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The Official Voice of Emergency Medicine

MARCH 2024 Volume 43 Number 3

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PLUS



ETHICAL ISSUES

**Interhospital
Transfers of
ED Patients**

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ELECTRICAL INJURIES

**It's Important to
Understand the
Nuances**

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CASE REPORT

Transillumination to Diagnose a Foreign Body

Many foreign bodies are not
radiopaque for x-ray imaging



by AMANDA ANDERSON, DO;
JADEN MILLER

A 4-year-old female, who is otherwise healthy, presented to the emergency department (ED) for evaluation of left foot pain. Three days prior, the patient had been on a wooden dock with family friends. She suddenly developed pain to the plantar aspect of the foot without any obvious trauma. She had not ambulated since then. At urgent care, two small

CONTINUED on page 15

AMANDA ANDERSON

SPECIAL OPS

Survival Tactics for ED Boarding

by SHARI WELCH, MD

A few statistics that help to frame our hospital capacity crisis today: Immediately following World War II, the population of the U.S. was 144 million and there were more than 1 million inpatient hospital beds. Today, the U.S. population has more than doubled to 336 million, but hospital beds have been reduced to 917,000. Simply put, there are not enough inpatient beds in this country.

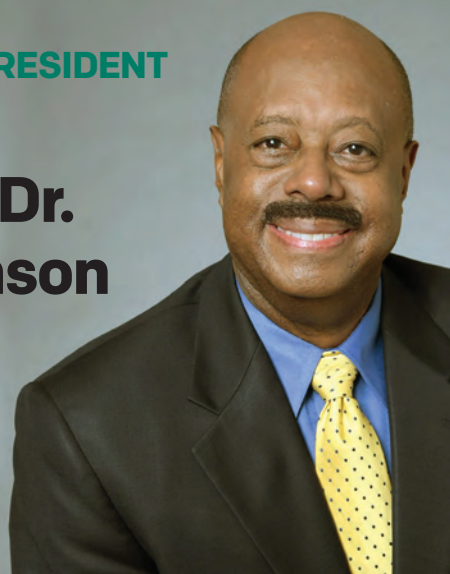
Prior to 2020, the problem of boarding, the holding of admitted patients in the emergency department (ED), was beginning to show signs of being managed. The Emergency Department Benchmarking Alliance (EDBA) had noted that pre-pandemic boarding, captured and measured as Admit Decision to Departure (ADD) time, was trending downward. Many hospitals and EDs during the pandemic actually got a brief reprieve in terms of their volumes. Most however are now seeing their volumes roaring back alongside the concomitant return of extreme levels of boarding. To the horror of the front-line doctors and nurses, these extreme boarding conditions come with all of the poor outcomes and sequelae we expect to accompany hospital boarding in the ED.²⁻⁵

There are several quick fixes that can mitigate boarding. Two are in the front end and two in the back end. The first fix in the front end allows EDs of all sizes to continue to manage patients, even when much of the department's real estate and resources are given over to the care of admitted patients. This initiative involves creating a Physician in Triage (PIT) model or more accurate nomenclature would be a "Physician Intake" area.⁶⁻⁸ PIT initiatives have been found to reduce wait times to see the physician, reduce walkaways, increase patient satisfaction and improve the quality of care for

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ABEM PRESIDENT

**Q&A
with Dr.
Johnson
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NEWS FROM THE COLLEGE

UPDATES AND ALERTS FROM ACEP

Take a Deep Dive into Physician Unionization

ACEP wants to protect and empower you. We invite you into the hard conversations about emergency physician unionization as we collectively wrestle with how to protect emergency physicians now and in the future. At acep.org/PhysicianUnionization, ACEP members can find these resources:

- Two courses from ACEP23 about unions and employer models.
- A recent Frontline podcast about physician unions.
- A quick survey about your interest level in physician unionization.
- Anyone in a union can contact *ACEP Now* to be featured in an upcoming story.



Research Forum Submissions Now Being Accepted

If you have original research you would like to see showcased at the world's premier emergency medicine research event, now is the time. ACEP Research Forum, which will take place in conjunction with ACEP24 from Sept. 29 to Oct. 2 in Las Vegas, is accepting abstract submissions through April 30. The Research Forum typically selects more than 400 abstracts per year, presented live during the event. Find out more about the criteria, format and submission process at acep.org/RF.

Comments Open for Draft Clinical Policy on Blunt Trauma

ACEP's Clinical Policy Committee is accepting comments on its draft clinical policy—"Critical Issues in the Evaluation of Adult Patients Presenting to the Emergency Department with Acute Blunt Trauma." The deadline is April

14 to submit comments at acep.org/cp-blunt-trauma.



Amplify Your Voice at Issues That Matter at LAC24

There's still time to register for ACEP's Leadership & Advocacy Conference, April 14–16 in Washington, D.C. Together, we will advocate in person to policymakers for a better environment for emergency medicine and your patients. Learn about some of the biggest topics emergency physicians are discussing today, including unionization, practice models, and scope creep—and what you can do in your hospital, in your state, and on the national level. Additionally, you will make Hill Visits and meet with Members of Congress to advocate for positive change on issues such as the boarding crisis. Learn more at acep.org/LAC.

Teaching Award Nominations Being Accepted

Know a medical educator who has gone above and beyond and demonstrates excellent and innovative clinical teaching, as well as mentorship of learners? Nominate them for a Teaching Award! The deadline for these awards is April 15 and more details can be found at acep.org/teachingaward.

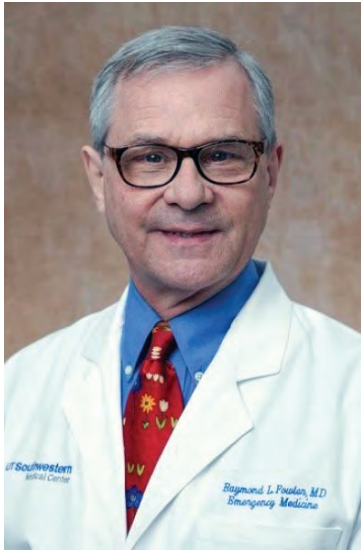
- Excellence in Bedside Teaching Award—Recognizes outstanding emergency physician educators who are 100 percent clinical and have teaching responsibilities of residents or medical students.
- Faculty Teaching Award—Recognizes outstanding emergency physician educators who are seven or more years post residency.
- Junior Faculty Teaching Award—Recognizes outstanding emergency physician educators who are less than seven years post residency. ➕

MEMBERS IN THE NEWS

RAYMOND L. FOWLER, MD, FACEP, FAEMS.

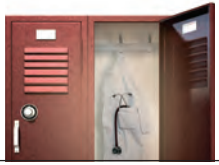
Members in the News

Parkland Hospital in Dallas recently dedicated its Bio-Tel Communications Center to **Raymond L. Fowler, MD, FACEP, FAEMS**. Dr. Fowler, an ACEP member since 1983, is a legendary leader in EMS education, operations, and medical direction. He was a founding member of the National Association of EMS Physicians, where he served as its second elected President. In addition to his EMS work, Dr. Fowler has been a practicing emergency physician for 43 years. He currently is a professor of emergency medicine at UT Southwestern, serves as the division chief of emergency medical services in the Department of Emergency Medicine and is the James M. Atkins, MD, distinguished professor of emergency medical services. ➕



SEND YOUR THOUGHTS
AND COMMENTS TO
ACEPNOW@ACEP.ORG

THE BREAK ROOM



Re: 'A Case Report: A Child with a Rash and Lead Poisoning History' (January 2024)

I applaud "A Case Report of Microcytic Anemia in a Pediatric Patient." This report demonstrates the need for routine screening of children for exposure to lead. It is frightening to think what might have been the long-term outcome had the child not been screened by his pediatrician, unrelated to the initial presenting problem to the emergency department. Many years ago, our emergency room agreed to send a blood lead level for screening for any child younger than 5 years of age, regardless of the presenting problem. We found many children who had elevated blood lead levels that might not have been identified otherwise.

Lead exposure is an example of an environmental disaster. The authors stated that the child was living in a "lead safe environment." The X-ray revealed the presence of radio-opaque materials suggesting/proving recent exposure to lead-containing material. During my career in academic medicine, I experienced innumerable cases in which children were sent home to "lead-safe" not "lead-free" homes, to be readmitted within weeks, with evidence of renewed exposure.

The treatment for lead "poisoning" is really not chelation, it is separating the child from

the exposure! The blood lead level will drop by itself as long as no further exposure occurs, chelation simply speeds the process.

Preventing lead exposure should be a societal goal. It is the most preventable cause of neuro-cognitive impairment.

—Steven M. Marcus, MD

Re: 'Artificial Intelligence in the ED: Ethical Issues' (December 2023)

I read with interest Dr. Iserson's article Artificial Intelligence in the ED: Ethical Issues.

The degradation of physician skill is not a patient-oriented outcome. These days, every time an automatus vehicle has a mishap, especially were injury to occur, it is national news. Invariably, these news stories neglect to point out how many people are injured from motor vehicle collisions in this country. Even at this nascent stage, the majority of car accidents involving self-driving cars were the result of the other driver. If (an admittedly big if) this technology can be demonstrated to be safer than human physicians, our relevance and our roles in medicine may as well be moot. Will there be marginal cases where AI performs worse than a human? Undoubtedly. But humans make frequent mistakes that cost patients in morbidity and mortality.

In an era when medical spending has far outstripped inflation, outcomes have failed to keep pace, our population aging, and Medicare is constantly on the verge of insolvency. It may very well be that AI could be a potential part of the solution. Agreed, physicians are not the most costly component of health care in this country. However, we must always be arguing on the side of what is best for our patients, not our positions.

—Greg Neyman, MD, FACEP

Re: 'Things Aren't Always Black or White' (January 2024)

Judging by Dr. Kendall's piece, "Things Aren't Always Black or White," the state of racism in health care is troubling indeed. Assumptions about humans based on immutable characteristics like skin color used to be called racism. Now it's championed under the banner of "antiracism."

Rebuking emergency physicians about "white fragility" doesn't improve emergency department boarding, understaffing or the morale of those trying to provide safe and compas-

sionate care, especially in underserved areas.

No doubt there are many personal stories of racism, as discrimination and bias are human flaws that escape no one, regardless of skin color. "White people do not exist under a non-racist force field," writes Dr. Kendall, but she is only partially correct—no one does. Pushing the idea that whites are hopelessly racist has no resolution, as it ensnares our society into endless racial division. Dr. Martin Luther King Jr.'s words, "I look to a day when people will not be judged by the color of their skin, but by the content of their character," provide a better solution.

Reducing humans to their immutable characteristics and assigning value or scorn based on these traits normalizes their dehumanization. This leads to the belief that certain humans hold more value than others—a dangerous perspective used to justify such past atrocities as forced sterilizations, the Tuskegee experiment and the Holocaust, as well as the explosion of antisemitism today.

Doctors should focus on healing all humans—regardless of skin color or any other attributes.

—Aida Cerundolo, MD +

HAVE AN IDEA?

Submit your story pitch to ACEP Now

If you have a story idea or drafted article, e-mail the word document file to Editor **Danielle Galian-Coolidge**, MPS, and Medical Editor in Chief **Cedric Dark, MD, MPH, FACEP**. We'll review your submission and update you on next steps.

To submit a story pitch, please send a 250 word summary along with bullet points of the following:

- Why our readers would value the story.
- How the story would influence the provision of emergency medicine.
- What you hope the reader would learn from your article.
- Potential outside experts or sources for the story.

The usual length of standard articles (departments, columns, one- to two-page articles) is about 800 words. The usual length of feature articles (two or more pages) is about 1,200 words. A reference list is also required to support researched material and the practice of evidence based medicine.

Preference will be given to new voices.

Submit a Case Report

To be considered for publication, send your case presentation to Medical Editor in Chief **Cedric Dark, MD, MPH, FACEP**, with the following:

- 200-word introduction of the pa-

tient's presentation, followed by,

- 600 word description of the diagnosis and management of the case including up to three bulleted teaching points,
- 10 reference maximum.

Rare, but not unusual, cases with clinical importance to emergency medicine will be considered. Those with clinical images preferred.

Submit a Letter to the Editor

ACEP Now welcomes letters to the editor from our readers. Letters should be 250 words or less, may be edited for length and style, and are published online and/or in print at the editorial team's discretion. Submit your letter including your name, title, organization, and contact information to Editor **Danielle Galian-Coolidge**, MPS.

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APRIL 30 Submission site closes

JULY

Email notifications

SEPT 29 - OCT 2 Presentations in Las Vegas



SUBMISSION REQUIREMENTS

Original research that has not been published in peer-reviewed form. Adherence to *Annals of Emergency Medicine* format: study objectives, methods, results, and conclusion. Abstracts are limited to 3,000 characters, not including spaces. Tables or figures must be black and white, with at least 300 dpi. Authors should not be identifiable via the title or body of the abstract.



REVIEW PROCESS

Abstracts will be peer-reviewed in a blinded manner. Review criteria focus on the validity, generalizability, and novelty of the findings, and the projected magnitude of impact on the quintuple aim.



CONTACT ACEP: 972.440.0911 | researchforum@acep.org

ACEP4U: ACEP Advances Boarding Solutions

COLLEGE ALSO SEEKING STRONGER PROTECTIONS FROM ED VIOLENCE

by STEVE ARNOFF

Emergency physician-supported solutions to some of the biggest challenges in health care are gaining steam in Washington, D.C.

In December, the Department of Health and Human Services (HHS) announced it would convene stakeholders to address boarding concerns through the Agency for Healthcare Research and Quality (AHRQ). ACEP conversations continue with the AHRQ.

ACEP helped make this possible by mobilizing Congress to request HHS action during last year's Leadership and Advocacy Conference, where emergency physicians from across the country gathered in D.C. to share their concerns directly with elected officials. ACEP advocates helped secure 44 signatories on a congressional "Dear Colleague" letter to the Administration, asking them to establish a task force on the boarding crisis.

The College is pushing for federal actions that align with input from the first National Stakeholder Summit on Boarding, which ACEP organized and hosted in September 2023.

In addition to boarding measures, ACEP strongly supports legislation to improve protections for the health and safety of emergency physicians on the job.

ACEP and the American Hospital Association co-hosted a congressional briefing Jan. 30 to discuss violence in the emergency department and encourage elected officials to pass the *SAVE Act*, bipartisan legislation that ACEP helped develop and strongly supports to protect physicians and health care professionals in the workplace.

This bill would make assaulting a health care worker a federal crime and create grants to empower emergency departments to enact solutions that work best for their community, while ensuring critical protections for patients in mental health crisis or who may be limited in capacity.

The expert panel included ACEP President Aisha Terry, MD, MPH, FACEP, alongside Kate FitzPatrick, DNP, RN, NEA-BC, FAAN, chief nurse executive officer at Jefferson Health Philadelphia, and Mark Boucot, president and chief executive officer at Garrett Regional Medical Center in Oakland, Maryland. The panel was joined by *SAVE Act* co-sponsors, Rep. Larry Bucshon, MD (R-IN) and Rep. Madeline Dean (D-PA).

"We can't be the safety net without feeling safe ourselves," Dr. Terry said at the briefing. "This is not a one-off. This is a daily situation in emergency departments across the country."

The panel emphasized the importance of accountability as a mechanism to prevent future attacks, and reiterated the need to change the culture of medicine, which too often allows these incidents to go unreported and unaddressed.

The sentiment is consistent with 2022 ACEP polling that shows the rise of violence and the impact these attacks have on patient care and



Each year, emergency physicians discuss key issues with their Members of Congress during ACEP's Leadership and Advocacy Conference.

physician mental health.

ACEP is reminding legislators and health care leaders that efforts to curb violence are still urgently needed today—this is not just a pandemic problem, but a persistent and growing one.

A January 2024 ACEP member survey with about 2,000 responses revealed that 71 percent of emergency physicians believe violence in the emergency department is worse than last year. Nine in 10 respondents (91 percent) indicated that they or a colleague were threatened or attacked in the past year, and more than two-thirds (68 percent) of those physicians said that they felt their employer's response was not appropriate. The survey also yielded more than 800 distressing firsthand accounts from members across the country.

Dr. Terry used her platform at the briefing to reference impactful ACEP state chapter efforts, including a recent Virginia College of Emergency Physicians-led effort to pass a law requiring trained security at emergency departments throughout the state, as well as an ACEP checklist developed so that anyone can speak to their hospital leadership about programs, plans, and features that make emergency departments safe.

ACEP is tackling this issue from every direction to make sure that emergency physicians are heard loud and clear: the status quo is unacceptable and now is the time for change.

ACEP also works to protect emergency physicians by shepherding support for the reauthorization of the *Dr. Lorna Breen Health Care Provider Protection Act*, legislation named to honor the life and legacy of the longtime ACEP member who died by suicide in April 2020.

ACEP and a coalition of nearly 60 health care organizations wrote:

Because of the Dr. Lorna Breen

Health Care Provider Protection Act, lives have been saved and livelihoods have been protected. Access to mental and behavioral health support and treatment has improved and more employers are able to engage with their workforce on these issues, provide greater resources, and accelerate promising solutions.

We must continue working to ensure an environment where each and every health care professional always has access to the necessary mental health care services they need and deserve, without fear of loss of licensure, loss of income, or other meaningful career setbacks associated with the stigma of getting the help they need.

To date, the law that bears Dr. Breen's name has enabled the distribution of more than \$100 million to 44 organizations to improve access to mental health services and resources for physicians and health care providers across the nation. Reauthorization ensures continued support for health care workers' wellbeing.

Efforts to support emergency physicians' most vulnerable patients are also a priority. ACEP is working in a bipartisan fashion to support the reauthorization of funds for the Emergency Medical Services for Children (EMSC) program.

EMSC is the only federal initiative focused on pediatric emergency services and ACEP wants to make sure that the program continues to support the use of child-appropriate medication, supplies and equipment, advances pediatric training and protocols, and expands opportunities for pediatric emergency care research.

ACEP members can identify opportunities to speak out to local officials and stay current

Advocate for Yourself and Your Patients at LAC24

Given all the challenges emergency physicians face, being able to share those experiences and how you are feeling is important. ACEP's Leadership & Advocacy Conference (LAC), April 14–16 in Washington, DC, will remind you that you're not alone in fighting to improve our professional lives and patient care.

Together at LAC, we'll:

- » Meet in person with your Members of Congress,
- » Tackle problems facing emergency medicine, such as the current boarding crisis, and
- » Develop tools to advocate at all levels.

Seasoned participants will build upon their already-valuable connections. First-timers will be trained on effective ways to educate your Members of Congress.

There's still time to register—celebrate emergency medicine's accomplishments and advocate in person to policymakers for a better environment for your specialty and your patients.

Learn more at acep.org/lac. ➕

on all of ACEP advocacy efforts through the ACEP Advocacy Action Center at acep.org/ActionCenter. ➕

MR. ARNOFF is a Senior Communications Manager at ACEP.

Creative CAREERS

Exploring unique career options for emergency physicians

RYAN STANTON, MD, FACEP

Ryan Stanton, MD, FACEP, vividly recalls watching his first car race as a child. The sounds, the speed, the energy ... there's nothing like it. Years later, emergency medicine allows him to combine his favorite sport with his life's work.

He got his start treating fans and race teams as a resident managing onsite care centers. Through his involvement with ACEP, he met race medicine luminary Dr. Bobby Lewis, medical director for Talladega SuperSpeedway. The connection opened the door for Dr. Stanton to work at the legendary venue and join the American Medical Response (AMR) Safety Team.

Fast forward and Dr. Stanton, based in Kentucky, now leads the NASCAR Safety Team as medical director of Global Medical Response Motorsports, which staffs NASCAR, USF, and the Superstar Racing Experience (SRX) series. "Emergency physicians are a perfect fit to manage the full range of care that drivers, crew members and fans may need leading up to and during a race," Dr. Stanton said. "Emergency care is the Swiss Army knife of medicine. Emergency physicians are accustomed to taking the unknown and making order from chaos."

Dr. Stanton, also the Vice President of Communications on the ACEP Board of Directors and host of the popular emergency medicine podcast "Frontline," lives out his



Dr. Stanton nurtures his well-being by using his emergency medicine skills on a race track in addition to his hospital role.

boyhood dreams more than 20 race weekends each year. But the job goes beyond the obvious care provided after a wreck. Drivers and crews spend months at a time on the road and they travel through rural areas,

where only critical access hospitals may be nearby.

Dr. Stanton has managed everything from muscle aches to injuries, norovirus outbreaks, and even crew member cardiac

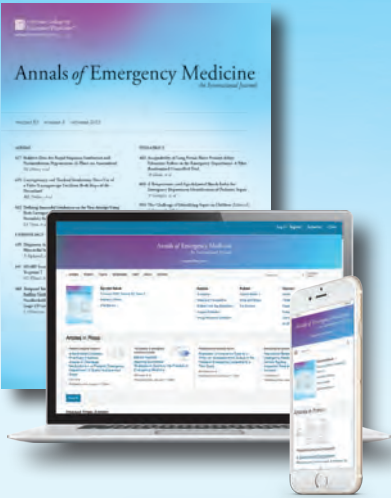
arrest. Temperatures inside the cars on the track can reach 120 degrees, so heat-related illness prevention and wellness checks are a regular part of the job. He's particularly proud of the COVID-19 plan that enabled NASCAR to be the first major sport to return after the 2020 shutdown. Another aspect of being part of the safety team is trackside training.

"We get rental cars and simulate crash scenarios," he said. "The pressure is real, and we have to be ready. On race days, everything we do is on camera. It's medicine under thousands of microscopes, and everyone seems willing to give a performance review." This passion project is much more than a side job. It helps him avoid burnout, too.

"Through medical school and residency, we are taught guard rails," said Dr. Stanton. "Told what to do, shown where to be. As my career progressed, I realized that I needed to find and fuel the piece of my career that I can build and grow, not in lieu of emergency medicine but as a complement—a practice-plus."

"I'm fortunate because this job is not about supplemental income, it's about self-preservation," he said. "I get to keep my skills fresh outside the ED in a challenging and fun way. That's how I make sure I don't run out of gas." 🚗

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By the Numbers

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OCE RESULTS

for emergency physicians who completed categorical emergency medicine residencies between **1973** and **2016**



FIRST ATTEMPT

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119 NEVER PASSED



372 RECEIVED SEVERE DISCIPLINARY ACTION

Reisdorff EJ, Johnston MM, Kraus CK, et al. Association between the American board of emergency medicine oral certifying examination and future state medical board disciplinary actions. *J Am Coll Emerg Physicians Open*. 2024;5(1):e13119.

A Conversation with ABEM President Dr. Ramon W. Johnson

The value of board certification

by CEDRIC DARK, MD, MPH, FACEP

I recently spoke with Ramon W. Johnson, MD, MBA, who is currently the president of the American Board of Emergency Medicine (ABEM). He joined me for our annual conversation between *ACEP Now* and ABEM to answer some questions from practicing emergency physicians. Our conversation has been edited for space and clarity.

Dr. Dark: Our profession is composed of over 44,000 ABEM certified emergency physicians,



about 96 percent of whom are EM residency trained. I've been listening to some of the more senior docs out there, and especially across specialties, many of whom are getting tired of certifying

boards and maintenance of certification. They are asking the question, "Why don't I just get board certified by an alternate board?" Or, in some circumstances saying, "Why don't I just go ahead and let my certification lapse?" What is ABEM's value proposition for physicians considering those options?

Dr. Johnson: I truly believe that there is not really an excellent alternative board out there. You may be aware that one of the alternative boards was recently discussed at the AMA and the AMA basically said that [other] certifying board didn't meet up to the expectations or the quality that they feel is necessary for a certifying board. I think it's important to understand that certifying boards have a responsibility to the public and it not only means that they must assure initial certification meets a certain standard and that standard needs to be an objective standard, but that continuing certification is also critical for that standard to be met. And very few alternate boards out there are doing anything like that now.

Dr. Dark: Let's talk a little bit about that initial certification. Conversations among younger physicians have noted that the oral examination is moving from a virtual platform back to an in-person platform. During the pandemic many things transition to virtual, including the oral boards. Why the change back? Why not stay virtual?

Dr. Johnson: It was never the intent that we would continue to have a virtual examination. I do think that if you look at the American Board of Medical Specialties, more than half of the boards do have a type of oral exam and the majority of those that went virtual because of the pandemic have now basically gone back to and in-person exam. When you look at the format of the virtual exam, there's clearly some limitations in what we can do with that type of format. And we know that we can create a better way of evaluating physicians by going back to in-person. There are some things



we just cannot examine adequately in the virtual setting. It's really, to the benefit, not only of the public but to the physicians, that we go back to an in-person exam.

Dr. Dark: Could you expand a little bit on that, things that you can't examine in a virtual setting? But also, why oral boards as opposed to just the written certifying exam. What are you actually looking for in order to board certify someone that you get from an in-person oral boards situation?

Dr. Johnson: One of the things we've noticed is that there are some additional competencies that are important to emergency medicine and our patients such as patient-centered communications, high stakes and difficult conversations, managing conflict, team management, how you prioritize patients that need to be seen. And probably one of the more important areas that we're really wanting to investigate more and evaluate better is in procedural skills. These are things we just can't do in the virtual format. But we now have ways that we can actually evaluate these things once we go back to in-person. As we go back to the new exam that we're creating, it will not be like the current oral exam. There will be some significant changes.

Dr. Dark: In our February issue, we talked about virtual reality in emergency training – people putting on their little goggles, even 3D printing things like laryngoscope blades, or other devices so that they can actually train in those tactile elements and the procedural elements that defines our specialty. Do you think the oral exam will get replaced by something like that? Do you see that happening in the future?

Dr. Johnson: It's interesting. We actually convened a summit looking at the future of the oral exam. And at that summit the idea of having some type of virtual reality did come up and there's certainly an interest in that among some of the stakeholders that participated at the summit. I have gone to some procedural assessment centers where they are actually using virtual reality in some of their simulation exercises and it's certainly something that is cutting edge. It is something I think is potentially a tremendous benefit as we look at ways that we can evaluate that competency in the future. I'm not sure the technology is quite there yet on the scale that we would like it to be, but it's something we want to continue to investigate and maybe someday in the future we will see that being utilized.

Dr. Dark: I was looking through the ABEM annual report for 2022/2023, and I saw where it said 700 clinically active physicians volunteered their services to ABEM in that year, usually serving as examiners. Being an academic myself, a lot of people are like, "Why all this free labor?" And I also saw ABEM, their revenue went up \$7 million. So why are we relying on volunteers as opposed to compensating people that are donating their time to the Board in order to certify the next generation of emergency physicians?

Dr. Johnson: We do have over 700 volunteers. It would be almost impossible to, if we were paying those physicians to do the work that they do provide for us as volunteers. One of the great honors in being even certified is serving as a volunteer. I started my career as a volunteer doing the oral board exam probably

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10 Pitfalls of Salicylate Poisoning

Be aware of these when assessing and treating patients with salicylate poisoning

by CARLEIGH F. HEBBARD, PHD, MD; MICHAEL E. MULLINS, MD, FACEP, FAAC

Salicylates, principally acetylsalicylic acid (ASA or aspirin), remain a common cause of poisoning morbidity and mortality. In 2021 America's Poison Centers recorded 18,309 cases mentioning ASA and it was among the top 25 causes of poisoning deaths.¹ Emergency physicians should be aware of 10 pitfalls in assessing and treating patients with salicylate poisoning.

Done With the Done Nomogram?

In the 1960s, A.K. Done published a nomogram to identify patients at high-risk for severe outcomes from salicylate poisoning. The graph was based on a patient's serum salicylate concentration.² Later research found that the nomogram performed poorly for this purpose.³ Advanced age, high respiratory rate, and elevated lactate concentration appear to be better in identifying severe salicylate poisoning.⁴

Critical action 1: Do not use the Done nomogram to assess salicylate toxicity.

Critical action 2: Assess severity of poisoning with the patient's age, the respiratory rate, and the lactate concentration in addition to the salicylate concentration.

Units Matter

Many medical laboratories measure serum salicylate using a colorimetric ferric nitrate or ferric chloride assay^{5,6} and can report this information in different units. While other countries use SI units (mmol/L), the two most common units in the U.S. are µg/mL (mg/L) and mg/dL. 1 mg/dL = 10 µg/mL = 10 mg/L = 0.072 mmol/L. A salicylate concentration of 100 µg/mL is at the lower end of the therapeutic range, but a salicylate concentration of 100 mg/dL is lethal without emergency dialysis.⁷ Henceforth, we express salicylate concentration in mg/dL.

Critical action: Know the units that your hospital laboratory uses.

Mind the Ions, Not the Gap

Salicylate is the "S" in MUDPILES, a mnemonic for causes of high anion gap metabolic acidosis. Salicylate ions sometimes

interfere with the ion-selective electrodes of chemistry analyzers and may overestimate chloride ion concentration. This can cause pseudohyperchloremia, which can suppress the anion gap.⁸⁻¹⁰ The anion gap may even be negative.¹¹⁻¹³

Critical action 1: Pay attention to a low bicarbonate level.

Critical action 2: Ignore a normal or low anion gap if the chloride is high.

Dextrose for Euglycemic Delirium

The brain needs glucose for energy. Salicylate uncouples oxidative phosphorylation—largely by drawing protons away from the mitochondrial intermembrane space. As this occurs, the brain consumes glucose more quickly while producing less adenosine triphosphate (ATP) and generating excess heat. This produces hypoglycorrhachia (low CSF glucose despite normal blood glucose), even when the blood glucose is normal.

Experiments in salicylic-acid-poisoned mice demonstrated that the mice had hypoglycorrhachia with relatively normal blood glucose.¹⁴ Case reports in salicylate poisoned children undergoing lumbar puncture due to clinical features resembling sepsis further illustrate hypoglycorrhachia.^{15,16} While children will often have hypoglycemia with severe salicylate poisoning, adults may maintain normal blood glucose due to glycogenolysis. Additional animal experiments showed rats given supplemental dextrose consistently survived an LD50 dose of salicylate.¹⁷

Glucose supplementation may quickly improve delirium and confusion in salicylate poisoned patients.¹⁸

Critical action: Give supplemental dextrose to any salicylate poisoned patient with altered mental status even if the blood glucose concentration is normal.

Hemodialysis

Salicylate has the four properties of highly dialyzable substances (low molecular weight, water soluble, small volume of distribution, and low protein binding in overdose).¹⁹ The Extracorporeal Treatments In Poisoning group recommends hemodialysis for patients with salicylate ≥ 100 mg/dL or ≥ 90 mg/dL in the presence of impaired kidney function (defined as Stage 3b or higher chronic kidney disease, serum creatinine ≥ 2 mg/dL (176 µmol/L) in most adults, or serum creatinine ≥ 1.5 mg/dL (132 µmol/L) in elderly patients).¹⁹ These thresholds, however, may be too high. Warrick et al. reviewed 29 years of salicylate deaths reported to America's Poison Centers and found that half of the fatal cases had ante-mortem concentrations below 100 mg/dL.⁷ A better threshold for considering dialysis would be salicylate more than 60 mg/dL.

Critical action: Consult your Nephrology colleagues early when the salicylate level approaches 60 mg/dL, or rises despite optimal treatment, or if the patient's condition worsens regardless of salicylate concentration.

Potassium

Salicylate poisoned patients typically have hypokalemia on initial presentation.²⁰⁻²² Sodium bicarbonate infusion and IV fluid resuscitation, needed to alkalinize the blood and urine, tend to exacerbate the already low serum potassium concentration. Supplemental potassium is necessary to replenish lost potassium and to alkalinize the urine successfully.

Critical action 1: Replete potassium generously with IV and oral potassium salts.

Critical action 2: Measure the urine pH periodically to confirm urinary alkalinization.

Critical action 3: Monitor salicylate concentration, basic metabolic panel, and venous blood gases as frequently as every 2 hours until the patient clearly improves.

Acetazolamide

Acidosis favors salicylate protonation to un-ionized salicylic acid, which more easily crosses the blood brain barrier than salicylate. Early work in children in the 1950s indicated that acetazolamide alkalinized the urine, increased urinary excretion of salicylate, and increased salicylate clearance from blood.^{23,24} In a report of three cases, one child died and had cerebral edema at autopsy.²³ Children in a larger cohort generally survived but had a mean serum salicylate of 38.7 mg/dL. Experimental animal evidence confirmed the increased urinary excretion of salicylate but also found that acetazolamide increased salicylate concentrations in both CSF and brain tissue and increased mortality in rats.^{25,26} In effect, blood salicylate concentration falls in part due to increased delivery of salicylate to the brain—the target organ of salicylate toxicity.

Critical action: Do not use acetazolamide in the treatment of salicylate poisoning.

Mechanical Ventilation

Patients with salicylate poisoning may develop metabolic acidosis with respiratory alkalosis. Although early respiratory alkalosis may be a direct effect of salicylate on the medullary neurons controlling respiration, later hyperventilation is a compensatory reaction to worsening acidosis.²⁷ When a salicylate poisoned patient's respiratory status leads you to consider intubation, give priority to emergency hemodialysis if available.¹⁹

In fact, such patients may not tolerate sedation and paralysis during rapid sequence induction and intubation because those actions can eliminate respiratory compensation and worsen acidosis. Case reports illustrate abrupt cardiac arrest in the minutes following intubation.¹⁶⁻¹⁸ Failure to hyperventilate after intubation likely contributes to this.

Critical action 1: When considering intubation, call for emergency hemodialysis, if available.

Critical action 2: If intubation is unavoidable, pre-treat with sodium bicarbonate and match the pre-intubation respiratory rate.

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Do I Stay or Do I Go?

Ethical issues in interhospital transfers of ED patients

by EILEEN F. BAKER, MD, PHD, FACEP; NICHOLAS H. KLUESNER, MD, FACEP; KENNETH MARSHALL, MD, MA, FACEP; LAURA E VEARRIER, MD, DBE, FACEP; KELLY BOOKMAN, MD, FACEP

Emergency departments (EDs) provide the essential service of evaluating patients with unscheduled, acute, undifferentiated, and decompensated conditions. ED crowding impairs this mission. Consequences of this are well documented and include delayed treatment, exposure to error, increased length of stay, and increased mortality.¹ Hospital boarding is the main driver of ED crowding, with patients nearly always awaiting transfer to inpatient beds and now more commonly, to other hospitals.

The Emergency Medical Treatment and Labor Act (EMTALA) mandates examination, treatment, and stabilization of anyone who comes to the ED. If the patient is found to have an emergency medical condition (EMC) requiring stabilization beyond the capability of the initial treating center, receiving hospitals must accept transfer, provided that they have the capacity and capability to treat the patient.² This article discusses the practical and ethical issues of interhospital transfer of these patients.

Case

An emergency physician working in the ED of a facility without the capability to perform dialysis diagnoses a dialysis-dependent patient with acute fluid overload, significant hyperkalemia, and uremia. The emergency physician calls the region's tertiary center, which is at 110 percent capacity, including 25 boarders and 30 patients waiting to be seen in their 50-bed ED.

When considering inter-hospital transfer, the patient's goals of care should be paramount in guiding the process. Said goals must be discussed with the patient and the receiving facility to ensure that the transfer is consistent with the patient's or surrogate decision maker's wishes, and so that the receiving facility can assess their capability to respect those expectations. Greater focus on this communication is needed, as data suggest poor agreement between sending facilities, patients, and receiving facilities as to why transfers were initiated.³

While it is ideal for patients to be transferred to a hospital where they are known, that is not always possible because of the accepting facility's capacity or capability. There are limited data on the average number of hospitals that sending facilities typically call before an acceptance, but if a patient has an EMC that requires higher-level specialty care unavailable at the initial facility, sending clinicians should pursue multiple destinations in expanding radii until an appropriate disposition can be established.⁴ Transfers of patients who are unstable or have the potential to decompensate should be prioritized. The sending facility's current ED and hospital census should only be an influencing factor if the receiving facility is not at capacity, has appropriate resources and has accepted the transfer.

The chief difficulty for the receiving center is determining whether it has the capacity to care for the potential transfer. Tertiary centers must continuously evaluate availability of space and resources to serve patients already under their direct care, as well as predicted needs for patients for scheduled and unscheduled care. Unfortunately, many tertiary hospitals routinely operate at censuses of greater than 100 percent capacity, due to factors including insufficient acute care bed capacity, a shortage of nursing care, and misaligned incentive structures for health care more generally.⁵ In such situations, tertiary centers must make the difficult decisions of when to accept transfer patients with critical needs. Important considerations in these decisions include granular detail about hospital resources and predicted scheduled care, the availability of nearby facilities with similar capability to provide care, and whether the patient already receives care at that center. Ultimately, receiving centers must accept transfers for critically needed care that is unavailable elsewhere within a reasonable radius from the transferring center, even when capacity is marginal. Accordingly, it is a moral imperative that tertiary centers focus efforts to preserve or create capacity, including working with regional peers to load-level such transfers to satisfy their shared mis-



Table 1: Systemic Recommendations to Optimize Interhospital Transfer Systems

Establish regional transfer centers
Load-level patients across the region
Arrange pre-set agreements for transfer patterns between sending hospitals and receiving hospitals that consider capacity, capability, distance, and time
Financially incentivize receiving centers with strategies to manage capacity <ul style="list-style-type: none">» Surgical and elective admission smoothing» Post-discharge clinics» Active inpatient capacity management
Define capacity thresholds at which elective admissions (i.e. elective surgeries) should be suspended
Encourage legislators to pass legislation to incentivize these changes

sion to provide both high quality, scheduled care of complex medical conditions, and acute care to their region.

It is becoming clear that EMTALA is not sufficient to address the transfer crisis. In many transfer situations, both whether the patient has a time-sensitive EMC and whether the receiving facility has "capacity" are ill-defined or uncertain. Moreover, receiving centers are financially incentivized to prioritize elective admissions and surgeries at the expense of protecting capacity for transfers requiring stabilization.⁵ This perverse incentive structure, along with the vagueness of "capacity," encourages facilities to evaluate transfers in a way that deviates from the intended purpose of EMTALA, which is to ensure that patients' acute needs are not in competition with the financial interests of institutions or clinicians. Currently, clarification of how "capacity" is defined and what specific circumstances constitute an "EMC" exist only through violation investigations and penalties. There is a critical need for proactive sys-

tem optimization to align incentives with patient needs and provide clarity around capacity thresholds (Table 1). Without legislative or regulatory guidance and funding intervention, the challenges of interhospital transfers will continue to cause acute patient care needs to be compromised by hospital operations incentives.

In the interim, the principles of triage in both usual and crisis standards of care should apply equally to the sending and receiving hospitals and their patients. These include assessing the acuity of each patient's needs equitably, with safeguards against discrimination or bias. To categorically prioritize those patients already at a receiving hospital over a sending hospital has inherent bias, may run afoul of appropriate medical acuity triage, and thus is inappropriate on the grounds of both medical and ethical triage principles. Patients at both the transferring and receiving facilities have the same moral standing as persons. The triage of multiple patients across facilities requires cooperation and trust between sending and accepting facilities that must reach a mutual understanding of where the patient requesting transfer falls in prioritization for treatment. It may, therefore, be appropriate for a patient to hold and wait, as happens in every ED waiting room, but it also may be appropriate for patients in the receiving hospital to wait longer or to be relocated for the inbound patient.

A subtle practice has been described on social media outlets in which a patient awaiting transfer "signs out AMA"—perhaps with an undocumented recommendation from the sending ED physician—and then immediately presents to the destination facility's ED. Practically, this circumvents the EMTALA and transfer obstacle, overcomes the receiving facility's triage prioritization, and facilitates the patient's arrival at their destination sooner. But, this is not an ethically or medically appropriate practice for one of two reasons: either (1) the patient is of sufficiently high acuity that they should have been prioritized over the receiving hospital's patients and their transfer expedited (confirming inappropriate prioritization on the receiving hospital's part), or (2) the patient is of appropriately lower acuity compared to the queue of patients at the receiving hospital, and the attempt to circumvent this triage harms the receiving facility's patients.

Case Resolution

The emergency physician arranges for the patient to receive temporizing care in the ED at the sending facility by the on-

call hospitalist for four hours, while a regional transfer center (unaffiliated with any specific hospital system) locates a facility to take the patient in an inpatient stepdown/ICU-level bed where dialysis can be performed.

Conclusion/Recommendation

ED crowding is a national patient safety issue driven by hospitals routinely operating over capacity. Hospitals have no financial incentive to reduce elective admissions to increase inpatient or ED capacity. Yet their crowded EDs must fulfill ethical and legal obligations to provide acute, episodic, unscheduled care to all who enter their doors. Emergency physicians and related advocacy organizations must call for legislation to better define capacity, stability, and what constitutes an EMC. This advocacy should include efforts to establish processes for centralized transfer centers not beholden to any specific organization but to our communities and the care they need. These transfer centers could be authorized to make standardized decisions about when and where patients should go, based on knowledge of regional capacity and where resources are housed. +



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PITFALLS | CONTINUED FROM PAGE 7

Persistence of Aspirin in the Upper GI Tract

Aspirin tablets can persist in the stomach and may coalesce to form a bezoar.^{21,31-33} This results in delayed or ongoing absorption of aspirin. The earliest clue may be a rising or persistently elevated salicylate level despite optimal treatment with IV fluids, sodium bicarbonate, and potassium replacement.

Critical action 1: Monitor salicylate, basic metabolic panel, and venous blood gases as frequently as every 2 hours until the patient clearly improves.

Critical action 2: Give repeated doses of activated charcoal unless endoscopy is available to remove retained pills or bezoars from stomach.

Recognizing Chronic Salicylate Poisoning

Some older adults may use over-the-counter ASA to self-treat arthritis or other persistent pain. Chronic salicylate toxicity can mimic sepsis with insidious onset of hyperthermia, confusion, tachycardia, tachypnea, metabolic acidosis, and acute kidney injury.³⁴⁻³⁷ Recognizing this possibility early can prevent morbidity and mortality, especially in older patients.³⁸

Critical action 1: Include salicylism in your differential diagnosis of an older adult who is unwell without apparent cause.

Critical action 2: Inquire about the patient's use of over-the-counter medications. +



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ELECTRICAL INJURIES

It's important to understand the nuances of electrical injuries

by ALEX KOO, MD, FACEP; DANIEL MCCOLLUM, MD, FACEP

A 44 year-old male with unknown past medical history came by emergency medical services (EMS) to the emergency department (ED) for an electrical injury and fall from a high voltage electrical pole. Per EMS, the patient was found at the bottom of a high voltage line with diffuse burns and amputation of his left forearm. The patient was Glasgow Coma Scale (GCS) 15 on scene and complaining of back pain. He was intubated by EMS due to the extent of his injuries. His vitals were stable and endotracheal tube confirmed with end capnography and chest radiography.

The patient had a small left pneumothorax. A left thoracostomy, foley, nasogastric tube, and central venous catheter were placed prior to computed tomography (CT) imaging. The patient's initial troponin was 17.78 ng/mL, creatine kinase greater than 60,000 U/L, glucose of 53 mmol/L, creatinine of 1.88 mg/dL and potassium of 5.7 mEq/L. He had estimated 45 percent total body surface area burns and received lactated Ringer's infusion per Burns Rule of TENS (estimating to the nearest 10 percent TBSA and multiplying by 10 for the initial mL/hr; 40-80 kg adults) cefazolin, D50, warming, calcium gluconate, and tetanus.

Electrical injuries—excluding lightning injuries—account for roughly 10,000 nonfatal shock incidents a year and 500 deaths a year. While uncommon, electrical injuries disproportionately account for five percent of burn admissions in the U.S. and five percent workplace-related deaths.^{1,2} It's important to understand the nuances of electrical injuries in order to identify hidden injuries and appropriately treat them.

Quick Review of the Physics

A brief review of the physics of electricity can help with clinical understanding. Electricity, in the form of electrons, travel down a gradient from high to low potential. The difference of the potential is the voltage (V). The “amount” of electrons in a timeframe down this gradient is the current. Resistance is the impedance of these electrons by the material and dissipates energy as heat. Our bodies have varying amounts of resistance—the higher the fluid and electrolyte content, the less resistance there is. Our skin is the barrier to prevent electricity from traveling into deeper tissues but varies in its resistance. Wet, thin skin of a child who just got out of a pool will allow electricity to pass into deeper tissues, which can lead to unseen internal burns. Thick, dry, and calloused skin of a construction worker can have as much as 100 times more resistance than the previous example.⁴ This may lead to more heat dissipated at the skin with impressive burns to skin, but less transmission of electricity to deeper tissues. Current can be alternating current (AC) or direct current (DC) with AC typically more dangerous as it is more likely to cause tetanic contractions and increase contact time with the electrical source. “High voltage” is defined by texts as 600 V and 1,000 V.^{2,3,5} Except for laundry or electrical car outlets (240 V AC), all U.S. household outlets are rated at 120 V AC. This means most household injuries are low voltage, with high voltage injuries happening in industrial settings or associated with power lines.

The Unstable, Electrical Injury Patient

In evaluating a patient with electrical injuries, an approach to the stability of the patient should always take precedence. An unstable patient who is altered or with tenuous vital signs should consider trauma and cardiac causes. 10 percent of high-voltage electrical injuries will have an associated, significant traumatic injury.^{4,5} High voltage injuries can throw a victim from the electrical source, lead to falls, and cause forceful tet-



Figure 1 (LEFT): Electrical burns of the patient's bilateral feet.

Figure 2 (BELOW LEFT): Traumatic amputation and electrical burn of the patient's left arm.

Figure 3 (BELOW RIGHT): Electrical burns of the patient's leg with proximal tibia intraosseous line.



PHOTOS: ALEX KOO AND ELIE RAMLY

any with spinal hyperextension injuries or joint dislocations. Thus, unstable patients should be stabilized based on a physician's trauma expertise; whether through Advanced Trauma Life Support, Trauma Combat Casualty Care, or one's own trauma assessment. In addition, electrical injuries can affect cardiac conduction, leading to dysrhythmias with anything from atrial fibrillation to ventricular fibrillation.^{1,4,5} Thus, an electrocardiogram (ECG) and cardiac monitoring should be performed for unstable, electrical injury patients.

Three Injury Patterns: Trauma, Burns, and Electroporation Injuries

Either after stabilization or in a stable electrical injury patient, it may be helpful to categorize and assess for three different injury patterns of trauma, burns, and electroporation injuries.

Burns in electrical injuries can vary from superficial to full thickness based on skin resistance. For high voltage electrical injuries, a high clinical suspicion and thorough evaluation should be performed for any internal burns, even without significant skin findings. Bone has high resistance, leading to periosteal and surrounding myonecrosis. Cardiac muscle can be burned, leading to significant rises in troponin. However, this is not likely due to occlusive myocardial infarction requiring catheterization, but rather direct cardiac muscle damage or vasospasm.^{4,6} Internal viscera, such as bowel, can be burned, but is less likely given its high relative electrolyte and fluid content. Lastly, vessels can be damaged by internal burns, which may

lead to poor perfusion and delayed complications as thrombosis or third spacing. Treatment for burns should focus on fluid resuscitation as appropriate based on your institution's burn protocol per Brooke, Parkland, Rule of 10s etc. In addition, subacute injuries as compartment syndrome and rhabdomyolysis should be considered with creatine kinase, urinalysis, electrolyte panel, and monitoring urine output.

Electroporation injuries are caused by inappropriate membrane depolarization to electrically sensitive tissues such as the cardiac electrical conduction system or the nervous system. Dysrhythmias can present as syncope and/or chest pain, and albeit rare, have presented up to 12 hours after injury in low voltage injuries.⁷ Thus, an ECG is recommended for all electrical injuries. Syncope can also occur due to disruption of central nervous tissue. Other electrically sensitive nervous tissue can be damaged, presenting with paresthesias, weakness, and cognitive dysfunction or mood alterations. These can be delayed, up to weeks later, so it's important to educate patients on the importance of follow-up with burn care well-versed with electrical injuries or neurology if they have or develop these symptoms.^{8,9}

Disposition

Disposition depends on the patient's clinical status and voltage exposure. All high voltage injuries should be transferred and treated at a regional burn center.¹⁰ Cardiac monitoring and observation of at least eight hours should be considered for



Figure 4: Computed tomography of abdomen and pelvis with edematous bowel.

a patient with an electrical injury and isolated syncope.⁵ Otherwise, if a patient’s ECG is normal, a low voltage exposure, and the clinical examination is without any significant trauma, burns, or electroporation injuries, the patient may be safely discharged with follow-up as warranted.

In our case, the patient had a CT of the head, cervical spine, and chest, abdomen, and pelvis with intravenous contrast demonstrated a C2, C7 compression fracture with significant bowel edema (Figure 4), and was taken to the operating room for left arm disarticulation, left below knee amputation and right above knee amputation. His ECG was unremarkable. In the operating room, there was minimal urinary output and the bladder pressures were 35 mmHg under sedation and analgesia. Subsequently, a decompressive laparotomy was performed for abdominal compartment syndrome. He underwent continuous renal replacement therapy (CRRT) with complications of acute respiratory distress syndrome and need for left scapular disarticulation, and transitioned to comfort care by his next of kin on hospital day five. +



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An artistic image of Dr. Durrani.

Young Member Passionate About Breaking Down Barriers to Care

by JORDAN GRANTHAM

Owais Durrani, DO, a first-generation American whose parents immigrated from Pakistan, has experienced barriers to health care firsthand. His family didn’t have health insurance when he was growing up, and he remembers comparing himself—who had to prove he was “really sick” to see a physician—to his friends who readily visited the doctor for any ailments. Even at his young age, he recognized the inequity and wanted to understand why it was that way. That’s when his interest in health policy and access to care was born.

After double majoring in biology and political science, Dr. Durrani earned an internship at the White House and got to

THE EQUALIZERS

OWAIS DURRANI, DO

Celebrating equity champions in emergency care

briefly work on some of the expansion acts of the *Affordable Care Act*. Inspired, he carried that problem-solver energy into medical school. His family had insurance for just two years when his father had a heart attack and needed open heart surgery. Dr. Durrani knew that if it had happened to his father just a few years earlier, it could have been catastrophic. Seeing how one law impacted his own family in such a positive way drove his passion for improving access to care. Above all, he wants to create positive change.

Beyond policy, which can take a long time to come to fruition, Dr. Durrani looks for other ways to help his patients. For example, he knows follow-up care is critical for many ED patients, but it can be challenging to find transportation to in-person care. Telehealth follow-ups are a great option, but many patients lack reliable internet. Now he works diligently to make sure his pa-

tients know about programs that subsidize internet costs and reduce that barrier to care. Dr. Durrani recently was on a committee at his hospital that discussed how to connect more patients to care, and these are the incremental changes that keep him motivated as the policy wheel turns very, very slowly.

Taking the time to connect those dots for his patients, going that extra mile, energizes him for the emotional toll of working the emergency department. He sees harsh realities every day on the job, and pushing for solutions gives Dr. Durrani an “extra burst of energy to, you know, really focus on this aspect of how medicine interacts with our society and practice.”

As a young physician, Dr. Durrani believes he is proactively staving off future burnout by being an advocate both in his hospital and on the federal level through his ACEP involvement. Every time he links underserved patients to better care, he remembers what he loves about his work. Certain moments, like when faces light up at the refugee clinic as they realize he speaks Pashto, also fuel his desire to be a voice for others.

“The thing that I have learned throughout my poli-sci degree and the health policy stuff I have done in D.C. is that if you’re not at the table talking about something, then those other people are talking about cutting you out of the equation or giving you less of a say,” Dr. Durrani said. He believes emergency physicians are uniquely qualified to speak to and help with health equity issues, so he’s going to keep using his voice for good. +

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patients with time-dependent conditions.⁹⁻¹² PIT is no longer a fringe idea. Many consider it a best practice, and the majority of moderate- to high-volume EDs in the U.S. employ a variation of this process.¹

When boarding is prevalent in a department, the physicians caring for those boarders will likely have the capacity to see new patients. The physicians have capacity (meaning time, medical knowledge and energy) but no place in which to see new patients. By creating a properly resourced intake area, arriving patients can continue to be seen and managed by physicians.

A PIT area (or physician intake area) typically needs an exam space with an exam table or stretcher, a computer for documentation and order placement, a workspace for an ED Technician to take vital signs and draw blood, supplies for this front-end work (i.e., phlebotomy and urine collection) and a waiting area for vertical patients to wait for test results. Some PIT models have a small medication-dispensary system for limited medication administration.

Patients identified as needing to be horizontal are brought back to the main department as quickly as possible. However, the majority of patients arrive ambulatory and can in fact remain vertical. The physician can begin the patient encounter and diagnostics from this intake area, even if the patient then backflows into the waiting room. Patients can be assigned beds later and their care assumed by a physician in the back. Some patients may have a discharge from the front end. No matter how you choose to design your patient flow, patient care must have clear ownership. The best of these PIT models will identify an internal waiting room (which may be chairs along a hallway) for patients who have seen the PIT doctor. When that is not possible, part of the ED lobby can be cordoned off as a “Results Waiting” area using signage and perhaps theater rope.

This ad hoc PIT process is not optimal. We should all agree that we prefer to avoid delivering care in the waiting room. That said, this is becoming a survival tactic for many EDs. It allows patients to receive care when the department’s treatment spaces are all occupied by boarders. This process can be “turned on” in EDs of any size, whenever capacity does not match demand in terms of space. If there are physicians able and willing to see new patients, the model will be successful and shorten the length of stay for patients overall. For EDs with an existing PIT process in place, it can be expanded by adding an extra physician or opening the model for more hours in the day when boarding is extreme.

The ED at Sentara Leigh Hospital in Norfolk, Virginia (70,000 visits per year) turns a variation of the PIT model on during periods of high census. Teams including a physician will rotate to the PIT area and “swarm” patients (typically three or four patients in a row). The team begins the patient encounter, ordering tests and treatments. As beds become available in the back, patients are brought to rooms in their original team’s zone. They arrive with testing already begun. In this way the Sentara Leigh ED guarantees that every patient in the waiting room has an assigned physician and a care team. This is essential in the present-day ED with a high-risk boarding burden: Physicians and staff must own and manage the waiting room. The front end is ours. At Sentara they discovered that in this model, physicians are motivated to make disposition decisions in a timely manner to make room for their other newly arriving patients still waiting in the waiting room. With the implementation of this model, Sentara Leigh reduced their door-to-physician times and their walkaways by more than 50 percent.¹³

It is important to note that sending a physician alone to the waiting room without proper resources is a failed tactic.

QUICK FIXES TO MITIGATE AGAINST BOARDING

A physician triage (PIT) intake area and process

An admission holding unit

A full capacity protocol



Example of a PIT, or physician intake area, space at a hospital.

The physician in the waiting room has no capability to begin the workup and treatments without the right resources. By creating a PIT that is properly staffed and resourced, the diagnostic and treatment phase of the ED encounter can actually begin. Many patients have results posted by the time they are taken to their rooms, making a final disposition quick and efficient.

A second quick fix in the front end that is worth considering in 2024 is the Behavioral Health Team (BHT) program implemented at Lancaster General Hospital (LGH).¹⁴ This innovative process helps a department to address the surge of behavioral health patients now presenting in a post-pandemic tidal wave to EDs across the country. With an extraordinarily large waiting room as part of their footprint, the LGH ED was able to create a space for the BHT to evaluate mental-health patients in the front end. Many patients did not need to go back to the main emergency department or even occupy a room. With the exception of regional psychiatric receiving hospital EDs, the percent of all patients presenting with acute psychosis, mood disorders, drug abuse and detox, and suicidality is approaching 13 percent, but only a small and variable fraction of these patients need inpatient care.^{15,16} The BHT had a small unit established in the waiting room using room using dividers, a desk and lounge chairs. From here the majority of patients were screened, treated and discharged with outpatient referrals. If the patient needed a medical issue addressed, the PIT physician (who was working in an adjacent area) was able to easily drop in to assist the BHT to write a few orders or do a quick medical clearance. These are two of the few quick fixes open to an ED, which use ED resources to continue patient flow when the department is struggling with crushing levels of boarding.

Two additional quick-fix tactics involving the back end are not really new:

- the Admission Holding Unit and
- the Full Capacity Protocol

The former involves dedicating a space (within, adjacent to or outside of the main ED) where admitted patients are localized and managed with special policies and procedures.¹⁷ Increasingly, these admitted patients are being managed by inpatient teams. The latter quick-fix strategy was introduced some 20 years ago by Peter Viccellio, MD, FACEP, at the Renaissance School of Medicine at Stony Brook University in Stony Brook, New York. It quite simply involves moving patients from the ED hallways to upstairs inpatient hallways. Using very clear

inclusion and exclusion criteria, patients being admitted to floors (not intensive care units) are systematically placed in the hallways adjacent to their designated rooms. The inpatient teams assume care for them while they wait for their assigned beds to be vacated and cleaned. Miraculously, these tasks are seen to occur more expeditiously when the inpatient team is now face-to-face with their newly admitted patient. Its success has been repeated wherever it has been introduced.¹⁸

A Primer on Boarding for the ED Physician

While the problem of boarding plays out in the ED, the real solutions to boarding are on the inpatient side and they are not simple. They often require culture change along with sweeping operational changes. The emergency physician ought to have some understanding of the basics of hospital boarding and its hospital-side solutions. The problem of boarding is due to a demand-capacity mismatch.¹⁹ This is most notably related to high census combined with inpatient discharge delays.^{20,21} Thirty years ago hospitals often operated at less than 90 percent capacity. In this new era of capacity constraint many large hospitals operate at 110 percent capacity

or higher, with the continual boarding of inpatients in the ED and post-op spaces. For every patient being discharged there is already a patient waiting to take their place. If the discharge is delayed that patient remains in limbo, ergo boarding in the ED.

By day of the week and hour of the day, most hospitals are in a state of perpetual disequilibrium. Admissions outpace discharges; and then on weekends there is a catch-up phenomenon.

Demand is so tight relative to capacity that any delay in discharging a patient translates into boarding. Innovative hospitals have been addressing disequilibrium by focusing on the capacity side of the equation, creating or optimizing capacity one initiative at a time.

Most tactics that provide remedies to alleviate boarding do so by creating or recovering inpatient capacity. They do this by either improving throughput or addressing discharge delays.²²⁻³⁰ Much work has been done by hospitalists, who are now the largest admitting service at most hospitals (and the majority of patients boarding in the ED are general-medicine admissions). The emergency physician should have a passing knowledge about the remedies and inpatient best practices for throughput and discharge.

It is important to note that sending a physician alone to the waiting room without proper resources is a failed tactic.

Unfortunately, pent-up demand for health care services deferred during COVID-19 has wiped out the capacity gains that hospitals had been making. A profound capacity crisis is afoot, and most EDs are experiencing boarding levels never seen before. Stakeholders are exploring any tactics to further address or mitigate boarding. Attention is shifting to the demand side of the equation, with a focus on “avoidable admissions.”^{31,32} Avoidable admissions for a group of diagnoses known as ambulatory care sensitive conditions (ACSC) are thought to be preventable. With the provision of timely and effective ambulatory-care services, many conditions can be treated as outpatient illnesses and the hospitalization avoided.

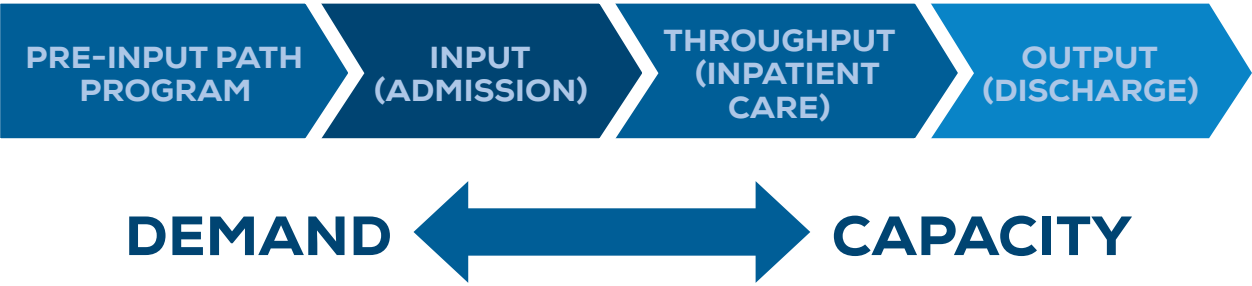
One roadblock to this work is ideologic and comes from our collective understanding of the specialty of emergency medicine. Emergency physicians have always prided themselves on providing whatever the patient needs in the moment, treating both emergencies and urgent unscheduled conditions. Now in this era of capacity crisis the specialty has met a new reality. Health care does not have infinite capacity. Health care delivery is a zero-sum game; if patient A receives a service it will not be available to patient B simultaneously. While health care delivery may not need rationing, it certainly needs sequencing and scheduling. This has led front-line emergency physicians to return to the demand side of the throughput equation.

This “avoidable admissions” movement to reduce demand for inpatient hospital capacity from the ED is sometimes dubbed the practical alternatives to hospitalization (PATH) movement.³³⁻³⁵ Studies vary in how much this demand can be reduced, but this new and growing body of literature suggests that tactics can reduce avoidable admissions by 10 to 40 percent.

The avoidable admissions tactics can include a number of processes, initiatives and programs. Avoidable admissions can be addressed using an array of interconnected strategies:

1. Rapid follow-up appointments: A number of studies have shown that when there are timely follow-up appointments for ED patients, then avoidable admissions can be managed effectively.³⁶⁻³⁸ Even next-day follow-up phone calls to check on discharged ED patients can help reduce admissions.³⁹
2. Deferred consultations or subspecialty appointments: One study from Norway recorded that 14 percent of ED admissions were due to a need for subspecialty consultations. The same study estimated that 21 percent of these subspecialty admissions could have been avoided.⁴⁰ This is leading to efforts at improving care transitions through patient navigation and efficient centralized scheduling to avoid those admissions of stable ambulatory patients in need of subspecialty care.
3. ED observation unit (EDOU) or clinical decision unit: In another prospective survey of emergency physicians, reported in the American Journal of Emergency Medicine by Watase in 2020, front-line physicians estimated that one in seven unscheduled admissions could be avoided through an ED OU, to allow more time to address diagnostic uncer-

The Throughput Equation



- tainty.⁴¹ A review in Health Services and Delivery Research identified Clinical Decision Units (CDUs) as having a similar effect.⁴²
4. Hospital at home programs: Certainly a Blue Ocean Strategy is the new field of inpatient-level care coordinated and delivered at home, referred to as the “hospital at home” movement.⁴³⁻⁴⁶ Patients are very satisfied and prefer to be treated in their homes whenever possible. This is different from hospice care in that the expectation is for the patient to receive treatment for treatable conditions. At the University of Texas San Antonio, patients that may be eligible are referred in real time to the hospital at home team who can screen and enroll patients into this program. It is one of the fastest growing programs in the Texas University Health System.⁴⁷
 5. Disease-specific pathways: When considering outpatient management of conditions that have been historically managed as inpatient conditions, there is an ongoing debate as to whether or not a disease-specific pathway approach is better than a patient-population-specific approach. Examples of conditions that are amenable to clinical pathways around the country include those for congestive heart failure, cellulitis, pneumonia, pyelonephritis, and chest pain.^{48,49} An example of a patient-population approach is the EDIFY work for frail adults.⁵⁰
 6. ED-based discharge teams: The last initiative that is getting traction in this avoidable admissions arena is one where a physician, nurse, care coordinator, or any combination of the three is placed in the ED to identify patients that might have their care plan adapted to an outpatient-care process model.⁵¹⁻⁵³
 7. Direct nursing home or rehab placement from the ED: Lastly, EDs are experimenting with placement agreements which allow the ED to place appropriate patients in nursing homes or rehab units without a hospitalization first. The Watase study found that this would reduce unavoidable admissions by 20 percent.⁴² A new study in a Spanish gerontology journal reported success with direct admission to a nursing home from the ED.⁵⁴ This may be a new trend on the horizon.
- When should you consider implementing the initiatives and tactics of a PATH program? If your hospital is constantly over capacity, with high numbers of hospital boarders every day, these initiatives are worth considering. Emergency physicians

Avoidable Admissions

PATH PROGRAM TACTICS
Rapid Follow-Up Appointments
Deferred Consult/Specialty Clinic Appointments
ED Observation Unit/Clinical Decision Unit
Hospital at Home Programs
Avoidable Admission Disease Specific Pathways
Disease Specific Pathways
ED-based Discharge Team
Direct NH or Rehab Admissions

want to deliver high-quality, safe, and cost-effective care. That is not what we are delivering when admitted patients have long dwell times and there is no room to care for newly arriving patients. In fact, as a large body of literature shows, ED care suffers during boarding.

As emergency physicians we have been struggling with a nationwide boarding burden for over 20 years. It is not a problem of our making and we are not the keys to solving it. But we are the innovators and leaders in our hospitals. It is important that we be conversant in all sides of the boarding issue. We are right to demand that our respective hospital leaders address this problem using effective inpatient strategies for creating capacity. Now you have the playbook. In these extreme circumstances we can and should partner with hospital leaders to identify and manage avoidable admissions. It is time to turn our attention to the demand side of the throughput equation! ➕



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Creating Inpatient Capacity

THROUGHPUT INITIATIVES	OUTPUT INITIATIVES
Case Management Extenders	Discharge Order by 10 am and Discharge Order by Noon Initiatives
Complex Care Case Management Team	DME Closet
Geographic Localization of Patients	Pharmacy Meds to Beds Program
Multi-disciplinary Rounding	Transportation Contracts
Discharge Planning on Admission	Discharge Lounge
Expedited Consults	Day Ahead Discharge Rounding
Expedited Imaging	Discharge Expeditors
Patient Milestones Tracking	Failed Discharges Monitoring
Throughput Goals and Data Feedback	Discharge Goals and Data Feedback

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FIGURE 1: Radiograph of foot without identifiable foreign body.



FIGURE 2: X-ray of foot revealing faint linear foreign body.

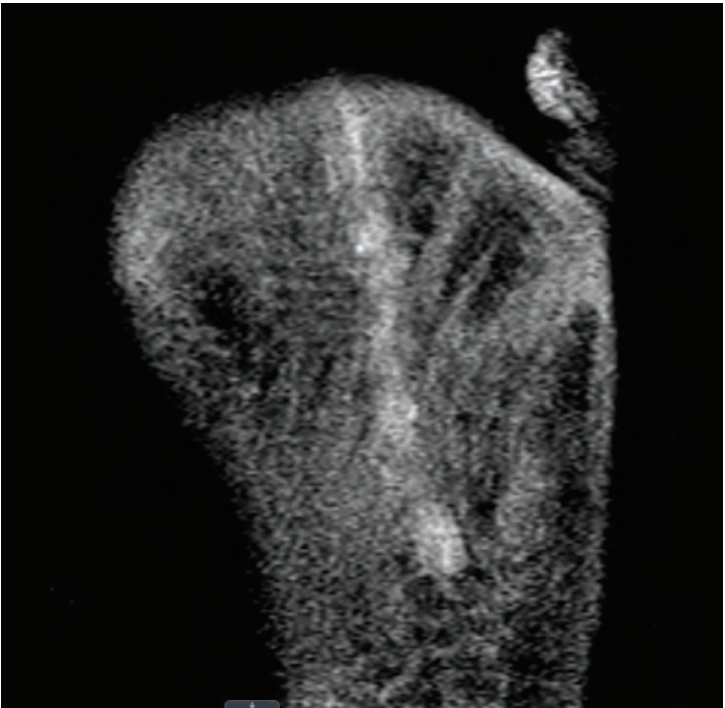


FIGURE 3: MRI of foot without identifiable foreign body secondary to motion artifact.

TRANSILLUMINATION | CONTINUED FROM PAGE 1

splinters were removed from the foot and a small amount of purulence was noted. She was discharged home with expectant management. After continuing to have poor pain control, the mother brought her to the ED. She was vitally stable and afebrile, but unable to be consoled. On physical exam, she cried continuously and had significant tenderness to the plantar aspect at the distal second and third metatarsals. Purulence was able to be expressed from a small opening as well.

Diagnosis: Wooden Splinter

The X-ray of the foot was read as “Salter-Harris III fracture involving the proximal 1st metatarsal. There was no evidence of foreign body” (Figure 1). In discussion with orthopedics, this was thought to be a variant and not the cause of her pain. With further discussion with the mother, she mentioned they had transilluminated the foot at home and thought they saw “something.” Indeed, with transillumination of the foot in the exam room with a light from a cell phone showed a faint linear foreign body was appreciated at approximately four cm in length (Figure 2). Podiatry was consulted and they recommended an MRI and antibiotics, plan for operative removal given the purulence and her level of discomfort. MRI did not appreciate a foreign body due to what was initially thought to be motion artifact (Figure 3). She was still brought to the operating room and an eight cm wooden splinter was removed from her foot. She was discharged from the hospital the following day on levaquin and cephalexin. Her wound culture ultimately grew *Clostridium tertium*.

Discussion

Foreign body-related injuries are often missed on first visits and are common causes of malpractice claims. There were more than eight million ED visits for open wounds.³ One study evaluating foreign bodies in cadaver feet evaluated sensitivity and specificity for detection via radiographs, CT, and MRI. Overall detection for radiography was 29 percent (sensitivity) and 100 percent (specificity), 63 percent and 98 percent for CT, and 58 percent and 100 percent for MRI.⁴ Interestingly, CT was superior to MRI in identifying water-rich fresh wood. Ultrasound has become a highly reliable modality for detecting non-radiopaque foreign bodies. Sensitivity and specificity were 63 percent and 95 percent respectively in a study from 2013.⁴ Although, this is often operator dependent and can be difficult given echo patterns which vary with size, nature, and retention time.² In areas such as hands and feet, transillumination can also help identify the presence of a retained foreign body, as in this case.

Teaching Points

- Transillumination can be used in soft tissue areas to further evaluate foreign bodies. Many foreign bodies are not radiopaque for X-ray imaging, and this was nearly missed on MRI due to the small nature.
- Early closure is a pitfall that was thankfully avoided by listening to the parents.
- Ultrasound could also be an imaging modality, if the patient would tolerate this. +



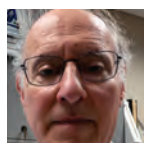
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Tracheo-Innominate Fistula

Hemorrhagic complication of intubation and tracheostomy

by JONATHAN GLAUSER, MD, FACEP, MBA; DAVID EFFRON, MD, FACEP

A 24-year-old male with history of quadriplegia and traumatic brain injury presents to the emergency department with hemorrhage in his oral cavity and blood from his tracheostomy tube. He has had a tracheostomy for approximately 15 months since his injury. Blood is spurting from the orifice of the tube.

Tracheo-innominate fistula (TIF) is an unusual and frequently lethal complication of such definitive airway placement. First reported in 1879 in the case of diphtheria in a pediatric patient, TIF is fatal without surgical treatment due to hemorrhage and failure of airway security. It occurs after an estimated 0.1-1 percent of tracheostomies.^{1,2,3} Unlike most lethal entities, TIF does not predominantly affect the elderly. In one case series of seven patients, the average patient age was 15.7 years, all of whom had prior severe neurological deficits such as cerebral palsy, agenesis of the corpus callosum, or muscular dystrophy.⁴

Sentinel bleeding may occur in more than 50 percent of patients, with peak incidence of three days to six weeks following tracheostomy. It is reported that massive hemorrhage occurring three days to six weeks after tracheostomy is TIF until proven otherwise. Vascular erosion from a tracheostomy tube requires at least 48 hours to develop.⁵

Diagnosis and Pertinent Anatomy

The innominate artery is the first branch off of the aortic arch. It divides into the right common carotid artery and the right subclavian artery behind the right sternoclavicular joint. The innominate artery runs anterior to the trachea, at approximately the 6th-10th rings, and usually traverses the trachea at the 9th ring.⁶ A high-lying innominate artery may therefore be a risk factor in formation of TIF. This is also a consideration in controlling bleeding around a tracheostomy site with direct compression.

The condition develops as a connection between the posterior wall of the brachiocephalic trunk and the anterior aspect of the adjacent trachea. On angiography of the brachiocephalic trunk, there may be a small dot of contrast medium accumulation, or no detectable leakage. Bronchoscopy may show no sign of TIF.^{7,8} The significance of this is clear: bronchoscopy or angiography may not suffice to make the diagnosis in the emergency setting.

Diagnosis of TIF may have to be made on clinical grounds—sudden arterial bleeding from a tracheotomy or ET tube—perhaps with radiographic finding of innominate artery compression by the trachea and/or computed tomography (CT) angiography of the neck and chest. CTA may show no active bleeding source, but may demonstrate that the tip of the tracheal tube is flush with the innominate artery.⁹ There may be no time in which to perform a CT scan, and as noted above, CTA and laryngoscopy may show no remarkable findings of fistula.¹⁰

Clinical Presentation

The patient may present with small amounts of blood from the trachea/ET tube (sentinel bleed), or with frank hemoptysis. There may be pulsatile movements of a tracheal cannula.

TIF classically develops from three days to six weeks after tracheostomy or insertion of a cuffed endotracheal tube. The clinical manifestation may be either sudden massive tracheal hemorrhage at the tracheostomy site and/or from the endotracheal tube, or a warning/sentinel bleed. Approximately 35-50 percent of patients develop a sentinel bleed prior to life-threatening hemorrhage.¹¹



Tracheo-Innominate Fistula, a lethal complication of intubation/tracheostomy.

Risk Factors for Development of TIF

High cuff pressures have been implicated, and it is recommended that pressure in a tracheostomy cuff be maintained at less than 20 mm Hg.¹² Attention to cuff pressure and tracheal injury appears to stem from the 1970s.¹³

Emergency Management

The immediate management includes overinflation of the cuff of the tracheostomy or endotracheal tube, and aspiration of blood to clear the airway. The inflation of the tube is done blindly, without any set volume, until the bleeding is stopped. In patients with a tracheostomy in place, use of a tracheostomy cannula with a wired silastic tube has been described to adjust the position of the cuff and using cuff over-inflation to provide hemostasis.⁴

Maximal inflation of the ETT balloon should be below the level of the tracheostomy. The cuffed tube may be inserted deep into the opening and the cuff expanded, followed by trying the maneuver moving the tube up and re-inflating if the bleeding is not controlled initially. An option if overinflating the tracheostomy cuff does not stop the bleeding is to insert a cuffed oral tracheal tube transorally, then advancing it so that the balloon lies distal to the tracheostomy stoma but above the carina, and withdrawing the tracheostomy tube in order to facilitate simultaneous transoral tracheal intubation. The balloon cuff should be expanded excessively from the lower portion of the bleeding area to prevent accumulation of blood in the lungs.¹⁰

If bleeding continues, pressure should be applied to the stoma site. These measures have been reported to control bleeding 80 percent of the time.¹⁶ If the patient is hemodynamically stable to undergo bronchoscopy, the major threat to the patient becomes respiratory compromise, so it is recommended to leave the tracheostomy tube in place.⁵

Manual compression of the innominate artery at the level of the tracheal stoma/manubrium is the Utley maneuver, which applies only for patients who have a tracheal/tracheostomy stoma. Digital compression consists of inserting a finger into the pretracheal space to tamponade the innominate artery against the posterior manubrium or sternum.¹⁷ Compression of the innominate artery against the posterior sternum may require enlarging the tracheostoma.¹⁸ The finger is inserted

OTHER RISK FACTORS¹⁴

- Low tracheostomy position (below the third or fourth tracheal rings)
- Prolonged tracheostomy
- Long-term mechanical ventilation, high ventilation peak pressures
- Excessive cuff inflation
- High-riding innominate artery
- Local infection, sepsis
- Previous radiation or operation
- Steroid use
- Innominate artery aneurysm (induced by prolonged infection around tracheostomy site)¹⁵
- Chronic inflammation
- Malnutrition
- Positive pressure ventilation
- Chest deformity (placing the innominate artery high over the trachea)

through the stoma alongside the endotracheal tube and, while 90 percent success rate has been reported with this method in controlling bleeding, the pressure must be maintained until the patient is transferred to the operating room.¹⁰

If a tracheostomy site is present, local compression with a Foley catheter balloon through the tracheostomy site has been described.¹⁵

Definitive Treatment

Definitive treatment of TIF has traditionally involved median sternotomy and ligation of the innominate artery. More recently management has involved endovascular stenting of the innominate artery. This may be via a right brachial artery approach to cover the fistula point and avoid the entrance of the common carotid artery.⁹ Experience with endovascular stenting has been limited, and the rate of endo leak associated with the procedure has been cited as 25 percent, with 50 percent mortality in those requiring bleeding control procedures.^{15,19} Endovascular intervention depends upon the patient's hemodynamic stability and availability of interventional radiology.

Bleeding control may involve a right supraclavicular incision/median sternotomy to expose the innominate artery, the right common carotid artery, right subclavian artery and the trachea, and reconstruct the vessel, using vascular clamps to control the bleeding.

Surgery may also entail ligation or resection of the artery with replacement by a vascular prosthesis, carefully maintaining continuity between the right common carotid and the subclavian artery, and placement of a sternocleidomastoid flap, adipose or thymus tissue to cover suture and tracheal

CONTINUED on page 22

BE A MEDICAL
DETECTIVE—
BONE UP ON YOUR
FORENSIC SKILLS

FORENSIC FACTS

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DR. RIVIELLO is chair and professor of emergency medicine at the University of Texas Health Science Center at San Antonio.

Scanning for Abuse

How to keep aware for potential signs of non-accidental trauma

by RALPH RIVIELLO, MD, FACEP; HEATHER ROZZI, MD, FACEP

A 14-month-old male presents with fussiness. Per his mother, he seems to have some discomfort in his right arm. She does not recall any falls or other trauma. On examination, you note that he will not reach for a toy with his right arm. He has bruising to the upper arm. Otherwise, he is well appearing and interacts normally with his mother and twin brother.¹

Question

What, if any, imaging needs to be obtained? Should you consider obtaining imaging for the patient's twin as well?

Discussion

Fractures are common injuries of childhood. Nearly 66 percent of boys and 40 percent of girls will sustain a fracture by their 15th birthday. Though these fractures are most commonly accidental, 25 percent of abused children sustain fractures as a result of child abuse.² As most fractures due to abusive trauma occur in children younger than 18 months old, physicians need to maintain a high level of suspicion when there is a traumatic injury, particularly without a witnessed traumatic event. Radiologic imaging may be the only indicator of abusive trauma, and it may also point to alternative diagnoses such as an abnormality in bone mineralization.

The American Academy of Pediatrics recommends that a skeletal survey be done in children younger than two years old if nonaccidental trauma (NAT) is suspected, as abused children may have occult injuries. Indications for skeletal survey include witnessed NAT, injury during a domestic violence assault, or a delay in seeking care for injury. Skeletal survey should be considered at the physician's discretion in children older than two years, especially those with developmental delays.

NAT should be suspected and a skeletal survey obtained in nonmobile children with any bruising. Skeletal survey is indicated in children younger than two years old who have patterned bruises and in children younger than four years old who have injury to the torso, neck, ear, or face (including the frenula).

A skeletal survey should be strongly considered in children younger than two years old with fractures that are not a toddler's fracture of the tibia or linear skull fractures with the appropriate history of fall. All nonmobile children with fractures unrelated to birth injury should have a skeletal survey. Burn injuries and abusive head trauma are also indications for a skeletal survey.

Other Children in the Home

When a child is suspected to be the victim of NAT, other children in the home should also be evaluated. Skeletal survey should be performed on siblings under the age of two years who live in the same home, as well as on any multiple birth sibling, of the abused child.

For children older than two years, with developmental delays who are suspected victims of NAT, skeletal survey should be strongly considered. For children between the ages of two and five years, the decision whether to get a skeletal survey should be based upon clinician judgement.

Skeletal surveys require considerable experience to obtain properly and to interpret accurately. Recommended imaging protocols are detailed by the American College of Radiology.³ If a severely injured child presents to a hospital without experience performing skeletal surveys and is awaiting transfer to a tertiary care center, it may be preferable to defer the survey until arrival at the receiving hospital. This should be discussed with the accepting physician.



Spiral humeral fracture.

Case Resolution

The patient was found to have a humeral fracture on X-ray. Subsequent skeletal survey revealed a healing ulnar fracture as well. The patient's twin sibling also had a skeletal survey, which showed a healing ulnar fracture. A report was filed with Child Protective Services and the hospital's child protection service was consulted. The hospital's social worker was also notified. +

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KEY POINTS

- Skeletal surveys are indicated for any child younger than two years old who is suspected to have had nonaccidental trauma (NAT)
- Skeletal surveys may also point to alternative diagnoses, as well as NAT
- When a child is suspected to have NAT, other children in the home should also be evaluated



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2023 Research Gems: Gotta Catch 'Em All

A flipped coin doesn't always land on heads or tails. Sometimes it may never land at all.

by RYAN RADECKI, MD, MS, FACEP

Every year, the volume of published research continues to outpace capacity to consume. “Gotta catch ‘em all!” may be an appealing mantra, however it is impracticable to achieve with the medical literature. The Sisyphean task remains to try to keep up—and, in that vein—here is a light round of the emergency medicine literature from 2023.

How Best to Stop the Bleeding in Trauma?

All bleeding stops. The delicate trick is to stop the bleeding before the patient dies, while also simultaneously not tilting the coagulation cascade too far in the direction of excessive clotting.

The past decade has seen the ubiquitous rise of tranexamic acid (TXA), for use in nearly all types of bleeding. Many of

the trials testing TXA, however, have been performed in low-resource settings, potentially limiting generalizability. The PATCH-Trauma trial took a critical look at TXA in major trauma in the advanced trauma systems of Australia and found a mixed result: a slightly greater number of patients were still

alive six months following TXA administration, but there was no difference in survival with a good functional outcome.¹ Yet another typically narrow result to add to the body of evidence surrounding TXA.

Asking the question, “Wouldn’t it be better to get ahead of the curve, rather constantly play catch-up to replete factor derangement associated with major bleeding?” A trial tested whether it would be fruitful to pre-emptively infuse four-factor prothrombin concentrate complexes (PCCs).² The brief answer from the “PROAG” trial in France is “no.” Empiric PCC infusion was associated only with increased pro-thrombotic events without corresponding witnessed benefits. In a similar vein, “CRYOSTAT-2” tested whether routinely adding cryoprecipitate to massive transfusion protocols improved all-cause mortality.³ In this instance, there was neither benefit nor harm.

What’s new in stroke care?

Adding further to the body of literature telling us tenecteplase is an entirely valid alternative to alteplase, we have “TRACE-2.”⁴ Repeated trials have not shown alteplase to have any signal of better outcomes, nor tenecteplase to have an association with increased adverse events. TRACE-2 continues to demonstrate these observations. The simplicity of tenecteplase administration makes its use likely the preferred agent for treating acute ischemic stroke.

Tackling the age-old question: “we can administer thrombolytics to everyone, right?” the “ARAMIS” trial throws up another red flag for patients suffering mild stroke.⁵ In this randomized controlled trial enrolling patients with non-disabling stroke, dual antiplatelet therapy provided better outcomes for patients than thrombolytics, while avoiding excess symptomatic intracranial hemorrhage. These results do not generalize to mild, disabling stroke.

In contrast, more is almost certainly better when treating devastating large-vessel occlusions (LVO). Early trials testing endovascular treatment of LVO enrolled primarily patients with very small core infarcts surrounded by large viable penumbra. The “SELECT-2” trial looked at occlusions of the internal carotid and proximal middle cerebral artery resulting in larger core infarcts.⁶ The outcomes were dismal whether treated with endovascular therapy or conservative medical care, but 20 percent achieved a modified Rankin score of 0 to 2 with the former, compared with only seven percent of the latter.

The Right Way to Airway

Video laryngoscopy (VL) is simply, in most situations, the better tool for the job. Expertise with direct visualization is still necessary, but the “DEVICE” trial adds another feather to the cap favoring VL.⁷ The operators involved in the trial were mostly emergency medicine residents or critical care fellows, but this fact does not diminish the generalizabil-

ity of these observations. Many clinicians staffing emergency departments intubate infrequently, as well, and these results are likely applicable to a wide scope of practice.

More commonly asked than *how* to intubate, the more challenging question is *whether* to intubate. It may be conveniently glib to base clinical practice on the charming rhyme of “less than eight, intubate,” but accumulated wisdom teaches many patients with depressed Glasgow coma scores (GCS) improve spontaneously without adverse consequences. Now, a randomized, controlled trial clearly demonstrates some patients with low GCS are far more likely to be harmed by an aggressive approach to airway management.⁸ Enrolling patients with depressed GCS thought to be from substance abuse and misuse, including nearly a quarter in each cohort with GCS 3, a conservative approach to airway management avoided both intubation-related risks and intensive care unit admissions.

Finally, the “EXACT” trial examined whether, in patients with return of spontaneous circulation after an out of hospital cardiac arrest, a peripheral oxygenation target of 90–94 percent conferred a survival benefit, as compared with the typical 98–100 percent.⁹ Unfortunately, this trial can be added to the heap of things ruined by the COVID-19 pandemic, as the arrival of COVID necessitated early termination. Only 425 of the planned 1,416 were enrolled, leaving the primary and secondary outcomes grossly imprecise. Survival to hospital discharge favored the “standard care” group, 47.9 percent to 38.3 percent, leaving little chance the lower oxygen target would have become a preferred strategy.

A Myriad of Infectious Disease Papers

The use of steroids in severe sepsis remains challenging, primarily as proper patient selection is necessary to tease out those with the greatest likelihood of benefit.

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One consistent signal for potential benefit has been community-acquired pneumonia, and the “CAPE COD” trial very clearly identifies those patients admitted to the intensive care unit as candidates for steroids.¹⁰ The trial was stopped due to superiority due to both its overall mortality benefit, as well as a reduction in the need for mechanical ventilation.

As much as we rely upon life-saving antibiotics, we must heed the stewardship nannies and their ever-important mission of harm reduction. Unfortunately, when the prevailing interest is preventing poor acute patient outcomes, prudent antibiotic prescribing falls by the wayside. A randomized controlled trial from the primary care literature attempts to gently reduce excess prescribing with personalized feedback and peer comparison—and fails.¹¹ It is absolutely possible to change physician behavior, but the means of doing so are likely more Draconian than most would find palatable.

There are some low-hanging stewardship fruit, however, addressed by trials such as “SCOUT,” looking at the duration required for antibiotics.¹² In this trial, children with a urinary tract infection were randomized to either five or 10 days of oral antibiotics. Nearly every child improved and treatment failures were rare, but they were clearly more common in those receiving short-courses of antibiotics. It is likely the most appropriate strategy for prescribing is to start with a short course, but to remain adaptable to the occasional need for longer-course therapy.

In a bit of an odd trial attempting to tease out the best candidates for antibiotic therapy

in those children with acute sinusitis, a trial explored clinical and microbiological predictors of treatment outcomes.¹³ The most interesting finding is the failure of the “color of nasal discharge” finding used by many to guide clinical management. This clinical manifestation was not shown to correlate with the presence of underlying pathogenic bacteria. While this trial was “positive” in the sense amoxicillin/clavulanic acid treatment was a bit better than placebo, the mean symptoms scores improved rapidly in both arms. Any benefit to antibiotics was restricted to the fraction whose testing proved presence of pathogenic bacteria. The most prudent strategy for mild acute sinusitis in children is almost assuredly still watchful waiting.

A Closing Treasure

Medicine is littered with perverse incentives to do “more” instead of “less.” Because of this, each gem in which an established dogma is challenged is greatly appreciated. The so-called “NINJA” trial evaluates whether children with nail and nailbed injuries benefit from replacement of the nail into the nail fold, or whether cosmesis and function are retained if the nail is simply discarded.¹⁴ While anatomic re-approximation sounds good in theory, these authors do not report any advantage to doing so. It turns out humans have at least some small remaining regenerative power, and the nail will grow back without any additional deleterious effect. ➔

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NTG in Right Ventricular MI

Will nitroglycerin make the pressure get low?

by KEN MILNE, MD

A 64-year-old male collapses after shovelling snow. Paramedics find a patient with eight out of 10 chest pain looking visibly uncomfortable. Vital signs are normal, but the ECG shows ST elevation in the inferior leads and some ST changes in V1-V2 that make you wonder if your patient is having an acute myocardial infarction (MI) with right-sided ventricular involvement (RVMI). In the emergency department, you administer 160 mg of chewable aspirin and your colleague asks if you should also administer 400 ug of nitroglycerine.

Background

Many of us may have been taught not to give nitrates to a patient with an RVMI. This likely comes from the American Heart Association (AHA) guideline recommendation stating that nitroglycerine is contraindicated in these situations.¹ It is categorized as Class III, LOE C (very low-level evidence) but has become part of clinical practice and EMS protocols.

The pathophysiologic rationale was that nitrates would cause vasodilation and thus reduce right ventricular preload, decreasing left end diastolic volume, and ultimately resulting in clinically important hypotension. Many times, pathophysiology has been used to explain something in medicine only to be discovered later that the human body is much more complex than we thought.

The evidence for this recommendation comes from a single retrospective observational study of 40 patients with inferior MIs published in 1989.² A large portion, 20 patients (50 percent), had hypotension after being administered nitrates. Those with inferior MI and hypotension had ECG evidence of RV involvement. It is important to note that there was no standardization of the nitrate dose or route of administration, so it's hard to know how to extrapolate the findings to our modern practice and protocols.

Clinical Question

In patients with right ventricular myocardial infarction (RVMI), is nitrate administration associated with increased adverse events compared to patients with myocardial infarctions in other anatomic regions?

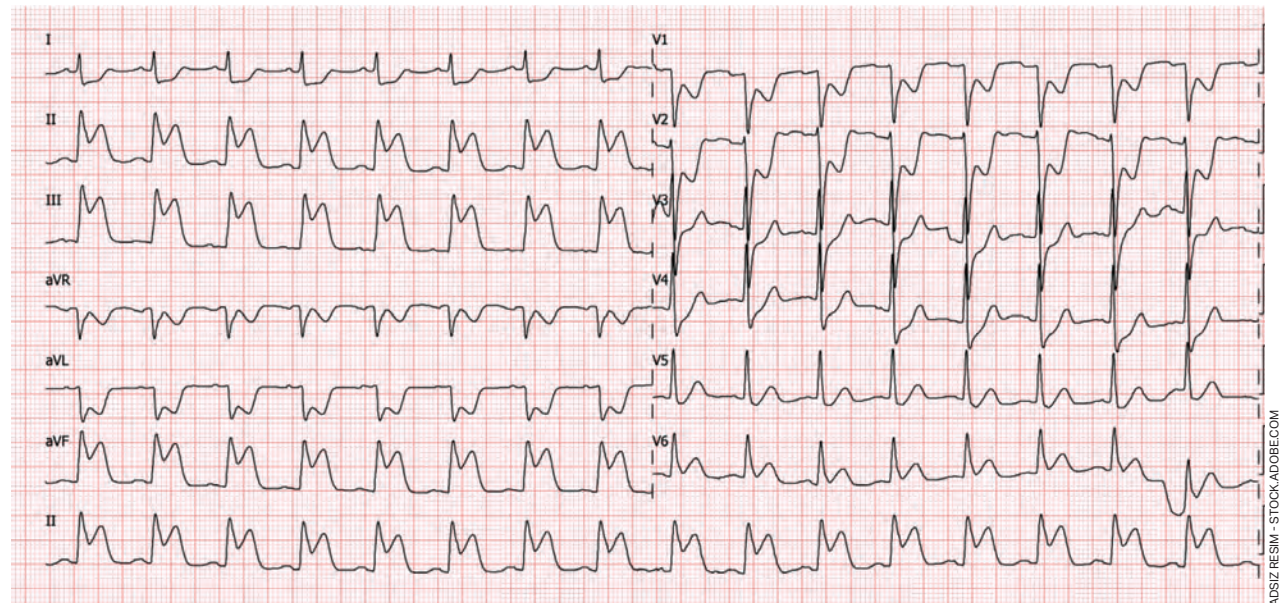
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Wilkinson-Stokes M, Betson J, Sawyer S. Adverse events from nitrate administration during right ventricular myocardial infarction: A systematic review and meta-analysis. *Emergency Medicine Journal*. 2022;40(2):108-13.

- **Population:** Adult patients diagnosed with an acute MI
- **Exclusions:** Patients with coronary vasospasm
- **Exposure:** Nitrate administration in any dose and by any route.
- **Comparison:** Patients with acute right-sided myocardial infarctions to patients with acute MI involving any other anatomic regions
- **Outcome:**
 - » **Primary Outcome:** Any adverse outcomes reported in the identified literature.
 - » The primary meta-analysis excluded studies of low quality, but a secondary analysis was also performed including identified studies (2) that were deemed of lower methodologic quality.

Authors' Conclusions

"This review suggests that the [American Heart Association] and [European Society of Cardiology] contraindications [stating that nitrates are contraindicated in RV MI] are not supported by evidence. Key limitations include all studies having concomitant inferior and RVMI, no evaluation of beneficial effects in any of the studies, and very low certainty of evidence.



As adverse events such as hypotension are transient and easily managed, nitrates are a reasonable treatment modality to consider during RVMI on current evidence."

Results

Their search strategy found five studies that met the inclusion criteria. Of the five studies, two used nitroglycerin 400 µg sublingual as their treatment and could be meta-analyzed. One was a small study (n=46) by McConnell et al, conducted in the UK and had 19 RVMIs. The other was a larger Canadian study (n=1,004) by Robichaud et al and included 86 patients in the cohort with an RVMI.

Key Results

There was no statistical difference observed in adverse events with the administration of nitrates based upon the region of cardiac infarction.

- **Primary Outcome: Adverse event rates of combined inferior and RVMI**
 - » Relative risk 1.31 (95 percent CI 0.81 to 2.12)
 - » Adverse events reported were categorized as transient and minor.

EBM Commentary

1. Pillars of Salt and Sand: In the systematic review and meta analysis, the authors point out that the "don't give nitrates in RVMI patients" recommendation seems to stem from the 1989 Ferguson, et. al., study of 40 patients. That retrospective study reported 20 patients with an inferior MI and hypotension after getting nitrates, and 20 patients with an inferior MI who weren't hypotensive after receiving nitrates. In the first group (hypotension), 15/20 patients had ECG evidence of RV involvement. Only 2/20 patients in the second group (non-hypotension) had ECG evidence of RV involvement. As is often the case, when you go back to the primary literature that informs guideline recommendations you discover it's not high-level evidence.

2. Papers Meta-Analyzed: Arguably the most compelling study included in the analysis (SRMA) is the one by Robichaud et al (n=1,004).³ It looked at the administration of 400 ug of sublingual nitroglycerin in MI patients who were categorized as inferior MI, inferior plus RVMI, inferior plus other territory, and MI's involving only non-inferior/RVMI territories. What it demonstrated was that there was no increased risk to any of those subgroups when given nitrates. Interestingly, nitrate administration appeared to be safest in patients experiencing an isolated inferior MI.

The other paper meta-analyzed is the other smaller study

(n=46) by McConnell et al.⁴ It was only published as an abstract presented at a conference. The SRMA authors were able to contact the study team, get the original study data, and incorporate that into their meta-analysis. McConnell's findings are congruent with the larger Robichaud et al study.

3. Benefits: The SRMA only looked at the potential harms of administering nitrates to patients with acute MIs. The hypotension observed is often transient, easily managed, and unlikely to be clinically meaningful (i.e., a monitor-oriented outcome). None of the studies included in the SRMA looked at the benefits of nitrate administration such as analgesia balanced against the risks of transient hypotension. The AHA recommends giving patients with ischemic discomfort up to three doses of sublingual or aerosol nitroglycerin until pain is relieved or low blood pressure limits its use (Class I, LOE B). This recommendation is much stronger than the Class III, LOE C provided for the contraindication of nitrates in RVMIs.

Bottom Line

It is reasonable to administer nitrates to patients with an RVMI. Be prepared to manage the potential transient hypotension when giving nitrates regardless of the infarct territory.

Case Resolution

The patient is having eight out of 10 chest pain and the ECG suggests an inferior MI with possible right ventricular involvement. You know the latest evidence doesn't support the contraindication of nitroglycerine administration and that it might ease his pain. At the same time, you know that any patient with an MI might become hypotensive, so before providing the first spray of nitroglycerine you establish an intravenous line.

Thank you to Dr. Rupinder Sahsi who works as an emergency physician in Kitchener-Waterloo, Ontario, Canada and is an assistant medical director for EMS at the Centre for Paramedic Education and Research in Hamilton, Ontario, Canada for his assistance with this critical appraisal.

Remember to be skeptical of anything you learn, even if you heard it on the Skeptics' Guide to Emergency Medicine. ➕

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FOOSH, There It Is

Occult and subtle wrist and hand injuries you don't want to miss



by ANTON HELMAN, MD, CCFP(EM),
FCFP

A 20-year-old man presents to the emergency department (ED) directly from the scene of a fall from a bicycle, where he lost balance and landed on his outstretched hand. He complains of pain both in the palm of his hand and in the wrist. Sound familiar? We see 2.6 million hand and wrist injuries annually in the United States and when we miss an occult or subtle injury it can be very morbid for our patients and not uncommonly leads to litigation.^{1,2} For every patient who presents to the ED with a fall on outstretched hand injury (FOOSH), we need to consider not only the common distal radius fracture clearly seen on X-ray, but also five sometimes occult injuries:

- Occult distal radius fracture
- Hook-of-hamate fracture
- Distal radial-ulnar joint injury (DRUJ)
- Scapholunate injury
- Occult scaphoid fracture

I outline some of the general principles of assessing the patient after a FOOSH injury and highlight the key clinical features.

Common Things Being Common

Let's start with the most common of these subtle injuries. The most common wrist or hand injury occult to X-ray is not the scaphoid—it's the distal radius.³ Tenderness over the distal radial metaphysis after wrist injury is strongly suggestive of a distal radius fracture despite normal plain radiographs and fluoroscopic images.⁴ Hence, these patients should be placed in a radial wrist splint with orthopedic follow up rather than be labeled as a "wrist sprain" and sent home without a splint or appropriate follow up. Remember that age-related prevalence, when constructing an orthopedic differential diagnosis, is critical. Children and older adults have weaker long bones than young adults and are more likely to sustain a distal radius fracture after a FOOSH than a carpal bone injury.

DRUJ Injury

Often associated with distal radius fractures, but underappreciated, are DRUJ injuries. This should be considered especially when the distal radius fracture occurs with a concomitant ulnar styloid fracture.⁵ The DRUJ injury has been coined "the forgotten joint of the wrist" as missed DRUJ injuries are common.⁶ A missed DRUJ injury may lead to chronic wrist supination deficit and pain, which can be prevented with surgery in some cases, so early diagnosis in the ED is important. There is a spectrum of DRUJ injuries from minor sprain to subluxation to dislocation. The mechanism of injury may be a sudden supination or pronation force or a FOOSH. Patients may report a clicking sensation with forearm supination or pronation. On physical exam it is imperative to screen for an associated DRUJ injury in all



patients with wrist injuries, especially those with distal radius and ulnar styloid fractures. We sometimes tend to palpate the distal radius, suspect a distal radius fracture, and stop there. The three most useful physical exam findings of DRUJ instability are point tenderness to palpation over the divot between the distal radius and ulnar styloid, limited range of motion with supination and pronation and the ballottement test.⁶ This test involves grasping the ulnar styloid while stabilizing the distal radius to assess for increased movement compared to the contralateral wrist, an often overlooked physical exam maneuver that should be considered in all wrist-injured patients. DRUJ injuries are often occult to X-rays, but it is imperative to scrutinize the lateral wrist X-ray for a widening of greater than 2 mm of the DRUJ or a loss of overlap of the distal radius and ulna on the lateral film suggesting a subluxation or dislocation of the DRUJ. While most patients with distal radius fractures can be managed in the ED with a below-elbow splint with the forearm in a neutral position, patients with associated DRUJ injuries should be placed in an above-elbow splint with their forearm in supination to prevent pronation of the wrist.

Hamate Fracture

The next of the five major wrist or hand injuries to consider in patients after a FOOSH is the hook-of-hamate fracture. Traditional teaching of the mechanism of the hook-of-hamate fracture is a direct blow from an elongated implement gripped in the hand such as a ski pole, golf club, or baseball bat. It is under-recognized that hook-of-hamate fractures can result from a FOOSH and occur concomitantly with a scaphoid fracture.⁷ Knowing the surface

anatomy of the carpal bones is essential. The hook of the hamate lies 2 cm distal and 1 cm radial to the pisiform and can be felt on deep palpation; it should be palpated routinely in patients after a FOOSH. Picking these injuries up in the ED is important because if missed and not immobilized, non-union may ensue and the patient may require surgical intervention.⁸ If the hamate is tender on physical exam, it is important to order an additional X-ray view with the standard hand X-ray views: the hook of the hamate or carpal tunnel view is more sensitive than the standard wrist X-ray views for hook-of-hamate fractures. An important pitfall is assuming no fracture if a hook-of-hamate fracture is suspected clinically and the standard wrist views as well as the hook-of-hamate or carpal tunnel view are negative. The sensitivity of the hook-of-hamate view is only 40 percent for fracture.⁹ Similar to scaphoid fracture occult to X-ray, if clinically suspected, immobilize and arrange orthopedic follow-up regardless of the X-ray findings.

Lunate Ligamentous Injury

Another overlooked injury is the lunate ligamentous injury including the scapholunate injury. Age-related prevalence of wrist or hand injuries is again important here. Children with open growth plates are more likely to sustain fractures involving growth plates or diaphyseal-metaphyseal junction of the distal radius, while those older than years are more prone to classic long-bone fractures. For people between 15 and 60 years old, carpal bone and inter-carpal ligament injuries occur more often. Hence, carpal bone injuries occur predominantly in young adults as a result of a high-energy mechanism. Lunate ligamentous injuries lie on a morbidity spectrum ranging

from scapholunate sprains to dissociation and dislocation. Again, knowledge of surface anatomy is essential for accurate physical exam testing: the divot distal to Lister's tubercle and a few millimeters ulnar is the scapholunate space. This space can also be identified by palpating 2 cm ulnar to the snuffbox. If a patient has point tenderness here, assume a scapholunate injury until proven otherwise.

There are several X-ray findings to consider: the radius-capitate-lunate alignment, which if absent may indicate a scapholunate injury. Knowing the normal shapes of the scaphoid and lunate is important to help identify X-ray abnormalities that may suggest a scapholunate injury. The scaphoid on the anterior-posterior (AP) view is normally the shape of a boat. The lunate on lateral view appears like a half-moon while on the AP view it appears roughly square-shaped. A change in any of these shapes may signify a scapholunate injury. The signet ring sign of the scaphoid is a rounded appearance of the cortex of the scaphoid tubercle on the AP view of the wrist, suggesting a subluxation. The pizza sign or piece of sign is the triangular appearance of the lunate on the AP view, suggesting a lunate dislocation. A widening of the scapholunate space of 3 to 5 mm on the AP view is suggestive of a scapholunate dissociation. This has been termed the Terry Thomas Sign and the David Letterman Sign: The gap between these celebrities' dental incisors appears wide like a widened scapholunate space on the AP view.¹⁰ A clenched fist view may be necessary to diagnose a significant scapholunate ligament sprain.¹¹ To pick up a subtle scapholunate dissociation and distinguish it from baseline physiologic widening of the scapholunate

CONTINUED on page 23

over 30 years ago. And it's been a tremendous experience just getting together socially with what used to be twice a year in Chicago to have camaraderie with my fellow emergency physicians. And I found that during that time it was amazing the things that you could exchange with your colleagues that ultimately would even make you a better physician.

It is the case that having paid individuals is expensive. We do try and compensate our volunteers by providing airfare, hotel room, and a meal stipend. We do what we can to offset some of that expense, but to pay someone full time I think would be probably an impossibility. Recently, we spent about \$10 million putting in a new IT system and technology and this will be something that will provide a greater experience for all of our diplomates. And we continue to invest in various ways to improve providing the services that we provide to all of our diplomates.

Dr. Dark: How are the test takers, the candidates, doing in terms of either their initial certification or their recertifications on things like the ConCert exam that was transitioned to the MyEMCert exam? What topics are of concern to ABEM as it pertains to what we as emergency physicians are not doing well on?

Dr. Johnson: That's a great question. I would probably have to do some research to see if there are any particular subject areas that are problematic. One of the things that we have tried to do

with the continuing certification exam or MyEMCert is to really look at ways that we can expedite knowledge translation into reality. And I think we've been extremely happy with the fact that we've really tremendously reduced how long it takes for us to take knowledge that's in the literature and bring it to our practices. In addition to the standard MyEMCert content are key advance questions. The key advances which are really cutting edge things that are happening in the field of emergency medicine, which we can bring immediately to the attention of our diplomates.

We launched several modules this year looking at substance use. These modules don't qualify for the required modules that are needed to maintain certification but do provide additional education and are tremendously cutting edge. I recently spoke to a diplomate who took one of the modules and he was able to apply it almost instantly in his practice when taking care of patients who came in with drug related problems. We launched a resuscitation module, knowing full well that if there's one thing that emergency physicians should be doing well, it's being able to manage resuscitation. And these types of activities, mean you don't have to be taking an ATLS or an ACLS or a PALS course every so often. It will lead to providing better care to our patients.

Dr. Dark: I have one last question for you and purely asking for a friend here. Do I still have to do the LLSA?

Dr. Johnson: It really just depends upon when your certification expires. We do know that the LLSA is phasing out depending upon when you have to recertify and then we are switching everything over to the MyEMCert modules. It's always a question when we're at the Scientific Assembly at the ABEM booth. Many of our diplomates will come by and want to know exactly where they are in the recertification process.

Dr. Dark: Is there anything else that I left out that you wanted to tell ACEP members?

Dr. Johnson: We know that there was a lot of concern about the new certifying exam. I want to let you know that I believe that the next exam we do put into play will be something that will take what your everyday type of practice and translate it exactly into what we're testing. We want it to be valid, we want it to be reliable. We do think it will really examine those competencies that we currently cannot do only with the written exam or even with our current oral exam. It won't launch until 2026, but we're hoping by that time we'll be ready to go. We'll be using a test center that's located in Raleigh, North Carolina. We chose that center because The Board of Anesthesia has been using that center for their own certification needs and they've been quite successful, being able to get their diplomates and candidates through the process. +

AIRWAY | CONTINUED FROM PAGE 16

defects.²⁰ Reverse saphenous graft has also been employed to produce aorto-carotid and aorto-subclavian anastomoses.²¹ The tracheal defect may be left adherent to the innominate artery or closed with a pericardial patch.⁴

Complications

Mortality of TIF has been reported to be above 50 percent, and approaching 100 percent if untreated. Fatal outcomes post-operatively may be due to re-bleeding after attempts to preserve flow in the innominate artery or using sutures or prosthetic material in an infected area.^{22,23} Ligation of the innominate artery is associated with a risk of brain ischemia and ischemia of the right upper extremity.

The high mortality post-operatively may be related to difficulty in controlling hemorrhage, high infection rates, or other comorbid conditions.²⁴ The fistula is an unclean wound, so that insertion of a stent carries a risk of wound infection. On the other hand, the procedure can be performed under local anesthesia and on an unstable patient. Innominate artery transection also poses a risk of infection such as sternal osteomyelitis after sternotomy—generally required for innominate artery transection—since the surgical field is not aseptic.²⁵

Neurologic deficits have been reported in 10 percent, and sternal wound complications in 39 percent. Many of these patients have pre-existing neurologic deficits. Occlusion of the right carotid or right subclavian artery may lead to steal syndrome.²⁶

Conclusion

The incidence of late onset TIF is likely to increase as treatment for patients with severe neuromuscular disorders improves, and these patients' life expectancy increase. The emergency physician must be prepared to intervene to stabilize these patients and route them to definitive care. +

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space, consider bilateral X-rays of the wrist, as some people have baseline physiologic widening.

SLAC Injury

One of the reasons that it is important for us to pick up scapholunate injuries in the ED is that some patients may progress to scapholunate advanced collapse (SLAC), a consequence of untreated scapholunate dissociation or complete rupture of the ligament. In SLAC the capitate collapses toward the radius, resulting in chronic arthritis and pain.

Occult Scaphoid Fracture

The occult scaphoid fracture is the most common occult carpal-bone fracture.¹² Like lunate ligamentous injuries, understanding age-related prevalence is important for scaphoid fractures, which occur more commonly in young adults. Anatomical snuffbox tenderness, scaphoid tubercle tenderness on the palmar aspect of the wrist, and pain on axial compression of the thumb should always be carried out on physical exam in young adults after a FOOSH. Sensitivity for each of these tests has been reported to be 100 percent,

with a specificity of 74 percent when all are positive.¹³ Axial compression of the thumb has been shown to have the weakest diagnostic performance of the three tests, likely because many older individuals have arthritis in the first carpometacarpal joint, leading to a false-positive test.¹⁴ Two nuances in performing these physical exam tests are key: snuffbox tenderness should be performed with the patient's wrist in ulnar deviation to bring the proximal scaphoid into the snuffbox, and palmar scaphoid tenderness should be elicited at the base of the thenar eminence with the wrist

in neutral or radial deviation to bring out the scaphoid. Two additional tests for scaphoid fracture include pain on resisted supination of the wrist, which has been shown to have a 100 percent sensitivity, and the clamp sign, where the patient uses a pincer grasp around their scaphoid with their thumb in the snuffbox and index finger of the palmar scaphoid tubercle when asked where their point of maximal pain is.¹⁵ This test has a high positive likelihood ratio for scaphoid fracture.¹⁶

While guidelines recommend CT imaging for suspected scaphoid fractures occult to X-ray within three to five days, CT may miss significant scapholunate ligament injuries and may falsely reassure clinicians who may neglect to splint and arrange follow-up for these patients.¹²⁻¹⁷ Another imaging strategy option is to obtain a scaphoid cone view X-ray, immobilize the patient's wrist in a removable splint or radial-gutter plaster splint, and arrange follow-up in 10 to 14 days for re-examination and repeat X-ray if necessary.

Next time you are chatting with a colleague or resident, ask them what they think the most common occult fracture of the wrist is. Chances are they'll be surprised to learn that the answer is distal radius fracture.

Many thanks to Dr. Arun Sayal and Dr. Matt Distefano for their tag-teamed contributions to the EM Cases podcast which inspired this column.

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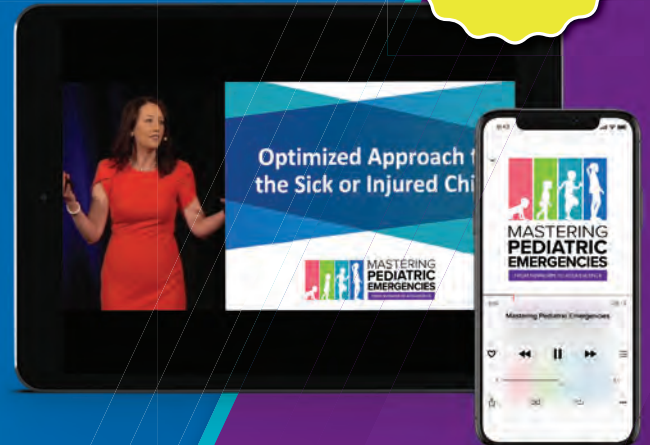
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