumping sodium	SIADH, diuretics, Thyroid, Adrenal
Normal (280-295)	Pseudohyponatremia (glucose, lipids, proteins)	
High ( $> 295$ ) “too little water volume”	Severe hyperglycemia with dehydration; mannitol	

# EMRA EVENTS AT SAEM



For the first time in the history of the EMRA Quiz Show – we had a tie for first place! Congratulations!



## EMRA Quiz Show

Fourteen teams battled – two came out on top to take the honor: **The University of California San Diego** (above left) and **Texas A & M Christus Spohn** (above right).



### Thanks to all the programs that participated.

- Carolinas Medical Center  
Returning Champions
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- St. Luke's Roosevelt
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- University of California San Diego
- University of Kentucky
- University of Mississippi
- University of Texas Austin
- University of Washington
- Washington University St. Louis
- Wright State University



# EMRA Resident SIM•WARS



Once again, the **EMRA/SAEM Simulation Academy Resident SimWars** spurred intense competition at the SAEM Annual Meeting in May. Kudos to our grand champion, **Northwestern University** (pictured at left), and the other fierce teams who entertained and educated us with their admirable intelligence, dexterity, and unexpected acting skills!



The 6 Contenders



# UPCOMING EVENTS

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1

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**ACEP15**  
Boston, MA

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Questions should be directed to  
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or by email at [lschiltz@acep.org](mailto:lschiltz@acep.org)

# Annals of Emergency Medicine

## Resident Editorial Board Fellowship Appointment

The Resident Fellow appointment to the Editorial Board of *Annals of Emergency Medicine* is designed to introduce the Fellow to the peer review, editing, and publishing of medical research manuscripts. Its purpose is not only to give the Fellow an experience that will enhance his/her career in academic emergency medicine and scientific publication, but also to develop skills that could lead to later participation as a peer reviewer or editor at a scientific journal. It also provides a strong resident voice at *Annals* to reflect the concerns of the next generation of emergency physicians.

Please visit *Annals'* Web site at [www.annemergmed.com](http://www.annemergmed.com) for a copy of the complete application.

**Due date is July 13, 2015**

# Blue Leg

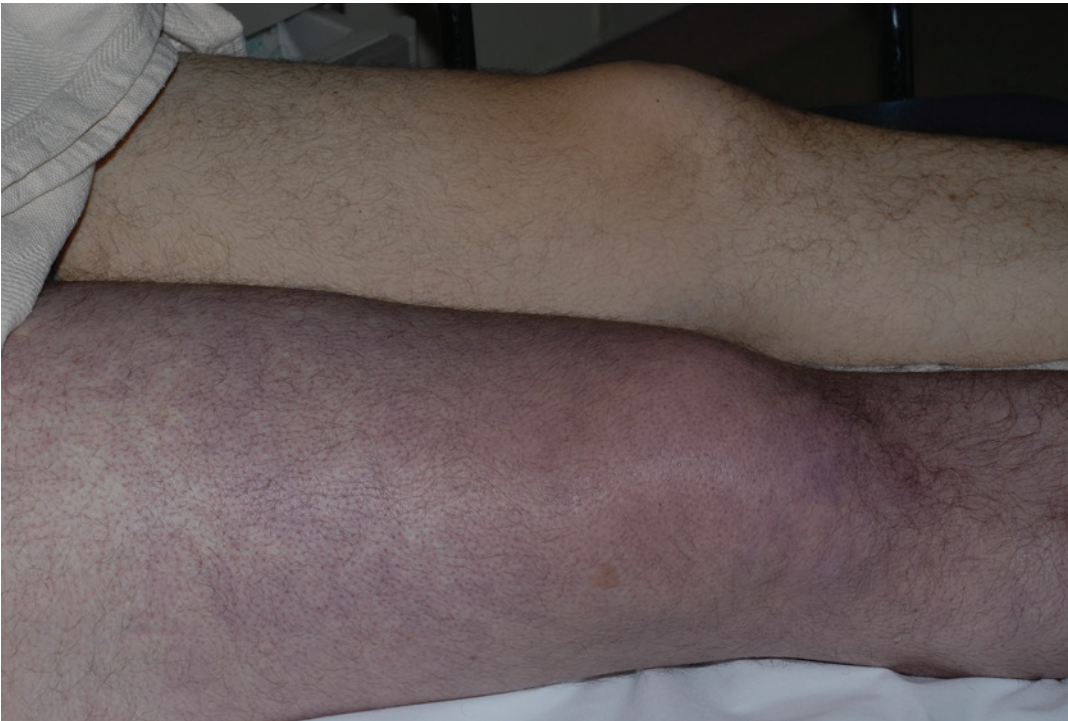


PHOTO COURTESY OF R. JASON THURMAN, MD

## The Patient

A 46-year-old male presents to the emergency department complaining of excruciating right leg pain. The pain began with a mild aching the day prior to admission along with some diffuse swelling of the leg, but has quickly progressed over the past few hours to severe diffuse 10/10 pain and worsening lower extremity swelling. The patient has no medical problems and has never had anything like this before. His physical exam is remarkable for a regular tachycardia to 124 beats per minute, and the findings depicted in the image provided.

*What is the diagnosis?*

R. Jason Thurman, MD  
Lawrence B. Stack, MD  
Vanderbilt University  
Nashville, TN

See the  
**DIAGNOSIS**  
on page 50

# The Diagnosis

## Phlegmasia Cerulea Dolens

The clinical findings in this patient are consistent with phlegmasia cerulea dolens. Phlegmasia cerulea dolens (PCD) is a condition that results from a massive diffuse venous thrombosis that results in acute venous outflow obstruction. In this patient, duplex ultrasonography revealed extensive thrombus from the groin extending all the way to the distal lower extremity. Patients typically present with significant pain, swelling, and cyanosis of the affected extremity. Given the potential for limb ischemia, emergent vascular surgery consultation should be considered. Treatment may include anticoagulation, catheter directed thrombolysis, and/or surgical thrombectomy along with pain control. As with any thrombotic process, Virchow's Triad (stasis, endothelial damage, and hypercoagulable states) helps to generate a differential diagnosis. Unfortunately in this patient, this was the initial presentation of severe metastatic cancer.

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# Board Review

## QUESTIONS

Provided by *PEER VIII*. *PEER (Physician's Evaluation and Educational Review in Emergency Medicine)* is ACEP's gold standard in self-assessment and educational review. These questions are from the latest edition of *PEER VIII*. For complete answers and explanations, visit [emresident.org](http://emresident.org) (Features section).

To learn more about *PEER VIII*, or to order it, go to [www.acep.org/bookstore](http://www.acep.org/bookstore).

- Which of the following systemic disorders is associated with pruritus?
  - Chronic kidney disease
  - Glucocorticoid deficiency
  - Heart failure
  - Mineralocorticoid deficiency
- A 32-year-old woman presents with chest pain that has worsened over the past two months. She says it gets worse when she lies flat or exercises and after she eats or drinks quickly. She has no significant past medical history, but her husband says she has lost about 10 pounds recently and has been throwing up undigested food. What are the expected diagnostic findings?
  - Diffuse ST-segment elevation and PR-interval depression
  - Dilated esophagus proximal to a beaklike lower esophageal sphincter
  - Gastric inflammatory changes
  - White matter plaques in the brainstem
- A 30-year-old woman presents with partial-thickness burns on her entire back and the entire posterior aspects of both arms after her shirt caught fire. No other parts of her body are burned. She weighs 65 kg. As calculated using the Parkland formula, how much crystalloid solution is required in the first 24 hours?
  - 2,340 mL
  - 4,680 mL
  - 7,020 mL
  - 9,360 mL
- Which of the following statements regarding amiodarone is correct?
  - Associated with pulmonary fibrosis when used as short-term intravenous therapy
  - Has never been shown to increase short-term survival to hospital admission in cardiac arrest patients
  - Not associated with hypotension
  - Recommended for ventricular fibrillation unresponsive to shock delivery, CPR, and vasopressor treatment
- End-tidal carbon dioxide monitoring is:
  - A poor predictor of correct endotracheal tube placement
  - An early indicator of carbon dioxide when the colorimetric sensor turns purple
  - An early indicator of respiratory depression during procedural sedation
  - Less accurate when used during CPR



# RISK MANAGEMENT PITFALLS

## Diagnosing and Managing Shock



From the March 2014 issue of *Emergency Medicine Practice*, “Diagnosis and Management of Shock in the Emergency Department.” Reprinted with permission. To access your EMRA member benefit of free online access to all *EM Practice*, *Pediatric EM Practice*, and *EM Practice Guidelines Update* issues, go to [www.ebmedicine.net/emra](http://www.ebmedicine.net/emra), call 1-800-249-5770, or send e-mail to [ebm@ebmedicine.net](mailto:ebm@ebmedicine.net).

**❶ “His blood pressure is normal. He can’t be in shock.”**

Focusing on blood pressure alone as an indicator of shock can lead to missing signs of occult shock. Impaired organ perfusion, as evidenced by acute renal failure, altered mental status and/or increased serum lactate concentration, is a sign of shock pathophysiology and obligates early, aggressive clinical management.

**❷ “Let’s get the chest CT scan before deciding whether to give antibiotics or not.”**

Failure to give antibiotics within one hour of presentation for all cases of possible septic shock may result in increased mortality. Early empiric antibiotic coverage is indicated for suspected septic shock with a target of administering (not just ordering) antibiotics within one hour of presentation.

**❸ “Her ejection fraction is 30%, so let’s start norepinephrine instead of giving a second liter of fluid.”**

Adequate volume resuscitation for hypovolemic patients is critical. Markers of tissue perfusion such as lactate clearance, ScvO<sub>2</sub>, pulse pressure variation with passive leg raise, and ultrasonographic measures of intravascular volume are appropriate determinants of the need for further volume resuscitation. A history of a low ejection fraction or other hypothetical concerns may lead clinicians to underresuscitate hypovolemic patients and may result in inappropriate initiation of vasopressors.

**❹ “It could be a myocardial infarction, but let’s wait for the troponin to come back before calling cardiology.”**

Time-to-revascularization is one of the

primary determinants of survival in patients with cardiogenic shock due to acute coronary syndromes. Delaying time to catheterization and revascularization will increase patient morbidity and mortality. When cardiogenic shock is possible, early consultation with cardiology and activation of the catheterization laboratory are necessary to optimize patient outcomes.

**❺ “Let’s give a fifth liter of saline and see if her mean arterial pressure comes up to at least 60 mm Hg...”**

Starting vasopressors without adequately volume resuscitating a patient while following markers of tissue perfusion and intravascular volume status is inappropriate (see pitfall #3); however, not recognizing that vasopressors need to be started for patients who are not volume responsive is also inappropriate. Patients with a pathologically decreased systemic vascular resistance may require vasopressors to maintain mean arterial pressure even after volume resuscitation and normalization of intravascular volume status. Continuing to administer fluids and not recognizing the need for vasopressors can result in perpetuating complications of shock.

**❻ “She has a fever and hypoxemia. Her hypotension is probably due to sepsis from pneumonia.”**

Failure to consider obstructive shock on the differential diagnosis can lead to inappropriate clinical management, such as treating a pulmonary embolism with antibiotics. Maintaining a broad differential diagnosis and considering obstructive pathophysiologic causes of shock, when clinically appropriate, can lead to more rapid diagnosis and treatment.

**❼ “I read that a hemoglobin of 7 gm/dL is the evidence-based transfusion trigger, so let’s hold off on giving this hypotensive trauma patient blood.”**

While conservative transfusion thresholds

are appropriate for critically ill patients without active hemorrhage, prompt resuscitation with blood products is critically important for patients presenting with hemorrhagic shock. Furthermore, the hemoglobin concentration will not reflect the degree of blood loss early in such a patient’s presentation, obligating the emergency clinician to identify possible acute hemorrhage based on the patient’s clinical circumstances.

**❽ “Her mean arterial pressure of 50 mmHg is probably just because she’s pregnant.”**

Numerous physiologic changes occur during pregnancy, including increased cardiac output, increased heart rate, and decreased systemic vascular resistance. The decrease in systemic vascular resistance usually results in a drop in the mean arterial pressure of 5 mm Hg to 10 mm Hg from normal prepregnancy levels. Mean arterial pressures <60 mm Hg, however, should raise awareness of the possibility of pathophysiologic processes contributing to hypotension.

**❾ “Let’s try bilevel positive airway pressure and see if his pneumonia gets better after antibiotics.”**

Recognition of multiorgan system failure and hypotension from septic shock that requires early intubation and mechanical ventilation is critically important. Failure to intubate early in the course of care for critically ill patients in septic shock can perpetuate the cycle of impaired oxygen uptake, deficient oxygen delivery to peripheral tissues, and increased metabolic demand from increased work of breathing. Furthermore, recognizing that a patient’s disease process will take days, rather than hours, to resolve prioritizes intubation above noninvasive mechanical ventilation. ★

# RISK MANAGEMENT PITFALLS

## Evaluation of Acute Unexplained Crying in Infants



From the March 2014 issue of *Pediatric Emergency Medicine Practice*, “A Systematic Approach to the Evaluation of Acute Unexplained Crying in Infants in the Emergency Department.” Reprinted with permission. To access your EMRA member benefit of free online access to all *EM Practice*, *Pediatric EM Practice*, and *EM Practice Guidelines Update* issues, go to [www.ebmedicine.net/emra](http://www.ebmedicine.net/emra), call 1-800-249-5770, or send e-mail to [ebm@ebmedicine.net](mailto:ebm@ebmedicine.net).

**❶ “The baby did not have a fever, so I did not consider that he could have a serious infection.”**

Sepsis and other significant infections can present as crying, alone or in conjunction with other findings. An infant may not manifest a fever as a sign of infection or, conversely, he may be hypothermic as a manifestation of infection. For a crying infant, all serious etiologies, including infection, should be considered and investigated when appropriate, with or without the presence of fever.

**❷ “Of course the baby had an elevated heart rate; he was crying.”**

Crying can often lead to tachycardia in infants. However, tachycardia can be a manifestation of infection, dehydration, evolving fever, pain, or distress. Vital signs should be taken repeatedly on a crying infant, in both the crying and noncrying state, to avoid inappropriately attributing abnormal findings to crying rather than other potentially serious underlying causes.

**❸ “I had a bad feeling about this baby, but how I feel shouldn’t impact my investigations.”**

As with parental concern, clinician concern and “gut instinct” regarding pediatric pathology has been supported as an accurate tool in determining serious illness. Emergency clinicians should acknowledge their concern and factor their intuition into an evaluation of a crying infant.

**❹ “The parents seem really nice, so there is no need to consider nonaccidental trauma.”**

Unfortunately, it is almost impossible to predict which caregivers may cause

nonaccidental trauma. It must be considered in any infant with persistent or unexplained crying regardless of a family’s stature or protestations.

**❺ “All babies cry. This is a normal finding and is nothing to worry about.”**

While some amount of crying is normal in all infants, any crying that exceeds the duration or quality of the infant’s typical crying, is concerning to parents or providers, or is accompanied by a change in behavior should be considered significant and potentially pathologic until proven otherwise. The spectrum of normal crying for an infant is variable by age and by individual infant, so caregiver descriptions of deviations should be taken seriously.

**❻ “If I am not going to perform any diagnostic tests (such as blood, urine, imaging), I should just send this baby home. There is no reason for him to sit around in the ED.”**

Observation and serial examinations are paramount to the evaluation of a crying infant for whom a diagnosis is not immediately clear. This may allow for the acquisition of additional information to guide further ED testing, allow for clinicians and caregivers to follow a trajectory of illness in the ED, and provide relief for stressed caregivers and time for education.

**❼ “The more tests I perform, the closer I will be to making a diagnosis.”**

There is no one test or series of tests universally recommended for the evaluation of a crying infant. History and physical examination remain the

cornerstone of diagnosis in crying infants. “Kitchen sink” testing is expensive, invasive, and inappropriate for most infants who present to the ED with acute unexplained crying.

**❸ “This baby just has colic.”**

Colic and unexplained crying are common diagnoses, but should only be applied to infants for whom other etiologies for acute crying have been considered first.

**❹ “This baby seems fine; there is no need for this family to follow up with their primary care provider.”**

Close follow-up is critical for crying infants evaluated in the ED. First, it ensures a second visit to document improvement or worsening for diagnosed conditions in which treatment may have been instituted. Second, it allows an additional diagnostic examination for infants in whom the ED visit was unrevealing and in whom an illness may now be more apparent. Lastly, it ensures a session with the primary care provider, someone who can provide reassurance and support to the family on a more long-term basis.

**❺ “Parents are always anxious about their babies, but it doesn’t mean anything is truly wrong with the infant.”**

The degree of parental concern has been shown to correlate with disease severity in infants. Parents can differentiate the cries of their infants and can intuit pathology as well. Parental concern should be one of multiple features to factor into the evaluation of a crying infant and should not be dismissed by providers. ★

## LEGISLATIVE REPORT (P. 6)

### Cutting the Check

1. This is a simplified formula and doesn't include the adjustment made for regional variability in costs. This adjustment is called the Geographic Price Cost Index and is used to adjust all three RVU components.
2. This is a simplified formula that does not include the Sustainable Growth Rate and the Medicare Economic Index. It also doesn't include the Medicare Physician Quality Reporting System and Value-Based Modifiers.
3. ACEP ED Facility Level Coding Guidelines. Available at <http://www.acep.org/Content.aspx?id=30428>.
4. Procedures such as EKGs, x-rays and lab tests are often billed separately using other distinct codes. These other codes won't be discussed here.

## NEUROLOGY (P. 9)

### Stroke Alert

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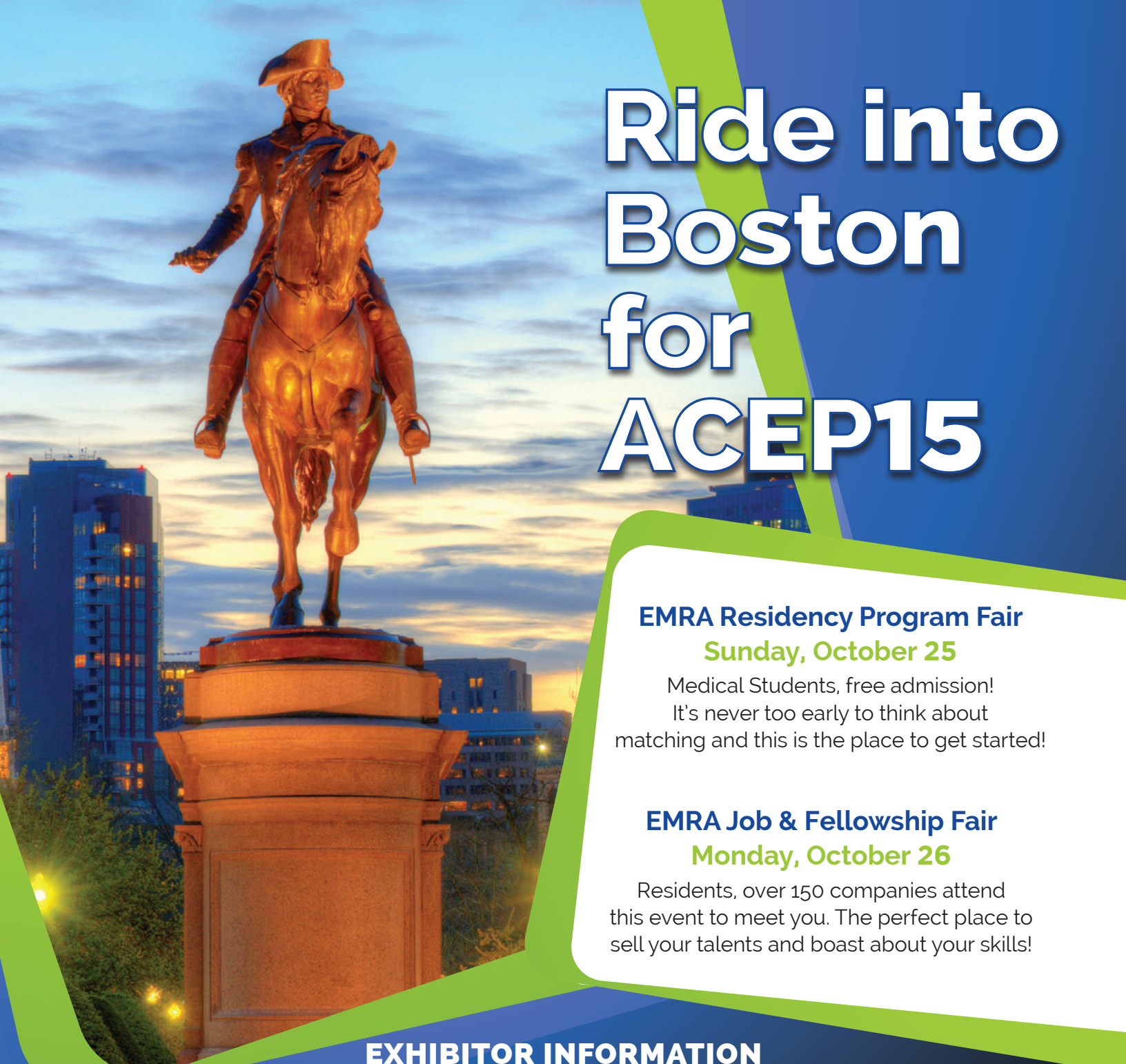
**Researching the Barriers**

- [http://www.acgme.org/acgmeweb/portals/o/pfassets/2013-pr-faq-pif/110\\_emergency\\_medicine\\_07012013.pdf](http://www.acgme.org/acgmeweb/portals/o/pfassets/2013-pr-faq-pif/110_emergency_medicine_07012013.pdf)
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**Cortland:** Cortland Regional Medical Center is a modern, full-service facility situated in the Finger Lakes Region between Syracuse and Ithaca. A broad mix of pathology makes up 33,000 ED pts/yr., and there is strong support from medical

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**New Bern:** CarolinaEast Medical Center is a respected 313-bed regional medical center located at the intersection of the Trent and Neuse Rivers just off the central coast. 70,000 ED pts./yr. are seen in the ED. Beautiful small city setting. Outstanding partnership opportunity includes equal profit sharing, equity ownership, funded pension, open books, full benefits and more. Contact Ann Benson ([careers@emp.com](mailto:careers@emp.com)), Emergency Medicine Physicians, 4535 Dressler Rd. NW, Canton, OH 44718, 800-828-0898 or fax 330-493-8677.

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**Urbana:** Mercy Memorial Hospital services the SW Ohio region's residents in Champaign County, the facility treats approximately 18,000 emergency pts./yr. Desirable residential areas in Dayton are easily accessible. EMP is a physician owned/managed group with open books, equal voting, equal equity ownership, funded pension, comprehensive benefits and more. Contact Ann Benson ([careers@emp.com](mailto:careers@emp.com)), Emergency Medicine Physicians, 4535 Dressler Rd. NW, Canton, OH 44718, 800-828-0898 or fax 330-493-8677.

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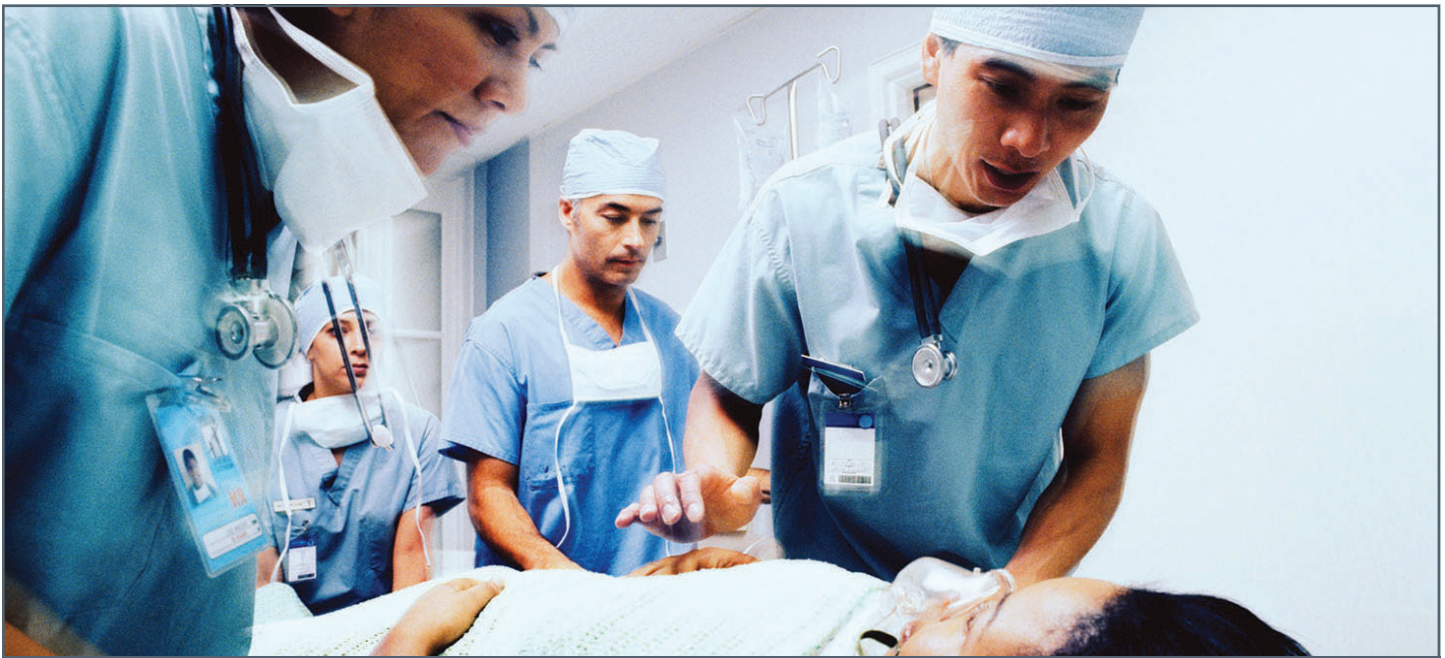
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Pittsburgh and suburbs, Canonsburg, Connellsville, New Castle and Erie: Allegheny Health Network and Emergency Medicine Physicians have formed Allegheny Health Network Emergency Medicine Management (AHNEMM), which offers a professional arrangement unlike that previously available

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Presbyterian Healthcare Services (PHS) is New Mexico's largest, private, non-profit healthcare system and named one of the "Top Ten Healthcare Systems in America." Over 600 providers are employed by PHS and represent almost every specialty. PHS is seeking BE/BC Emergency Medicine trained physicians to work in our Emergency Medicine department in Albuquerque and will consider BC/BP Family Medicine, Internal Medicine or Emergency Medicine trained physicians in Ruidoso, NM.

Albuquerque thrives as New Mexico's largest metropolitan center with a population of 700,000. Albuquerque has been listed as one of the best places to live in the United States by *Newsweek*, *U.S. News & World Report*, *Money* and *Entrepreneur* magazines! Albuquerque is considered a destination city for most types of outdoor activities with 310 days of sunshine.

Ruidoso is a mountain community at seven thousand feet altitude with snow skiing in the winter and horse racing in the summer. The community is best surveyed from the Chamber website at [ruidosonow.com](http://ruidosonow.com). We currently have six Family Practitioners, one General Surgeon, one Radiologist, two Internists, two Obstetrician/Gynecologists, three Orthopedic Surgeons as part of a group practice with Podiatrists, two inpatient Hospitalists that cover 24/7, four Emergency Room physicians and four nurse practitioners. We are part of the Presbyterian Healthcare Services network and are a twenty-five bed Critical Access Hospital. Emergency Medicine physicians will enjoy a flexible work schedule a monthly requirement of twelve, 12 hour shifts with midlevel support.

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For more information regarding Albuquerque, contact Kelly Herrera, [kherrera@phs.org](mailto:kherrera@phs.org); 505-923-5662; For more information regarding Ruidoso, contact Aracely Pena, [apena6@phs.org](mailto:apena6@phs.org); 505-604-7590.

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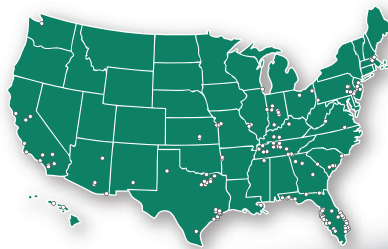
**Ellwood City and Indiana:** Allegheny Health Network Emergency Medicine Management (AHNEMM) is pleased to announce our newest affiliations with The Ellwood City Hospital (TECH) west of Pittsburgh, and Indiana Regional Medical Center northeast of Pittsburgh (IRMC). TECH sees 12,000 emergency pts./yr. and is in a smaller community that affords easy access the north-Pittsburgh's most desirable suburbs. IRMC sees 45,000 ED pts./yr. and is situated in a nice college town. AHNEMM offers equal equity ownership/partnership, equal voting and the opportunity to be part of a progressive EM group. Comprehensive compensation package



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## Emergency Medicine Physicians Opportunities

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*\*G-SACH is a campus of Geisinger Medical Center, Danville.*

### **Geisinger-Bloomsburg Hospital**

Join a growing team of Emergency Medicine staff Physicians and Advanced Practice Providers at Geisinger-Bloomsburg Hospital (G-BH), located in Bloomsburg, Pa.


Geisinger-Bloomsburg Hospital's Emergency Department, which was recently renovated, houses 13 beds and handles approximately 16,500 visits annually. At the hospital, surgery, OB, hospitalists, a psych unit, and radiology with ultrasound, CT, x-ray, and MRI are available 24 hours a day. Geisinger Medical Center (GMC), located in Danville, Pa., is just miles down the road for complicated cases, trauma, STEMI, and pediatrics.

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