EM Resident
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Special Focus: Med Students and Match 2023

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Rough Waters, Calm Doctors

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IMPORTANT INFORMATION: The U.S. Department of Education recently announced a student loan debt relief plan which includes forgiveness of up to $10,000 for qualifying federal student loans and up to $20,000 for qualifying Pell Grant recipients. For more information, please read the announcement. Please note that if you refinance qualifying federal student loans with Laurel Road, you may no longer be eligible for certain benefits or programs and waive your right to future benefits or programs offered on those loans. Examples of benefits or programs you may not receive include, but are not limited to, student loan debt relief or public service loan forgiveness, repayment options such as Income Based Repayment or Pay As You Earn, or COVID-19 relief benefits such as a 0% interest rate, suspension of payments or loan forgiveness. Please carefully consider your options when refinancing federal student loans and consult StudentAid.gov for the most current information.

1. EMRA members get a $50.00 discount on an annual program membership with GradFin ("Offer"). The discount will be applied on the current annual membership fee of $249.00 and will automatically apply at checkout. This Offer is only available to current EMRA members, is non-transferable and cannot be applied to previous membership purchase(s). This Offer cannot be redeemed for cash or combined with other offers and is subject to cancellation at any time and without notice.
2. To qualify for PSLF, you must be employed by a U.S. federal, state, local, or tribal government or not-for-profit organization (federal service includes U.S. military service); work full-time for that agency or organization; have Direct Loans (or consolidate other federal student loans into a Direct Loan); repay your loans under an income-driven repayment plan; and make 120 qualifying payments. For full program requirements, visit www.studentaid.gov/manage-loans/forgiveness-cancellation/public-service.

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The Necessity of 'Paying It Forward'

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My first month in the emergency department was near the end of my third year of med school.

Although I had experienced the controlled chaos as a scribe, my initial steps in the ED were filled with trepidation. I wasn't sure I would be ready to build a comprehensive differential with such limited information, especially for those patients whose primary surveys were borderline or not at all intact.

Pivotal in the development of my early gatherings of knowledge and clinical acumen — and, ultimately, my love for emergency medicine — were my attendings and fellow team members, from whom I learned invaluable lessons during that crucial month. From bedside manner, including actively listening to the patient rather than furiously taking notes, to my first fascia iliaca block where the hydrodissection was almost as satisfying as the patient's pain relief, the consternation I felt before each shift slowly transformed into excitement.

As I progressed through that month, a sub-internship, and later an ultrasound elective, my aptitude and resultant confidence increased with each week. I was pulled into rooms with interesting clinical presentations, given the opportunity to apply my growing ultrasound knowledge, and guided through procedures by residents, attendings, and nurses who knew I was eager to learn as much as I could.

Years and countless patients later, those who helped me along the way have left a lasting impression. I'm beyond grateful for their enthusiasm for teaching, and for their willingness to engage me in learning opportunities.

Reflecting on these magnetizing experiences of my past, the good fortune I've had to learn from my current attendings and co-residents, and the contagious enthusiasm of medical students who may pursue pathways into emergency medicine, some of my reservations regarding the future of our specialty are assuaged.

One of the many strengths of an emergency physician is the ability to swiftly establish rapport. When we combine this affability with the breadth of conditions we diagnose and treat, there is endless potential to engage medical students during their ED rotation and perhaps demonstrate how fulfilling it can be to care for anyone, anything, anytime.

I understand the challenging practicality of prioritizing medical student education along with ever-present, everyday demands — not to mention the delicate balancing act of juggling extra tasks on top of serving as senior resident of a pod, responding to resuscitations, and dealing with innumerable interruptions throughout the day.

However, all of this does seem less insurmountable when I force myself to pause and acknowledge the gratitude I feel toward attendings, fellow team members, and mentors along the way — all of whom took more than a few moments to ensure I truly understood, and appreciated, the medicine I now practice. Through the lessons they taught and examples they set, they have shown me the importance, the value, and the joy of paying it forward.

So, while it sometimes may be difficult to visualize the precise future of our specialty given the current climate, I am doing my best to focus on the things I can control — and that includes serving as a source of information and motivation for today's medical students. Experience is often touted to be the best teacher. But sometimes, we — as residents in the midst of our training and in the early stages of our careers — can *choose* to be the best teacher. ✶

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EM Resident (ISSN 2377-438X) is the quarterly magazine of the Emergency Medicine Residents' Association (EMRA). The opinions herein are those of the authors and not of EMRA or any institutions, organizations, or federal agencies. EMRA encourages readers to inform themselves fully about all issues presented. *EM Resident* reserves the right to edit all material and does not guarantee publication.

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Strengthening the Specialty from All Sides: EMRA's Response to the 2023 EM Match

Jessica Adkins Murphy, MD
EMRA President
@DrAdkinsMurphy

At a time of year when most of us would prefer to be celebrating our incoming class of residents, instead EM-bound students, residents, and faculty have spent the past few months discussing the Match. Questions cast uncertainty upon the future of our specialty. We have been asked about the numbers, the possible causes, if these trends will continue, and what will reverse these trends and strengthen our specialty.

EMRA cannot promise answers to all of these questions, but we have identified factors at play that point to potential solutions. And now, we're sharing what we've learned so that you can be part of the response.

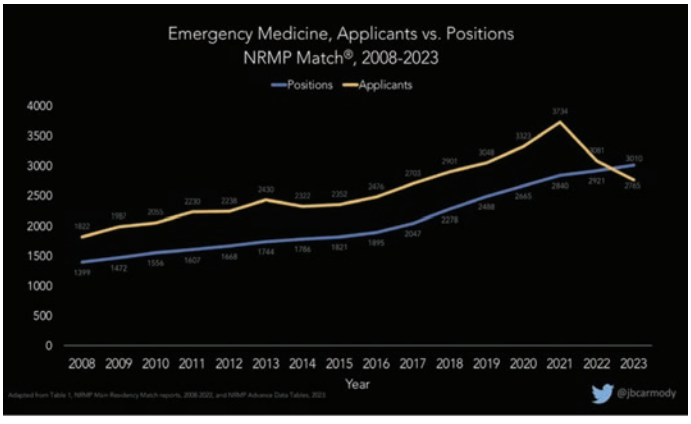
THE TIPPING POINT

For years, applicants to EM have increased in parallel with the increase in residency positions. Consistently, there have been a greater number of applicants than residency positions. Unfilled spots were under 30 per year for more than 15 years.[1]

Applicants to EM peaked in 2021, coinciding with the initial surge of public support for frontline health care workers amid the COVID-19 pandemic. In the 2022 Match, applicants began to decrease, while spots continued to increase. This resulted in 219 unfilled emergency medicine residency positions through the 2022 Match, almost all filled in the Supplemental Offer and Acceptance Program (SOAP).[2]

In this year's Match, applicants continued to decrease while spots continued to increase. Pre-SOAP, only 82% of EM positions were filled, the second-lowest match rate of all specialties. This resulted in 554 unfilled EM positions,[2] of which a reported 501 have been filled after the SOAP (though official data is pending).

The supply-demand curve has shifted in ways that affect all of us in emergency medicine.



Graph courtesy of Bryan Carmody, DO. Used with permission.

DEMAND

The total number of applicants applying to EM has fallen by 17.5% since its peak in 2021 and now is approaching 2019 levels. Among MD applicants, the drop is even steeper. MD applicants fell from 2,385 at their peak two years ago to 1,460 — a 38.8% decrease. DO and IMG applicants also decreased, but to a lesser degree.

Historically, medical students have had more opportunities to experience EM and find mentorship. Some have speculated that recent classes missed those experiences due to the COVID-19 pandemic limiting in-person workshops and clinical experiences. However, a more concerning possibility is that students with more access to emergency departments may have seen the burnout, boarding, and other frustrations that make work more difficult for those in the ED. When EMRA called upon medical students to share their reasons for reconsidering a career in emergency medicine, a few cited discouraging experiences with some faculty and residents on shift.

Students also are concerned by gloomy predictions for the EM job market. The 2021 report "The Emergency Medicine Physician Workforce: Projections for 2030" forecasted a surplus of 7,845 EM physicians by 2030.[3] EMRA's medical student members reported that, for those saddled with hundreds of thousands of dollars in debt or committed to working in a specific region, the concern about saturated job markets was enough to drive them away. They also reported they had been cautioned by their deans and non-EM advisors not to pursue EM out of concern for workforce projections. In response to the workforce report, EMRA countered with an extensive analysis titled "Unity, Purpose, and Passion: Influencing the Future of the EM Workforce."[4]

SUPPLY

Meanwhile, residency positions have grown significantly during the past decade.

As a disclaimer, there are some new and established programs that are expanding sustainably. These programs have adequate leadership, clinical acuity, and procedural training to sustain a larger complement of residents, and residents graduate into communities that can support this growing pipeline of EM physicians.

However, there are also likely financial incentives for hospitals to open new programs or rapidly expand existing ones. In staffing emergency departments, residents earn lower salaries than attendings and most physician assistants and nurse practitioners, and part of resident salaries are government funded.

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References available online.

Barriers to U.S. Visiting Student Rotations for Overseas Applicants

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International medical students face several challenges when they seek rotations in the United States. EMRA, along with our Medical Student Council, worked with relevant stakeholders — including EM program directors, clerkship directors, and international medical graduates (IMGs) — to identify major barriers.

The 4 main barriers are: finances; lack of access to the Association of American Medical Colleges' Visiting Student Learning Opportunities (VSLO) program; need for visa sponsorships; and programs that reject international student participation in rotations.

We elaborate on each barrier below.

FINANCES

The financial impact of applying for, and attending, audition rotations is certainly an issue for all medical students — allopathic, osteopathic, and international. However, international students have a higher financial investment during the rotation and interview seasons.

Virtual interviews have helped, but there is still the need to travel to the U.S. for rotations and move stateside after graduation.[1,2] Some institutions charge international medical students more than allopathic or osteopathic students to rotate, making the disparity even greater.

In speaking with stakeholders, this fee is due to the institution not having a contract with most IMG schools, as well as a lot of osteopathic schools. This results in a required fee that goes toward the costs of creating contracts and obtaining required insurance. A simple Google search highlighted several programs that required an additional fee for international students. Johns Hopkins, for example, wrote "an additional registration fee of $5000 per clinical elective is charged for visiting students from schools not accredited by LCME or COCA."

Thankfully, many programs have started to create diversity externships/scholarships to offset costs associated with rotations for diverse students. See EMRA's Diversity Oriented Away/Scholarship Programs webpage for a list of institutions that have such scholarship opportunities. Also check out EMRA Match for Clerkships and select the Diversity Externship Scholarship filter under Rotation Types in the upper banner of the webpage.

While we recognize that not all

References available online.

international students come from diverse backgrounds, for those who do, these scholarships can help offset the costs of rotations.

LACK OF ACCESS TO VSLO

International medical students face an uphill battle to obtain away rotations due to limited access to VSLO, as this AAMC program only allows certain types of medical schools to create accounts for students. Students do not always know of programs that do not use VSLO for away applications. When discussing this issue with stakeholders, they recommended international students who cannot use VSLO search for rotations on EMRA Match for Clerkships, as this will allow them to apply for rotations outside of the VSLO system.

VISA SPONSORSHIP

Some students and IMGs require visas to come to the U.S. for a rotation or residency, but some institutions do not sponsor specific types of visas. Due to these visa restrictions, a program cannot accept students to rotate if those students would not be able to come to that program for residency because of their visa type. The types of visas that can be sponsored are decided at an institution-wide level so, unfortunately, clerkship directors cannot lift this barrier.

PROGRAM LIMITATIONS

Unfortunately, there are many institutions that do not accept international students for rotations due to variations in curriculum and perceived differences in the caliber of medical education outside the U.S. Such factors make some clerkship directors hesitant to extend offers to international applicants. To find clerkship directors who do accept international medical students, we encourage searching via EMRA Match for Clerkships (use the Consider IMG Students filter). We would like to highlight these programs that value international medical students and consider them for rotations.

CONCLUSION

As outlined above, students from other countries face an uphill battle when applying for visiting student rotations in the U.S. EMRA is committed to easing their transition and dedicated to supporting them with resources such as EMRA Match for Clerkships, the EMRA Student-Resident Mentorship Program, various scholarships, numerous networking opportunities via EMRA committees, and more.

Please note: This report is in direct response to Resolution S'20-4 (Equal Opportunity for International Medical Students to Obtain Audition Rotations) from RepCo Spring 2020. The resolution states: "EMRA will work with relevant stakeholders to identify barriers for international medical students to obtain visiting student rotations." ✶

References available online.

EMRA @ ACEP23

EMRA programming will be held at the Philadelphia Marriott Downtown, a 2-minute walk from the Pennsylvania Convention Center. Registration is open for ACEP23 and is **NOT required** to attend EMRA programming, but it is encouraged.

Sunday, October 8

8 am – 1 pm	EMRA Medical Student Workshops
3 pm – 5 pm	EMRA Residency Program Fair supported by Laurel Road
4 pm – 6:30 pm	EMRA/ACEP Leadership Academy (Invitation Only)
7 pm – 9 pm	EMRA Leader Meet Up (Invitation Only)

Monday, October 9

11 am – 5 pm	EMRA Committee Programming
1 pm – 5 pm	EMRA Medical Student & Resident Case-Con
5 pm – 7 pm	EMRA Job & Fellowship Fair supported by Laurel Road and TeamHealth

Tuesday, October 10

7 am – 1 pm	EMRA Representative Council
9 am – 3 pm	EMRA Resident Sim Wars Competition
3 pm – 5 pm	EMRA Committee Programming
5 pm – 7 pm	20 in 6: EMRA Resident Lecture Competition supported by Hippo Education
10 pm – 2 am	EMRA Party

Wednesday, October 11

8 am – 5 pm	EMRA Committee Programming
5 pm – 7 pm	EMRA Airway Stories

Thursday, October 12

8 am – 5 pm	EMRA MedWAR supported by BTG and Elsevier

** Schedule as of 5/15/23. Dates and times are subject to change. Please check the website for the latest information.*
***All times listed are Eastern time*

Follow **@emresidents** on social media
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For a full schedule of EMRA events, visit
www.emra.org/be-involved/events--activities/acep

EMRA @
acep Scientific Assembly PHILADELPHIA, PA 23

What Every EM Resident Needs to Know About Reimbursement in 2023

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Emergency medicine residency prepares physicians to deliver compassionate, evidence-based, and up-to-date patient care in the emergency department. An additional, essential, and fundamental topic worthy of intentional time and education is the physician reimbursement process. Just as the health care landscape evolves over time, so do the intricacies and nuances of how emergency care is reimbursed.

In January 2023, policymakers launched a once-in-a-generation comprehensive overhaul and monumental pivot to how our specialty gets reimbursed. They did this by completely modernizing our documentation guidelines.

This paper highlights three aspects of EM physician reimbursement:

1. EM coding and documentation
2. Physician payment and reimbursement
3. Procedures and critical care

SECTION 1: EM CODING AND DOCUMENTATION

Documentation should serve to provide a complete account of the patient's presentation and ED course in the emergency department. In addition to providing a documented history of the patient encounter, documentation is essential for billing purposes by assigning level codes to patient care and/or procedures. These codes assigned to billing are Current Procedural Terminology, or CPT, maintained by the American Medical Association (AMA) since 1966. This code set is updated annually by an advisory committee made up of representatives from each specialty society. CPT codes describe the cognitive and procedural work emergency physicians provide during patient care.

The International Classification of Diseases 10th Edition, or ICD-10, codes are used to communicate patient diagnoses to insurance companies. These codes are different from CPT coding and serve a different purpose. While ICD-10 codes provide diagnoses, CPT codes reflect work and cognition performed by the physician to arrive at that diagnosis. Unfortunately, some payers use the discharge ICD-10 codes to limit payment for certain discharge diagnoses; however, if the emergency physician also documents their differential diagnosis, interventions, and cognitive processes to arrive at the discharge or admitting diagnoses, the CPT code used to bill for the encounter should accurately reflect the work performed.

Enacted in 1999, The Prudent Layperson (PLP) Standard established the principle of reimbursing the work done to establish a medically emergent condition and the subsequent care and treatment for this patient, regardless of the final diagnosis. The Prudent Layperson language, adopted individually by most states, defines an emergency medical condition as a medical condition manifesting itself by

References available online.

FIGURE 1

Table 2: Current 2023 RVUs for E/M Codes

Code	Description	Work RVU	Facility RVU	MP RVU	2023 Total RVUs
99281	ED Visit	0.25	0.06	0.04	0.35
99282	ED Visit	0.93	0.21	0.10	1.24
99283	ED Visit	1.60	0.35	0.18	2.13
99284	ED Visit	2.74	0.57	0.27	3.58
99285	ED Visit	4.00	0.79	0.42	5.21
99291	Critical care 1st hour	4.50	1.39	0.42	6.31
99292	Critical care add'l 30 min	2.25	0.70	0.22	3.17

Note: MP = Liability insurance, Facility = practice expense

acute symptoms of sufficient severity (including severe pain) such that a prudent layperson, who possesses an average knowledge of health and medicine, could reasonably expect the absence of immediate medical attention to result in: (a) placing the patient's health in serious jeopardy; (b) serious impairment to bodily functions; or (c) serious dysfunction of any bodily organ or part. Downcoding charts based on discharge diagnoses that are less severe than others forces the patient to decide if they truly have an emergent condition or not. That is the role of the EM physician, and forcing a patient to do so is a clear PLP standard violation.

Earlier this year, significant modifications were made to the ED evaluation and management (E/M) code set (99281-99285), which now are solely determined by the Medical Decision Making (MDM) components of your documentation. Three components are used to determine the appropriate E/M code:

(1) Complexity of Problems Addressed (COPA)
(2) Data Reviewed and Analyzed
(3) Risk of Complications and Morbidity or Mortality

The highest two scores out of the three components determine the level of CPT coding.

To learn more about the 2023 E/M documentation changes, please refer to "A Worthy Investment: What Every EM Resident Needs to Know About Reimbursement in 2023," published Feb. 22, 2023, on emresident.org.

SECTION 2: PHYSICIAN PAYMENT AND REIMBURSEMENT

In U.S. payment models, physicians can receive reimbursement through productivity measures known as the Relative Value Unit, or RVU. An RVU is the universal metric of physician effort and the building block of payment.

Each CPT E/M and procedure code is assigned a certain number of RVUs based on determinations from the Relative Value Scale Update Committee (RUC) composed of representatives from member specialties who provide recommendations to the Centers for Medicare and Medicaid Services (CMS) for the Medicare Physician Fee Schedule. ACEP holds the only permanent seat representing emergency medicine. Assigned RVU valuations reflect both the cognitive nature of patient care as well as the procedural work performed by the physician. (See **Figure 1**).

Total RVUs are calculated by taking the sum of physician work,

Example:

Level 5 RVU x Medicare 2023 CF = Total Physician Payment

5.21 x $33.89 = $176.57

EXAMPLE GRAPHIC 1

References available online.

Table 3: Procedure RVUs

Procedure	RVUs
EKG (93010)	0.24
Finger laceration: Simple 2.6 – 7.5 cm (12002)	1.75
Facial laceration: Intermediate 2.6- 5 cm (12052)	5.93
Central line placement (36556)	2.48
Chest tube placement (32551)	4.58
CPR (92950)	5.38
Shoulder dislocation reduction (23650)	9.21
Colles' fracture reduction (25605)	15.63

Compare to E/M value	RVUs
99282	1.24
99285	5.21
Critical Care	6.31

Surprises	RVUs
TMJ dislocation reduction (21480)	0.93
A-line insertion (36620)	1.31
LP (62270)	1.86
Patellar dislocation reduction (27560)	10.51

TABLE 3

practice expenses, and professional liability insurance. There also exists a Geographic Practice Cost Index (GPCI), where a cost differential exists based on practice location. Each RVU component is adjusted based on local cost index and multiplied by the Medicare Conversion Factor (CF) to determine final payment. It is important to note that RVUs increase with each increase in E/M CPT level. A formula can be used by emergency physicians to determine their productivity: RVU/Hour = RVU/Patient x Patients/hour. (See **Example Graphic 1** and **Table 2**.)

SECTION 3: PROCEDURES AND CRITICAL CARE

Most (90%) of the RVUs and reimbursement in EM come from the ED E/M codes 99281-99285. Procedures make up 9% of RVU-related reimbursement, while critical care performed by emergency physicians makes up 8% of the total RVU-related reimbursement. **Table 3** demonstrates common procedures and RVUs that emergency physicians perform.

Critical care is defined as an illness or injury that acutely impairs one or more vital organ systems with probability of imminent or life-threatening deterioration expected in the patient's condition. To bill for critical care, there must exist a suspicion that failure to initiate interventions on an urgent basis would lead to sudden, clinically significant, or life-threatening deterioration in the patient's condition. Critical care must have documentation of at least 30 minutes of service spent directly managing the patient, resuscitating the patient, reviewing laboratories and imaging, or discussing the patient's care with specialists or consultants. Critical care is the only time-based code in EM. Time spent on procedures such as CPR or intubation is separately billed and does not count toward critical care; it must be deducted from the time claimed as critical care.

HELPFUL 2023 DOCUMENTATION GUIDELINE TIPS

Did you…

1. Thoroughly and accurately document the chief complaint(s) and a detailed, complete MDM? The MDM is the most important factor in determining E/M level coding. It is essential to understand the documentation components that will allow the MDM coding to accurately reflect the work performed.
2. Document abnormal vital signs and abnormal diagnostic test results?
3. Record a medically appropriate history and physical exam?
4. Document social determinants of health (i.e., housing, food, transportation insecurity, substance abuse, etc.) and how they have significantly impacted a patient's care plan?
5. Accurately document your procedure and/or sedation note? Learn what elements are required to generate a full and complete procedure note for commonly performed procedures (for example: site, size, technique, and complexity).
6. Document your own interpretation of the ECG, monitor strip, and imaging (as your clinical skills afford)?
7. Document any and all conversations with family, consultants, or specialists?
8. Complete your charts in a timely manner?

Remember that documentation is not only used for billing, but for clinical care and medical-legal purposes as well. "Think in Ink" — If you did it, document it.

CONCLUSION

This is a limited summary to provide some introductory knowledge on how an emergency physician receives reimbursement for services and patient care provided. For further details and more information, make sure to read "A Worthy Investment: What Every EM Resident Needs to Know About Reimbursement in 2023" on emresident.org. ✶

ACKNOWLEDGEMENTS

Drs. Alexa Golden, Nicholas Cozzi, and Brian Hiestand are members of ACEP's Reimbursement Leadership Development Program. Thank you to ACEP's Reimbursement Committee as well ACEP's Coding and Nomenclature Committee for expert consultation.

To bill for critical care, there must exist a suspicion that failure to initiate interventions on an urgent basis would lead to sudden, clinically significant, or life-threatening deterioration in the patient's condition.

References available online.

Job & Fellowship Fair

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Are you a fellowship director or employer? Join us!

Contact **Heather Deja · 469.499.0167 · hdeja@emra.org**

Visit **emra.org/exhibitors/job-fellowship-fair** for more information.

Kidney Chronicles: A Pediatric Blunt Renal Trauma Case Report

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INTRODUCTION

Unintentional injury continues to be one of the major causes of morbidity and mortality in the pediatric age group, with urogenital injury occurring in 10-20% of blunt abdominal trauma cases.[1,2]

Depending on the severity, the short-term complications of renal trauma can include hemorrhage, sepsis, perinephric abscess, fistula, and urinary extravasation, and long-term consequences can include renal failure and unrelenting hypertension.[3]

Management of these patients can be intimidating and require significant interdisciplinary coordination among urologists, interventional radiologists, trauma surgeons, and intensivists. With emergency physicians often serving as the mediator in these situations, it is imperative to familiarize oneself with evidence-based guidelines, and we hope to help provide some tools in this article.

CASE

A 13-year-old male presented to our emergency department via EMS secondary to blunt trauma to the right flank in a football game resulting in severe right-sided abdominal and flank pain. While jumping, he was struck in his right side by another player's knee and then fell to the ground. He was unable to stand or ambulate on his own, but he did not lose consciousness or hit his head. There was no other trauma sustained at that time. On arrival, he was awake, alert, and oriented with 10/10 right abdominal and flank pain localized over the 11th and 12th ribs. He denied any other pain. Physical exam demonstrated hemodynamic stability and severe tenderness to palpation of the right abdomen and right flank with no overlying ecchymosis. There was no diffuse abdominal tenderness, distension, or guarding that would suggest an acute abdomen.

Given the site of injury, we had a high index of suspicion for injury to the ribs, liver, and kidney. Chest X-ray did not demonstrate rib fractures or pneumothorax. Focused Assessment with Sonography for Trauma (FAST) exam demonstrated loss of normal right kidney architecture with equivocal perinephric fluid collections with no signs of intraperitoneal fluid collection (**Figure 1**). A retroperitoneal ultrasound of the right kidney was ordered and showed an enlarged kidney with evidence of complex renal laceration and perinephric hematoma

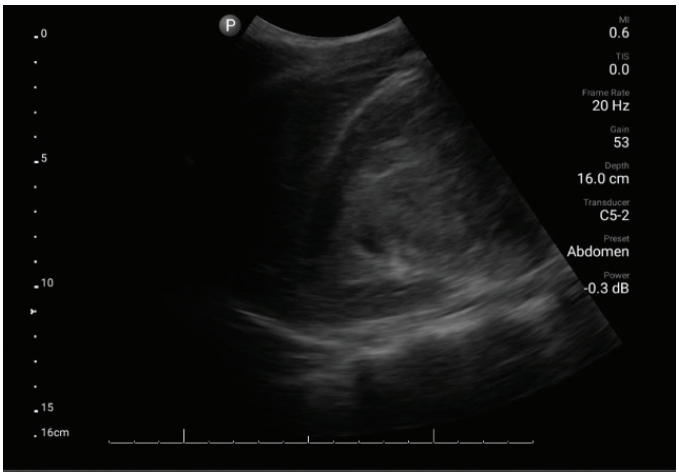


FIGURE 1: RUQ ultrasound demonstrating loss of normal renal architecture

FIGURE 2: Abdominal CT imaging showing a large right perinephric hematoma

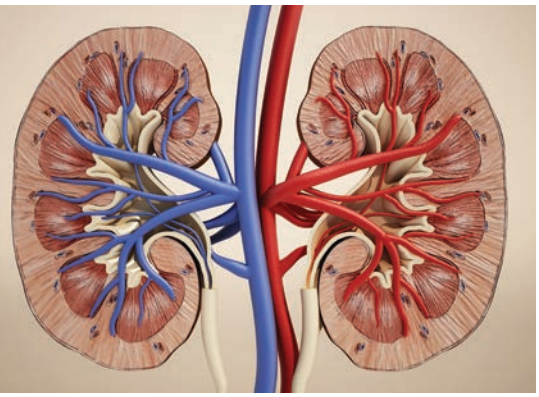
References available online.

Unintentional injury is a major cause of morbidity and mortality in the pediatric age group, with urogenital injury occurring in 10-20% of blunt abdominal trauma cases.[1,2] Depending on the severity, short-term complications of renal trauma include hemorrhage, sepsis, perinephric abscess, fistula, and urinary extravasation, and long-term consequences include renal failure and unrelenting hypertension.[3] Patient management can be intimidating, requiring coordination among urologists, interventional radiologists, trauma surgeons, and intensivists. With emergency physicians often serving as mediators, it is imperative to familiarize oneself with evidence-based guidelines, and we hope to help provide some tools in this article.

as well as minimal blood flow within the renal hilum on color Doppler. Three hours after initial presentation, a CT abdomen/pelvis with IV contrast demonstrated a grade IV/V right kidney laceration extending into the renal hilum with a large perinephric hematoma (**Figure 2**). No excreted contrast was seen outside of the renal collecting system on delayed imaging, and there was low suspicion at that time for ureteral injury.

Because of the grade IV/V renal injury, the patient was admitted to the surgical trauma intensive care (SICU) unit for close monitoring, including frequent hemoglobin checks and serial abdominal examinations. Interventional radiology recommended conservative management without embolization or drainage of the perinephric hematoma. His SICU stay was uneventful with stable hemoglobin and hemodynamics. He was discharged to the floor on day three where a repeat CTA abdomen/pelvis showed partial devascularization of the right inferior pole of the kidney as well as contrast extravasation consistent with a renal pelvis injury. Interventional radiology was again consulted for possible percutaneous nephrostomy tube placement but declined due to the risks associated with procedures on abnormal renal architecture and possible loss of tamponade effect. Urology was consulted and a right ureteral stent was placed to assist with drainage of the collecting. A third CTA abdomen/pelvis on hospitalization day eight demonstrated decreased urine extravasation, and the patient was discharged on day nine with close urology follow-up.

References available online.



DISCUSSION

There is a 10-20% incidence of urogenital trauma, with the kidney being the most commonly affected organ. Ninety percent of blunt kidney injuries are associated with high-velocity deceleration with mechanisms like major falls, motor vehicle accidents, or sports injuries.[3] Additionally, children and adolescents are more likely to suffer renal injury than adults following motor vehicle accidents.[4] The kidney's fixation only to the renal pelvis and the highly vascular pedicle makes it prone to insult, but the vast majority are minor.

As emergency physicians in both adult and pediatric settings, it is important to use an informed and standardized approach in the evaluation and treatment of a patient like the one in this case. The American Urological Association (AUA)'s guidelines for urotrauma management steered the establishment of a multidisciplinary set of recommendations from the World Society of Emergency Surgery (WSES) and the American Association for the Surgery of Trauma (AAST), involving urologists, interventional radiologists, trauma surgeons, emergency physicians, and intensivists. Expectedly, urologists and trauma surgeons can have differing priorities when choosing their ideal management in an ill patient, so this collaborative, evidence-based, published advice can help guide the team toward the best outcome for the patient and their urological organs.

PRESENTATION

Clinical examination should consider the presence of hematuria, flank/abdominal pain/contusion, rib fractures, pelvic injury, and mechanism of trauma. It is important to remember that children are more vulnerable to blunt kidney injury due to less perirenal fat, thinner abdominal muscles, lack of ossification of the rib cage, larger kidney size, and fetal kidney lobulations. Non-operative management (NOM), especially in pediatric patients, is preferred unless the patient is hemodynamically unstable or has an expanding retroperitoneal hematoma, which would prompt emergent surgery or interventional radiology consultation.[3,5,6]

EVALUATION

If the patient is hemodynamically stable, further workup must take place, including CBC, CMP, and UA. While FAST exams are effective at rapid identification of intra-abdominal free fluid, they have low sensitivity (22-67%, depending on level of expertise) in kidney trauma. Therefore, contrast-enhanced CT scan associated with delayed urographic phase is the gold standard for adults and children with deceleration mechanism of injury or hematuria with hypotension. Delayed urographic phase imaging is particularly useful in evaluating injury to the urinary collecting system.[5] For stable pediatric or pregnant patients with hematuria of <50 RBCs, ultrasound and close clinical monitoring can be used, but be aware of its limitations. CT scans showing at least two of the following criteria with high-grade injury (AAST III-V, **Figure 3**) have a high likelihood of failing NOM and requiring earlier and more aggressive intervention: contrast blush, perirenal hematoma >3.5cm, medial laceration with extravasation, and lack of contrast in the ureter. [5,6]

MANAGEMENT

NOM is the treatment of choice for all hemodynamically stable patients as it leads to higher renal preservation rate, shorter hospital stays, and comparable

American Association for Surgery of Trauma Renal Injury Scale		
Grade	**Type**	**Description**
I	Contusion	Microscopic or gross haematuria. Urological studies normal.
	Haematoma	Subcapsular, non-expanding without parenchymal laceration.
II	Haematoma	Non-expanding peri-renal haematoma confined to renal retroperitoneum.
	Laceration	< 1.0cm parenchymal depth of renal cortex with no urinary extravasation.
III	Laceration	> 1.0cm parenchymal depth of renal cortex w/out collecting system rupture or urinary extravasation.
IV	Laceration	Parenchymal laceration extending through renal cortex, medulla & collecting system.
	Vascular	Main renal artery or vein injury with contained haemorrhage.
V	Laceration	Completely shattered kidney.
	Vascular	Avulsion of renal hilum that devascularises kidney.

FIGURE 3: AAST grading criteria for renal injury

References available online.

complication rate to operative management (OM). CT image-guided classification of injury severity can help determine a stepwise approach from conservative management to minimally invasive intervention to laparotomy. It is reasonable to consider NOM in severe injuries at tertiary centers where close monitoring and immediate interventional resources are available, and it may be continued following angioembolization of injury.

In the unstable patient, treatment should include OM, and Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) can bridge to definitive procedures if necessary.

In pediatric patients, angioembolization is the first choice for intervention if resources allow, as the reported success rate and morbidity rate is 100% and 0% respectively for pseudoaneurysm or contrast medium extravasation.[5] A comprehensive algorithm from WSES/AAST can be seen in **Figure 4**.

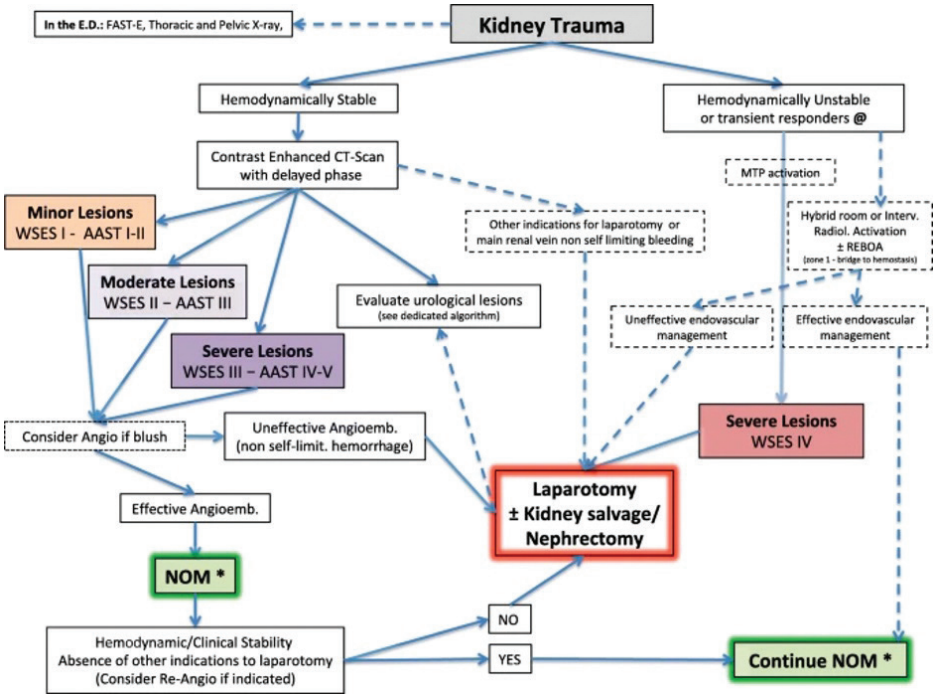


FIGURE 4: WSES/AAST algorithm for the diagnosis and management of renal trauma

OUTCOMES

Complications to blunt renal injury can be seen in the hospital setting or in follow-up visits to the emergency department. For example, renal ischemia can lead to unrelenting hypertension due to activation of renin-angiotensin-aldosterone system. In addition, secondary hemorrhage is fairly common (25% of moderate/severe injuries) and can occur within two weeks of the initial insult. A nephrectomy is required in about 4% of blunt renal injury patients and is associated with a 4.58-fold increased risk of acute kidney injury with decreased renal function.[7,8] In contrast, transarterial embolization is not a risk factor for AKI.[7] A patient can return to sports activities when microscopic hematuria is resolved, likely 2-6 weeks for mild to moderate injuries and 6-12 months for more severe injuries.

OUR PATIENT

This adolescent patient demonstrates a classic presentation of a high-grade blunt renal injury with severe flank pain and a clear mechanism of injury. It was prudent to obtain FAST imaging to assess for intraperitoneal bleeding as well as chest X-rays to assess for pneumothorax and rib fractures; however, as discussed, these modalities have low sensitivity for renal injury.

Contrasted CT imaging with delayed phase imaging would have been the best diagnostic next step, but these images were not obtained until three hours after arrival. Urology was not officially consulted until day five of admission after repeat imaging demonstrated injury to the renal pelvis. Despite the severity of the renal injury, non-operative management with close observation was the appropriate initial choice for our patient due to his hemodynamic stability. Surgical management remained conservative with no surgical interventions pursued aside from ureteral stent placement to help divert the extravasation of urine.

Our patient continued to follow-up with urology frequently after discharge. His only reported symptoms in the months after his hospitalization were infrequent crampy pain in his right flank. A repeat CT of the abdomen and pelvis with contrast one month post-discharge showed decreasing size of the right perinephric fluid collection with a devascularized right lower pole; CT imaging two months post-discharge showed complete resolution of the perinephric fluid collection. A ureteral stent was left in place until three months after initial placement, at which time it was removed uneventfully. To date, there have been no signs of persistent hypertension, and renal function has returned to baseline. Our patient has been cautioned about the risk of returning to football and the need to wear an abdominal guard if he does choose to continue playing.

In summary, the choices made in this case were in accordance with WSES/AAST guidelines and resulted in a positive patient outcome. In the future, we can improve by obtaining CT imaging with delayed phase more rapidly in hemodynamically stable patients and by facilitating an early interdisciplinary approach to patient care, including urology, trauma surgery, and interventional radiology. ✶

References available online.

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Lymphatic Malformation: A Rare Cause of Pediatric Abdominal Pain

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Department of Emergency Medicine
University of Michigan Medical Center

Congenital lymphatic malformations, also known as lymphangiomas, are benign vascular proliferations of fluid-filled channels or spaces that are thought to arise from failure of the lymphatic system to properly connect to the venous system during embryologic development.

The lymphatic system of the body is derived from the lymphatic endothelial cells on the dorsolateral side of the anterior cardinal veins during the 6th embryonic week.[1] Between the 12th and 14th weeks of gestation, lymph sacs anastomose with each other to form a lymphatic plexus, which expand and remodel into a highly branched network of capillaries, lymphatic vessels, and ducts.[1] When these sacs fail to communicate with the rest of the lymphatic system during development, the lymphatic vessels dilate and form masses as lymph accumulates.

Lymphatic malformations are typically present at birth and grow bigger with the child. This usually leads to a diagnosis in children by 5 years old, and some case series have observed a slight predominance in male children.[2-4] The malformations usually arise from the neck and axillary regions. Abdominal lymphatic malformations are rare and comprise less than 5% of all lymphatic malformations.[5] Within the abdominal cavity, these malformations can arise from solid organs (pancreas, liver,

References available online.

spleen), mesentery, retroperitoneum cavity, or gastrointestinal tract. Isolated occurrence in the small intestine mesentery is rare, accounting for less than 1% of all lymphangiomas.[5] Grossly, lymphatic malformations appear as cystic lesions with a thin-walled and smooth external surface.[3,4] The fluid in the cysts may be serous, hemorrhagic, or chylous.

Mesenteric cystic lymphangiomas are the most common type of abdominal malformations. Complications of mesenteric lymphatic malformations occur as they increase in size and include volvulus, gastrointestinal obstruction, and bowel hemorrhage.[5] Gastrointestinal tract lymphatic malformations are intramural lesions that are frequently detected incidentally on imaging or during endoscopy in adult patients.[6] Hepatic lymphatic malformations are uncommon and may be seen in isolation in older children or as a part of other systemic lymphatic malformations in early childhood. Splenic lymphatic malformations are usually subcapsular and not in intraparenchymal locations. They appear as multiple focal lesions on computed tomography (CT) and may closely resemble pseudocysts, abscesses, or neoplastic lesions. Renal lymphatic malformations are rare and usually present as focal cystic lesions on imaging.[7] Pancreatic lymphatic malformations can be located within the pancreatic parenchyma or directly attached to the pancreas by a pedicle. They may mimic pseudocysts or neuroendocrine neoplasms in children. Retroperitoneal lymphatic malformations are extremely rare and usually present in adolescents and adults.[7]

The clinical presentation varies depending on the location and size of the malformation. Most malformations are painless masses and may be incidentally found on imaging obtained to evaluate other complaints. However, the most common presentation is abdominal pain with possible palpable abdominal mass that may be tender or nontender causing a partial small bowel obstruction.[4,5,8] Symptoms suggestive of an acute abdomen including abdominal pain, abdominal distension, emesis, constipation, ascites, palpable mass, or fever.[8,9] In a case series of 21 children, the mean time between initial presentation of symptoms and diagnosis was 27 days and 10 patients presented with acute symptoms.[4] Retroperitoneal lymphatic malformations may cause ureteric obstruction and hematuria.[7]

Imaging results can suggest a diagnosis of lymphatic malformation and aid in accurate surgical planning. Lymphatic malformations appear as solid multilocular masses and often contain multiple anechoic cystic spaces on ultrasonography. Lymphangiomas may contain echogenic debris or homogeneous fluid, and ultrasonography can help differentiate lymphangiomas from simple mesenteric cysts.[10,11] On CT, multilocular lymphangiomas are septated and the fluid is usually homogenous with low attenuation values. Intravenous contrast enhances the walls and septa of the malformation.[4,10] Negative attenuation values may indicate presence of chylous fluid. Other uncommon findings on CT include hemorrhage or calcifications. Magnetic resonance imaging reveals fluid that is hypointense on T1-weighted images and hyperintense on T2-weighted images. Heterogeneous signal intensity can suggest chylous or hemorrhagic fluid.

The diagnosis is confirmed after surgical excision and histopathological evaluation. Complete surgical intervention for removal should be emergently performed if there is severe abdominal distension, volvulus, or peritonitis caused by torsion or rupture.[12] A complete resection rate of 82% has been reported in children and rarely requires partial bowel resection.[7] Elective surgery is acceptable if a child's abdominal pain cannot be managed with conservative therapy.[12] Percutaneous image-guided intralesional sclerotherapy has been shown to be effective as primary intervention in children with intra-abdominal lymphatic malformations.[13] However, it is limited to few pediatric institutions at this time, and further studies are required to evaluate for complete resolution and recurrence rates. Recurrence after resection is unlikely in children within two years and usually does not require repeat exploration.

Although lymphatic malformations are rare and usually do not manifest as acute abdomen, they should always be considered in the differential diagnosis in a previously healthy child who presents with abdominal pain and palpable mass. ✶

References available online.

Taking to the Sky: Launching an EM Resident Flight Physician Program

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INTRODUCTION

Air medical transport (AMT) is a vital component of emergency medical care in the United States. Exposure to the different aspects of EMS care is a core competency for emergency physicians, and experience with AMT can be a valuable contribution to resident education.[1]

Despite this, resident participation in AMT during residency is often brief and primarily in an observational or ride-along roll.[2,3,4] And despite the value to resident education and potential patient benefit of physicians providing care in AMT, few residency programs offer a longitudinal AMT experience. (Internationally, physician-staffed Helicopter Emergency Medical Services [HEMS] agencies are quite common, whereas in the United States, the crew model typically consists of a nurse and paramedic.[5])

In this article, we describe our experience developing a longitudinal AMT curriculum within our residency program and training new EM physicians

References available online.

to become fully independent flight physicians.

WESTERN SKIES: A CRITICAL NEED

New Mexico is the 5th largest state in the United States, yet it ranks 46th in population density.[6] University of New Mexico Hospital (UNMH) is the only Level I trauma center and academic referral center in the state. UNMH is also home to the state's only emergency medicine residency program. Given the distances patients must travel to access tertiary care, AMT is a critical component of our state's healthcare infrastructure and is a necessity for the delivery of equitable care to our rural population.

UNM Lifeguard Air Emergency Services is the AMT program of UNMH. Lifeguard operates 3 fixed-wing aircraft, 1 rotor-wing aircraft, and 1 ground ambulance. Lifeguard's primary staff consists of flight nurses, flight paramedics, and flight respiratory therapists.

Because of our altitude and hot climate, aircraft performance is limited, and weight becomes a major operational factor. As a result, physicians must replace another crew member rather than simply fly as a 3rd person. Historically our program's EMS fellows, as well as some attending physicians, have flown with Lifeguard as crew members, but residents becoming full crew members is a recent development that required considerable planning and buy-in from multiple stakeholders.

RESIDENT FLIGHT PHYSICIAN TRAINING PROGRAM

In July 2018, a resident arrived to our program with considerable prior AMT experience. He worked with the residency program director as well as the Lifeguard program director and medical director to develop a longitudinal elective in AMT. Beginning with ride-alongs during his PGY-1 year, he progressed to becoming a full crew member. His experience became the template for the UNM Resident Flight Physician Training Program.

The training program starts during the PGY-1 year. In the 2nd half of the academic year, after new residents have had time to acclimate to the clinical environment of the hospital, interested residents begin the program with 6 ride-along shifts to become familiar with how care is delivered in the AMT environment and gauge their level of interest. These shifts also serve as "interviews" in case there are more interested residents than downstream spots.

Up to 4 residents may progress to the PGY-2 phase of the program, when they take on increased roles as trainee flight crew members. During their PGY-2 flight shifts, residents act as 3rd crew members and work with senior crewmembers to provide patient care just as any other "new hire" would. Because of the aforementioned density altitude limitations, this often occurs in fixed-wing aircraft or on cooler winter days.

UNM Resident Flight Physician Training Timeline

TRAINING YEAR	FLIGHT RESIDENT REQUIREMENTS
PGY-1	• 6 orientation flights as ride-a-longs
PGY-2	• Hybrid flight ultrasound month • 2 flight shifts per month during ED months as 3rd crew member • Participation in quarterly flight crew education days
PGY-3	• 2 flight shifts per month during ED months as primary crew member • Participation in quarterly flight crew education days

Resident flight physician Mike Lauria and flight nurse Beth Beazley prepare en route to a fixed-wing mission.

Resident flight physicians Jeff Wayland (left) and Chris Root (right) resuscitate a simulated trauma patient during their final simulation exercise.

References available online.

Resident flight physician Hallie Meador restocks the aircraft after a call.

In lieu of the standard EM residency PGY-2 ultrasound rotation, flight resident trainees take on a hybrid rotation consisting of 3 days a week of ultrasound in the department, a weekly department conference 1 day per week, and two 12-hour flight shifts per week. They also do 2 flight shifts per month during each of their PGY-2 ED rotations.

Throughout the year, there is a competency-based skills training program where they are trained, evaluated, and tested on important clinical and operational skills. The 2nd-year flight experience culminates with a day of high-fidelity simulation exercises when the residents are tested in the same clinical and technical knowledge domains as Lifeguard's non-physician crew members. They are evaluated not only on clinical decision-making and resuscitation but also on the technical skills required of critical care transports teams such as the set-up of IV pumps and ventilators, patient packaging, and radio communication.

After successful completion of the culminating simulation exercises, flight residents are considered fully-qualified flight crew members.

During the PGY-3 year, flight residents will work a minimum of 2 flight shifts per month during their ED rotations. Throughout both the PGY-2 and PGY-3 years, flight residents are expected to participate in Lifeguard's quarterly education days as instructors.

BENEFITS OF FLIGHT

The priority of any emergency medicine residency should be the education and training of its residents. Any additional activities beyond standard clinical duties must add tangible value to resident learning. We feel that working as a flight physician and providing care in the AMT environment is an incredibly valuable learning experience for residents.

In the AMT environment, residents must practice critical care and resuscitation in a setting with more autonomy than what is typical in the ED or inpatient settings. Flight residents are also exposed to a broader array of patient care settings than they would typically see during their training. They will care for patients at pre-hospital scenes, in rural and under-resourced emergency departments, and quaternary referral centers in other states. This means they often must provide the same high standard of clinical care with more limited resources and personnel.

There is also tremendous benefit in the educational exchange that takes place between residents and other flight crew members; they provide valuable interdisciplinary input on patient care.

Finally, residents learn about the process of interfacility patient transport — from initial acceptance to patient arrival at the destination hospital — and develop a deeper understanding of a process they may have to initiate as a referring physician in their future careers.

Resident involvement in AMT has tangible benefits to flight crew members as well. Residents can provide additional education on some nuances of patient management and answer clinical questions about downstream management for crew members.

Residents also act as a resource in the hospital for crew members to shadow and learn from during clinical rotations. In addition, residents act as force multipliers for the program educational team. They can deliver lectures, assist in the development of crew simulations, and operate skills stations for invasive procedures.

Resident involvement in AMT also opens a significant avenue for research collaboration. Having direct involvement with the clinical operations of an AMT program allows residents to formulate and investigate relevant clinical questions. Residents in our program have collaborated with flight crew on poster presentations, case reports, review articles, and original investigations published in peer-reviewed journals.[7,8]

POTENTIAL BARRIERS

As with any changes to an existing curriculum, there are several potential barriers to creating a resident flight program that should be anticipated and proactively addressed. Residency leadership must understand the benefit to resident education that flight offers. It must also be made clear that flight time will not negatively impact resident rest and wellness or lead to duty-hour violations. Of course, there is an inherent risk to flight that must be considered as well.

From the perspective of the flight

References available online.

program, the addition of resident physicians must be done deliberately and with consistent input from program leadership and flight crews. Flight resident trainees have a high level of clinical knowledge, but they may have minimal prehospital care experience. It is essential that full-time crew members see the physicians as good partners. We believe that resident flight physicians must be held to the same educational standard as full-time nurses and paramedics and must demonstrate competency in all mission aspects including charting, cleaning, restocking, and pharmacy management. Because flight residents replace other full-time staff, there is a risk that residents are seen as threatening available hours. To this end, our physicians commit to collectively filling one full-time equivalent (FTE) position in the hospital flight program. This translates to 9 shifts per month staffed with a physician at PGY-3, fellow, or attending level. Additional shifts may be worked if there are schedule openings, which is often the case.

As the flight program develops, leadership should also anticipate increasing resident interest in flight and be prepared for a surplus of interested residents compared to available positions. Ideally, any interested resident would be able to have a robust flight experience, but the staffing needs of the flight program or the residency program may not allow for that.

CONCLUSION

Resident involvement in AMT can lead to significant mutual benefit for residents, residency programs, and flight programs. Residents are able to gain unique clinical experiences and broaden their understanding of AMT and the diversity of care settings in their geographic area. Residency programs in turn benefit from the experiences of their residents. Flight programs that add resident physicians to their staff gain an enthusiastic and knowledgeable group of new physicians who can augment the organization's educational and clinical capabilities.

Starting a resident flight program requires careful planning and significant coordination of stakeholders, but the end result is an outstanding clinical experience for clinicians and patients alike. ✶

The authors would like to thank the amazing faculty and residents at University of Wisconsin MedFlight and University of Cincinnati AirCare for their support and help starting the resident flight program at University of New Mexico Lifeguard. Their willingness to share lessons learned, best practices, and educational material was invaluable in getting our program off the ground.

References available online.

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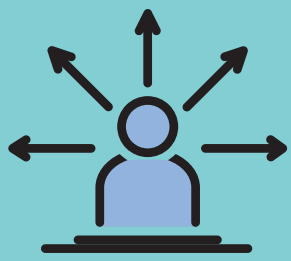

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ADVANCING EMERGENCY CARE

Intracranial Hemorrhage in a Postpartum Patient Secondary to Preeclampsia and HELLP

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INTRODUCTION

For emergency physicians, intracranial hemorrhage (ICH) is always at the top of the differential when a patient presents with altered mental status. Although uncommon, the relative risk of ICH during pregnancy and up to five weeks postpartum is 5.6 times higher than in nonpregnant women and carries an in-hospital mortality rate of 20%.[1,2]

We present a case of a woman of advanced maternal age who presented with altered mental status at 10 days postpartum. She was subsequently diagnosed with intracranial hemorrhage secondary to both preeclampsia and HELLP (hemolysis, elevated liver enzymes, and low platelets) syndrome.

CASE REPORT

The previously healthy 44-year-old Black patient, G5P4014, presented to the ED for altered mental status 10 days postpartum from a spontaneous vaginal delivery. According to her partner, she began experiencing a sudden onset headache about an hour prior to arrival. The partner denied any triggers, including recent trauma. Prior medical records from her last delivery indicated that the patient had an unremarkable prenatal course and an uncomplicated vaginal delivery. Her records did not indicate any antihypertensive or anticoagulant use.

Triage vitals were significant for a blood pressure of 202/113 mmHg, respiratory rate of 30 bpm, heart rate of 44 bpm, rectal temperature 36.8 degrees Celsius, and oxygen saturation 99% on room air. On initial examination, the patient was somnolent, eyes opened to command, withdrew from pain, no comprehensible speech. There were no obvious signs of trauma.

Given the vital signs and clinical presentation, the patient was sent immediately to CT imaging to evaluate

References available online.

for intracranial injury. Initial imaging (**Figure 1**) revealed bilateral frontal intraparenchymal hematomas, small bilateral frontal subarachnoid hemorrhages, and moderate right and mild left intraventricular hemorrhage in the lateral ventricles. Laboratory workup revealed: WBC 8.0 K/mm3; Hgb 8.4 g/dL; Hct 23.2%; Plt 70 K/mm3; AST 95 IU/L; ALT 55 IU/L; T. Bili 1.8 mg/dl; and LDH 904 IU/L. Coagulation studies were as followed: aPTT 27.4 and PT/INR 22.7/1.3. Urinalysis revealed 3+ proteinuria.

After imaging, the patient became increasingly altered and minimally responsive to pain, requiring intubation for airway protection. Her blood pressure continued to remain elevated, with systolic blood pressures in the 190s mmHg. Propofol, midazolam, magnesium, and nicardipine infusions were started, with improvement in blood pressure to systolic blood pressure to the 140s mmHg. Additionally, the patient was given levetiracetam for seizure prophylaxis and mannitol to reduce intracranial pressure.

Neurosurgery was consulted at a nearby tertiary care center. Our patient was subsequently transferred and upon arrival had emergent bifrontal craniectomy for evacuation of hematoma and bilateral external ventricular drain placement.

After neurosurgical intervention, the patient continued to require ICU level care. On hospital day 10, the patient aspirated and was subsequently diagnosed with right-sided aspiration pneumonia. During this time, she became septic, required vasopressor support, and was started on piperacillin-tazobactam. On hospital day 16, she underwent tracheostomy and PEG tube placement. On hospital day 17, sedation was weaned off, but the patient had little improvement in neurocognitive status. On hospital day 30, the patient was transferred to a long-term care facility for continued ventilatory weaning and monitoring of neurological status. At the time of article submission, she remained at a similar neurological status: able to open eyes to voice but unable to move extremities.

DISCUSSION

ICH is a rare pregnancy complication but an important cause of maternal mortality and is greatest up to 12 weeks postpartum.[2] Significant risk factors for pregnancy-related ICH include advanced maternal age, Black race, preeclampsia, and coagulopathy such as HELLP syndrome.[3,4,5]

Preeclampsia is characterized by hypertension, proteinuria, and edema after 20 weeks gestation.[6] The incidence of preeclampsia in the United States is approximately 5% of singleton pregnancies.[7] Postpartum preeclampsia can be defined as signs and symptoms of the disease more than 2 days, but fewer than 6 weeks, after birth.[8] In a retrospective study, 63% of patients who had late onset postpartum preeclampsia had no diagnosis of hypertensive disease in their current pregnancy, similar to our patient.[8] The presenting symptoms are commonly nonspecific and require a high clinical suspicion. Symptoms include persistent or severe headache, visual disturbances, abdominal pain, altered mental status, and new onset shortness of breath.[9]

HELLP syndrome is characterized by hemolysis, elevated liver enzymes, and low platelets.[10] Although it may be a form of preeclampsia, it can present as a separate pathology given that up to 20% of patients with HELLP do not have hypertension or proteinuria.11 The pathophysiology of HELLP is multifactorial and has similar risk factors to preeclampsia.[11]

CASE MANAGEMENT

Our initial differential for our patient included infectious etiologies such as meningitis or encephalitis, hemorrhagic or ischemic stroke, cerebral venous thrombosis, status epilepticus, and carotid artery dissection. As our patient was 10 days postpartum, preeclampsia with severe features became the more likely diagnosis.

Our patient had an unremarkable prenatal course, but she met multiple risk factors for developing both preeclampsia and HELLP syndrome, including advanced maternal age and

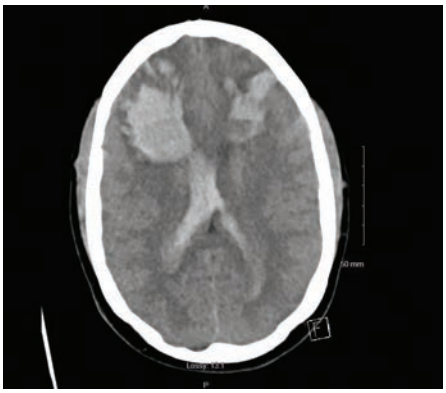

FIGURE 1

Black race. Based on her presentation and laboratory findings, we suspected she developed postpartum preeclampsia, which made her more susceptible to ICH because of her acquired coagulopathy from HELLP syndrome. Unfortunately, our patient's initial triage vitals demonstrated Cushing's triad: bradycardia, hypertension, and irregular respirations as a result of increased intracranial pressure due to significant intracranial hemorrhage.

Women who experience pregnancy-related ICH are 85 times more likely to die compared to women who do not experience pregnancy-related ICH.[2] The goal of ICH management is early recognition to prevent neurological decline and long-term neurological deficits. Management in the emergency department includes immediate head imaging, rapid reduction in blood pressure, and frequent neurological assessments to monitor mental status and airway protection. Ultimately, management requires multidisciplinary collaboration with neurology, neurosurgery, and intensive care, which may mean transferring the patient to an appropriate care facility.

Our case report supports the importance of maintaining a high clinical suspicion for intracranial hemorrhage when a postpartum female presents to the emergency department with acute neurological symptoms. Prompt recognition and management are cornerstones for the patient's best neurological outcome. ✶

References available online.

Medical Direction in EMS: Get the Doc on the Line!

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Medical direction is a growing subspecialty within the world of emergency medicine and emergency medical services (EMS). A physician, who serves as medical director, guides or "directs" emergency medical technicians and paramedics as they provide prehospital care to patients. EMTs and paramedics must work under the guidance of the medical director.

HISTORICAL PERSPECTIVE

The history of physicians in EMS has evolved over the decades, but the goal has remained the same: to guide EMTs and paramedics in the prehospital care of sick and injured patients through direct and indirect control aspects of medical direction.

In the early days of EMS in the 1960s and 1970s, there was little medical direction other than a handful of physicians pioneering the role.[1] Two legislative acts were key in the development of EMS. First, the Highway Safety Act of 1966 created the National Highway Traffic Safety Administration (NHTSA), which was charged with developing EMS systems, training, and funding for state-level EMS agencies. And second, the EMS System Act of 1973 allocated federal funding to create EMS systems and training programs. One of the components listed in the EMS system was medical direction.

In 1982, ACEP released a position statement regarding the medical direction of prehospital EMS.[2] It outlined the requirements of medical direction and initiated the ideas of direct and indirect control (discussed later). However, it was not until 1985, with the development of the National Association of EMS Physicians (NAEMSP), that the importance of the physician in EMS was

References available online.

The field of EMS — and alongside it, the role of the EMS physician — is growing each year. Thanks to this rapid growth in the past few decades, the idea of medical direction is evolving and developing well beyond its humble beginnings, though much advancement is still possible.

truly recognized.[1]

Since then, there have been several iterations of position statements released by ACEP regarding the physician medical director's role in EMS. Most recently, in 2017, ACEP established a list of 15 principles reaffirming its commitment to physician medical directors and their leadership of EMS.[3] Some of these principles include the active direction and oversight of general operations, credentialing programs, quality improvement programs, evidence-based education development, and promotion of EMS research initiatives.

Another advancement for the physician medical director is the recognition of EMS as a subspecialty within EM and the formalization of EMS fellowship programs beginning in 2010 with examinations beginning in 2013.[4] Not only are EMS physicians involved in the medical direction of EMS agencies, but they are also involved in the initial education of prehospital providers. From the beginning of formal EMS education, physicians have been involved with medical oversight. Since 1978, EMS education programs seeking accreditation are required to have a medical director in place. While medical directors are not required to be emergency physicians, they must have adequate training and experience in prehospital care. The NAEMSP has recognized that an EMS board-certified physician is best prepared to meet the expectations of an EMS medical director.[5]

However, as of 2022, no state requires EMS board certification, and only 8% of states require board certification in emergency medicine.[6] While ACEP provides a position statement on the roles and responsibilities of the EMS physician, the ultimate decision on specific job descriptions is determined by the state where the physician works, as well as by the individual EMS agency through contractual agreements.

DIRECT VS. INDIRECT CONTROL

Several levels of medical oversight are generally included in all EMS systems under the headings of direct and indirect control.

Direct control includes online direction, active participation in protocol and guideline development, and working alongside personnel as a prehospital provider. Online direction is the ability for immediate consultation for specific procedures, medications, or other orders, and may not be provided by the agency's specified EMS physician but rather by a physician at a designated facility. Direct control may also be implemented in the form of an EMS physician on scene providing direct patient care alongside prehospital providers.

Indirect control includes offline direction and administrative responsibilities. Offline medical direction is generally in the form of protocols and standing orders.

The EMS physician may assume other roles as part of the incident command system at large-scale incidents as well as in education, prehospital provider support, and performance improvement.[7] While there has been minimal research on how much involvement the EMS physician should have in the EMS system, several studies have shown that active involvement in EMS education, continuing education, oversight, skills training, and case review has a positive impact on prehospital provider satisfaction and patient care.[8,9,10]

IMPORTANCE OF PRESENCE

Medical direction not only has written and verbal components, but also presence and visual aspects. Medical directors should be available, accountable, and on the frontlines with their EMS crews. Crews need their physicians as leaders to help guide them toward best practices for jurisdiction and population. EMTs and paramedics respond positively to leaders who work with them on calls, in stations, and at hospitals. Medical directors who only appear when something is amiss are perceived as disciplinarians rather than teachers or mentors, which may lead to mistrust or apprehension; this negative association may cause crews to avoid their director. The goal should be open communication, as this has been shown to increase responders' training levels and ultimately improve prehospital patient care.

A 2000 study at the University of Maryland showed medical directors had 100% involvement in instances of deviation from protocols, which is certainly required, but significantly less involvement in dispatch, system evaluation, and other vital aspects of their EMS systems, which strays from national guidelines.[11] All physicians in the EMS agency are held accountable for providing both online and offline medical direction to their crews.[12] This guidance is supported by an active quality assurance program and allows crews to work more autonomously for most cases by providing the minimum standard, or higher quality, of care.

Medical directors must support their first-response teams when skills and knowledge are questioned by the public, fellow first responders, and hospital staff. Appropriate oversight, education, practice, and remediation will build confidence between medical directors and their first responders.[13] One study by Studnek et al. quantified the amount of interaction EMS personnel nationwide had with medical directors. More than a third of respondents reported not having any contact with their medical

References available online.

directors within the past 6 months. Medical director involvement varies based on the EMS agency's size, type, and setting (urban, rural, etc.).[14] Medical director involvement, when provided consistently and appropriately, can be a powerful force that strengthens EMTs and paramedics.

GROWTH AND FUTURE PROSPECTS

The field of EMS — and alongside it, the role of the EMS physician — is growing each year. Thanks to this rapid growth in the past few decades, the idea of medical direction is evolving and developing well beyond its humble beginnings, though much advancement is still possible.

A 2022 study at Penn State University reviewed all EMS fellowship programs in the U.S. since they were first created in 2010.[15] Their systems and curriculums varied widely, and the outcome of those variations is unknown. Researchers suggested that programs share resources to allow fellows nationwide to have similar experience and training. More research is needed to better identify traits that have the most impact on high-quality medical direction. Individualized system-wide review is also needed to parse out the most effective and efficient means of medical direction for each agency.

The ultimate goal — improving the level and quality of care by prehospital providers — can be achieved through active and continuous involvement with EMS agencies and advancement of the scope of medical direction. ✶

TAKE-HOME POINTS

- Medical direction is a growing subspecialty within EM and more important than ever as prehospital care continues to increase and expand.
- A major responsibility of the EMS physician is medical direction of EMS agencies. This includes both direct and indirect control.
- Active and ongoing engagement with EMS agencies and positive interactions with personnel are keys to successful medical direction, which leads to improved personnel satisfaction and higher quality of patient care.
- Participation only to resolve issues or complaints can build a bad relationship and create negative feelings toward the EMS physician.
- Medical director involvement can be a powerful force that strengthens personnel within a system when provided consistently and appropriately.

References available online.

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Intussusception: Intestinal Obstruction in the Pediatric Patient

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Intussusception is the most common cause of intestinal obstruction in infants and children. Although traditional teaching revolves around the "classic triad" of paroxysmal abdominal pain, bloody stool, and vomiting, the presenting symptoms often vary, which can make intussusception a diagnostic challenge.

CASE PRESENTATION

A previously healthy, fully vaccinated 2.5-month-old female born at full gestation presented to the emergency department with hematochezia and bilious emesis. She had presented four days prior to the ED with fussiness. At that time, she was initially inconsolable, but had improved with resolution of her fussiness by the time of discharge. Since discharge, her fussiness had worsened, and she became increasingly lethargic. She was noted to have had decreased oral intake and had not tolerated a full feed in three days.

On the day of presentation, she had multiple episodes of "ninja turtle emesis" as well as multiple episodes of bright red blood per rectum. The child had not had fevers, recent travel, antibiotic exposure, constipation, or diarrhea. Triage vitals were within normal ranges. On exam, she was pale and lethargic with intermittent episodes of crying. She had dry mucous membranes, a distended abdomen without any palpable masses, and had a soiled diaper with blood but no stool.

Given the concern for intestinal obstruction and her overall ill appearance, medical resuscitation efforts were started immediately and calls to transfer to the nearest pediatric acute care hospital were initiated, including notifying the pediatric surgical team. After an IV was established, a 20 mL/kg bolus of crystalloid was administered and labs were sent, which were unremarkable. A nasogastric (NG) tube was ordered, but the appropriate size was unavailable immediately. Plain radiographs of the abdomen were obtained and were notable for dilated loops of bowel without evidence of free air. The transfer team arrived before abdominal ultrasound could be obtained. Upon arrival to the closest children's hospital, a bedside point-of-care

References available online.

ultrasound identified an intussuscepted bowel in the pattern of a target sign as distal as the left upper-quadrant. The on-call radiologist confirmed ileocolic intussusception on formal abdominal ultrasound.

DISCUSSION

Intussusception is the most common cause of intestinal obstruction in infants and children between the ages of 3 months to 6 years but typically occurs between 6 to 36 months.[1] It can, however, occur in older children and, rarely, in adults. It is a life-threatening illness resulting from one part of the intestine telescoping into another, causing bowel obstruction that can lead to ischemia and, ultimately, bowel necrosis and peritonitis. In most cases, the cause is unknown, but some patients have an identified lead point such as a polyp or tumor. Viral infections may also be responsible for some cases. There is a slight male predominance for the illness. With early diagnosis, appropriate fluid resuscitation, and immediate therapy, the mortality rate in children is less than 1%. However, if left untreated, the condition is often fata.[2]

Because of the patient's age, we considered alternative causes of her presentation, including other obstructive processes (i.e., malrotation, volvulus, Hirschsprung's disease, and necrotizing enterocolitis). Pyloric stenosis was briefly considered, but given that symptoms typically present within the first 3-6 weeks of life and usually without stool changes, this diagnosis was unlikely.

The classic triad that is often described for intussusception includes colicky abdominal pain, currant-jelly stools, and vomiting or a palpable sausage-like mass. All three symptoms, though, are present in fewer than 25% of cases.[3]

Pain in intussusception is colicky,

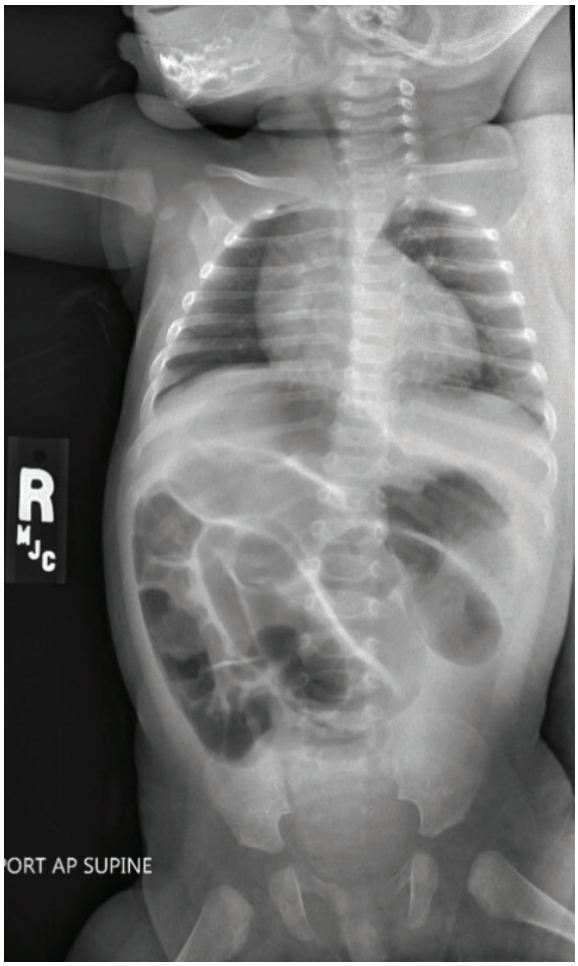

FIGURE 1: Abdominal X-ray demonstrating multiple dilated loops of bowel

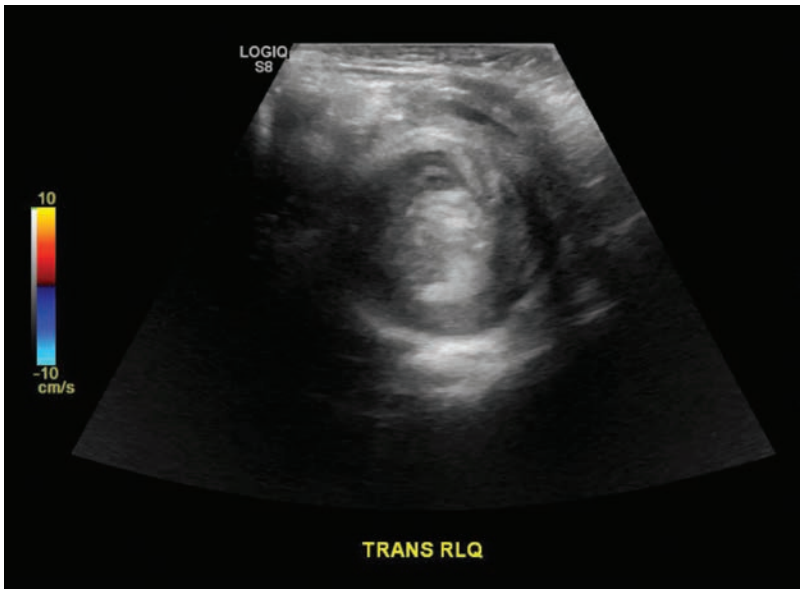

FIGURE 2: Abdominal ultrasound showing a "target" sign most consistent with an ileocolic intussusception

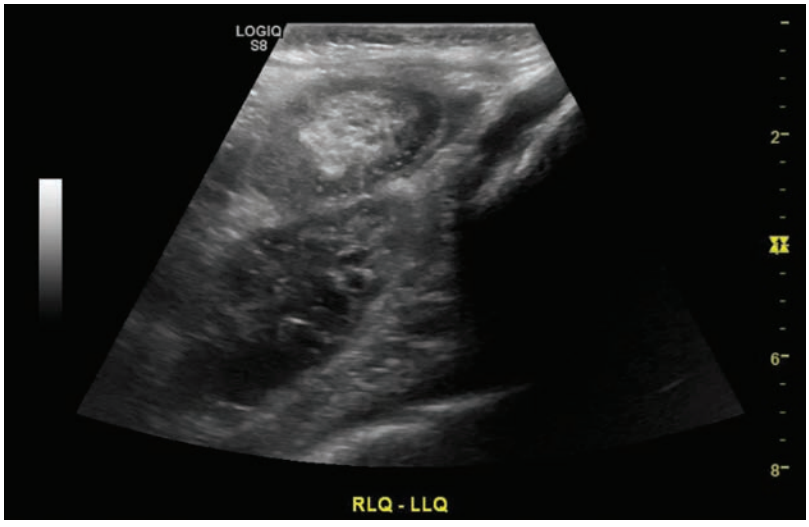

FIGURE 3: "Pseudokidney" sign on abdominal ultrasound also diagnostic of an ileocolic intussusception

References available online.

severe, and intermittent. Initially, vomiting is nonbilious but in later stages becomes bilious. Parents may report stools that look like currant jelly; these stools are a mixture of mucus, sloughed mucosa, and blood. Diarrhea can be an early sign of intussusception. Lethargy may be the sole presenting symptom in young infants and can make the diagnosis challenging, thus requiring one to have a high index of clinical suspicion.

The exam can be challenging, and the most frequent presentation is a child with intermittent episodes of fussiness during which they are not consolable. Patients are often seen drawing their legs up to the abdomen with periods of relief in between attacks. There may be a palpable right hypochondrium sausage-shaped mass, but this is a rare finding, and its absence does not exclude the diagnosis. Abdominal guarding may be present during acute episodes of intussusception. Further adding to difficulty in evaluation is that intussusception may spontaneously reduce only to recur soon afterwards. Consider the diagnosis in the young child who has intermittent episodes of extreme irritability. Be aware that a child with a later presentation may present with altered mental status. In addition, assessment of hydration status is critical in these patients.

Laboratory investigation is usually non-specific; with persistent vomiting, dehydration and electrolyte derangements may be present. If present, leukocytosis or acidosis may suggest bowel injury, necrosis, or perforation. Plain abdominal radiography may show signs of intestinal obstruction and free air if complicated by perforated viscus. However, ultrasonographic imaging is the diagnostic modality of choice and will demonstrate the "target" and "pseudokidney" signs.[4] Point-of-care ultrasound has shown very high sensitivity in identifying acute intussusception and should be considered if available.[5]

INITIAL MANAGEMENT

Vascular access, fluid resuscitation, NG tube placement for decompression, and prompt surgical consultation should take place concurrently with radiologic consultation. Nonoperative reduction is first-line therapy. A water soluble or an air contrast enema will definitively diagnose intussusception and is frequently curative.[6]

Surgery may be indicated when nonoperative reduction is incomplete or the patient has a perforation or peritonitis. Perforation is a risk of reduction by enema, and surgical specialists are often at bedside or immediately available for operative intervention if this occurs.

Patients generally have good outcomes, and recent data has shown that most patients can be safely discharged from the ED following reduction after a brief period of observation. There is no evidence for a difference in the rate of complications between patients who are observed in the ED versus admitted following enema reduction of an ileocolic intussusception.

Though the rate of recurrence is low, parents should be educated on recurrent symptoms and the importance of returning to the ED, while physicians should assess the family's local resources and ability to return to the ED if needed. When assessing which patients may be better suited for admission, those who are clinically dehydrated, unstable, or had a complicated reduction should be given greater consideration for hospital admission and serial reassessment.[7,8]

CASE CONCLUSION

Pediatric surgery evaluated the patient, and she was taken urgently for nonoperative reduction with an air contrast enema performed by the pediatric radiologist. The reduction was noted to be difficult due to the degree of bowel involved, but it was ultimately successful. Following reduction, the patient was admitted for inpatient observation without further complication and discharged on hospital day 2. On follow-up with her pediatrician, the patient has been doing well, tolerating feedings, and has made expected growth for her age. ✶

References available online.

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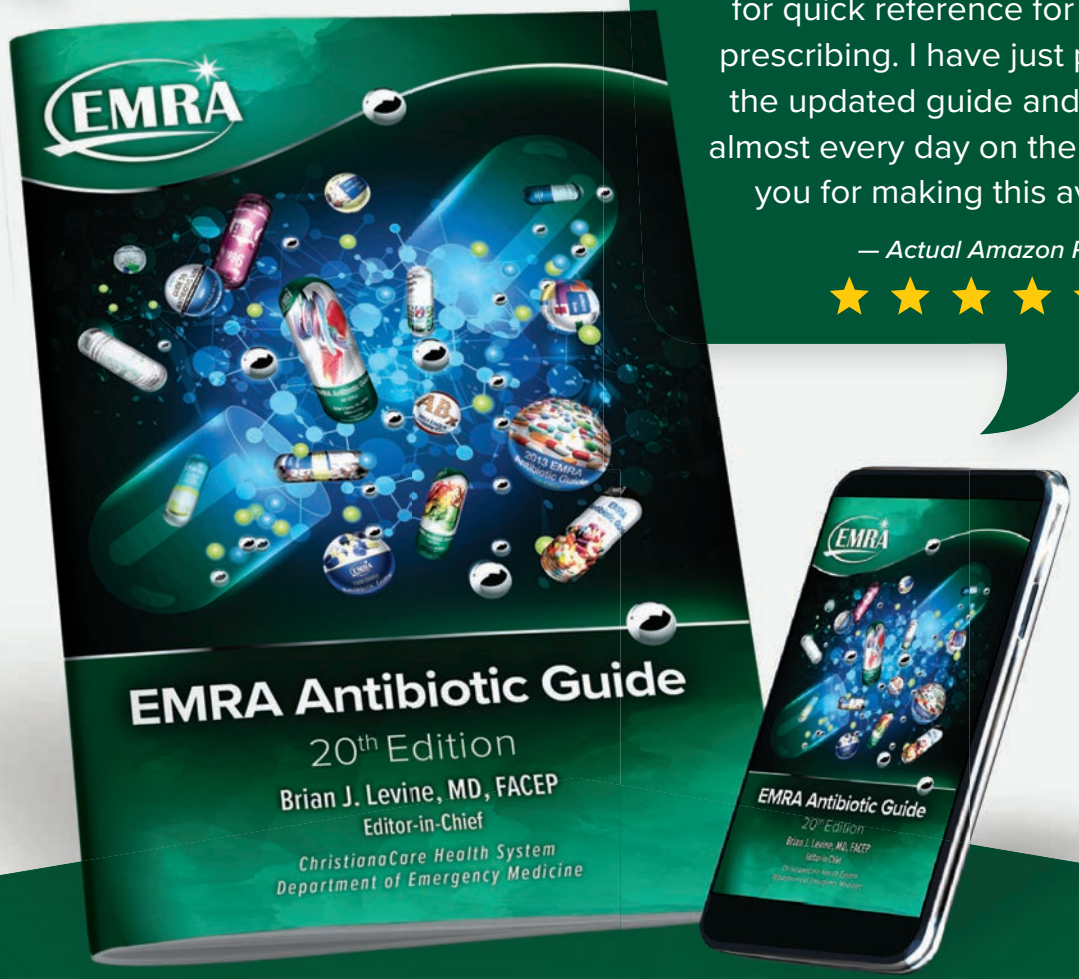

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Effective Interventions to Improve the ED Consultation Process

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INTRODUCTION

Two of the most significant administrative issues presently faced in the emergency department are long lengths of stay (LOS) and extensive waiting times. A major contributor to these issues is the consultation process. Patients whose workup is otherwise complete, and are simply waiting for disposition recommendations from consulting services or admitting teams, are occupying beds that could be used by other patients.

Recently, Voaklander et al. published a systematic review of interventions aimed at improving the consultation process in the ED.[1] Using this review as a starting point, we highlight effective interventions that have been shown to improve the consultation process in EDs across the United States.

REVIEW OF THE LITERATURE

Policies and Metrics Approach

A cost-efficient approach to improving the consultation process involves setting a time-based standard that specialists are required to meet. This type of approach requires buy-in from ED and consulting services' leadership, as it relies heavily on their support and reinforcement of the policies and adherence to metrics.

One group instituted a hospital-wide guideline stating that the admitting or consultation service must evaluate the patient in the ED within 30 minutes of the admit or consultation order being placed and reach a disposition decision within an additional 60 minutes.[2] This policy was reinforced by weekly metric reports to administrators and chairs.[2]

Response times before and after the new guideline showed significant reductions in disposition time by 21 minutes and in LOS by 18 minutes.[2] However, likely due to the consultants' attention being turned to adhering to the new guidelines, during the study period patients were discharged from the in-patient setting a statistically significant 50 minutes later.[2] This is a reminder that an ED-focused intervention may have unintended consequences when the same group of physicians are tasked with two different but equally important responsibilities.

Another group conducted a quality improvement project consisting of emailing performance metrics to the ED chair, ED vice chair, and the chief of acute care surgery on patients requiring surgical consultation.[3] Leadership received information daily regarding the amount of time to respond to the consult order, time until recommendation, and time to final disposition.[3] The hospital was able to significantly decrease LOS by almost one hour and decrease time to consultation by 25 minutes.[3]

Team-Based Approach

Team-based approaches are particularly effective if they target a patient population that has two separate types of needs, such as psychiatric patients who often need medical clearance and psychiatric evaluation. Collaborating with the psychiatric service to form different patient management frameworks or teams can be an effective approach to decreasing LOS for this patient population.

One study used a co-management approach between the emergency physician and the psychiatrist on the consultation service, who completely assumed care of the patient after a consult order was placed.[4] Once the patient was medically cleared, the psychiatrist was immediately able to start managing the patient, instead of strictly being a consultant as they were in the pre-intervention phase.[4] This team-based strategy resulted in a 22% decrease in LOS.4 The time to medical clearance did not change between the study periods, indicating that the co-management model significantly decreased the psychiatry portion of the visit.[4] Despite improvement in LOS, the study did not find improvement in surrogate markers for improved patient throughput, namely the number of patients who left without being seen and hours on ambulance diversion.[4]

Another study utilized a specialized team consisting of a child psychiatrist and a mental health social worker who was solely responsible for ED consults.[5] This team would also initiate family therapy in the ED and follow up with them while in-patient.[5] This intervention resulted in a significant decrease in LOS of 27% and in the number of patients admitted to a psychiatric facility.[5] The second finding was likely related to the initiation of therapy in the ED, which would not have been possible without a dedicated ED-based team.

Admission Process Interventions

To decrease time between an ED disposition and placed orders, numerous research teams have attempted to implement different strategies targeting the admission process.

At one institution, for patients suspected of acute appendicitis or acute cholecystitis, the acute care surgery team would directly admit patients to their observation unit if all criteria on a checklist completed by the ED provider

References available online.

ED overcrowding correlates with higher mortality, longer time to treatment, and more patients leaving against medical advice or without being seen. Improving the consultation process and decreasing lengths of stay can improve patient flow. Ultimately, increasing the throughput of patients will help decrease ED crowding. This review highlights a variety of successful strategies focusing on different aspects of the consultation process that can be implemented within the U.S. health care system.

was met.[6] This process resulted in decreasing LOS by half.[6] Although the process itself was successful in reducing LOS, only about a quarter of both acute appendicitis and acute cholecystitis patients met the criteria and were eligible for this unique pathway.[6]

One group created an ED admission holding order set and protocol that replaced the typical process of waiting for a consult to be completed prior to the ED receiving admission orders.[7] The ED admission holding order set included a consult order to let the admitting team know about the patient, a verbal sign-out of the patient, a bed request, and orders including medications, diagnostics, diet, activity, and code status.[7] If the admitting team disagreed with the ED team during the verbal sign-out, the admitting team needed to evaluate the patient within 30 minutes.[7]

The addition of this order set decreased LOS by 22% and time between the ED decision to admit and the physical departure from the ED by 57%.[7] However, there was a 14% increase in time from patient registration to ED disposition, which perhaps indicates that patients received more comprehensive evaluations in the ED during the intervention phase.[7]

Another team established a direct admission pathway from the ED to ICU for critical trauma patients not immediately receiving operative intervention.[8] The ED LOS for patients in this rapid admission pathway was 1.54 hours — significantly less than the 5.88 hours via the traditional pathway.[8] Although patients in the rapid admission group had significantly higher Injury Severity Scores and significantly lower Glasgow Coma Scale scores, there was no significant increase in mortality between the rapid and traditional admission protocols.[8]

Through a collaboration with the

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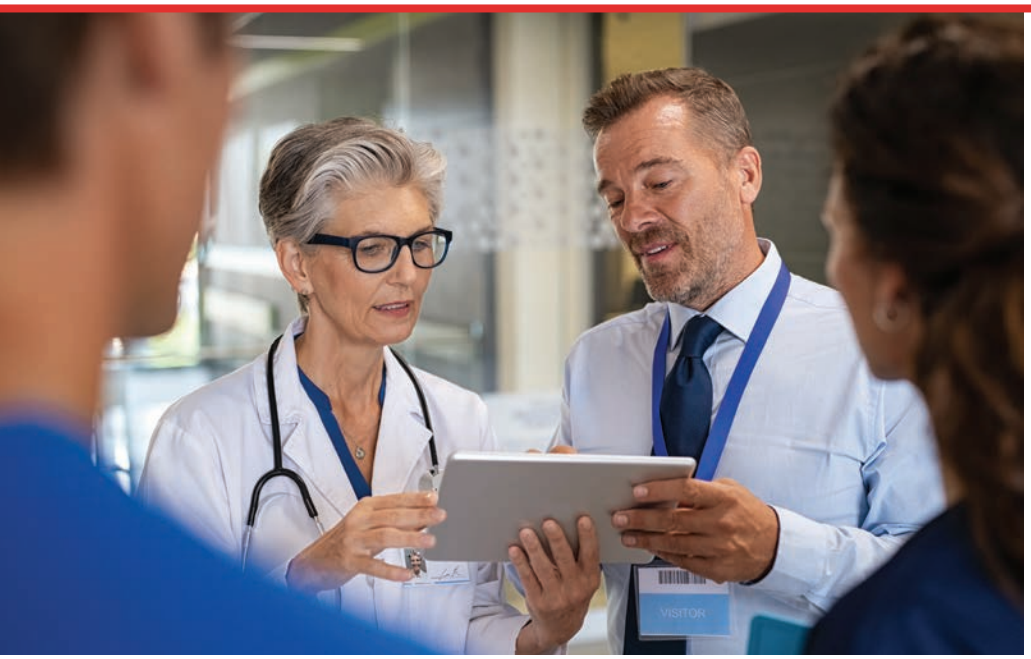

internal medicine service, a streamlined admission process was implemented where the ED provider could send stable patients to open inpatient beds after presenting the case to the admitting team.[9] This process bypassed the need for the admitting team to see the patient in the ED and for all testing to be finished prior to admission.[9] This intervention resulted in a decreased ED LOS of only 10.1 minutes.[9] This intervention was likely limited by the small amount of pathologies that can be admitted prior to all of the diagnostics being completed.

DISCUSSION

Improving the consultation process and decreasing LOS can improve patient flow. Ultimately, increasing the throughput of patients will help decrease ED crowding. One review found that overcrowding in the ED correlated with higher mortality, increased time to treatment, and increased rate of patients leaving against medical advice or without being seen.[10]

Interventions involving collaborations between the ED and admitting services seem to be particularly effective and would likely be practical at many institutions. Additionally, an expedited admission process where diagnostic testing is not required for patients requiring ICU admission (such as those who are mechanically ventilated) would likely be feasible and decrease ED LOS. This review highlights a variety of successful strategies focusing on different aspects of the consultation process that can be implemented within the U.S. health care system. ✶

References available online.

Aortic Occlusion: A Rare Presentation of Back Pain

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INTRODUCTION

Back pain is one of the most common chief complaints in the emergency department. It is estimated that between 2002 and 2016, back pain was the primary complaint of 4.4% of all ED visits.[1] Additionally, 84% of all adults will have lower back pain at some point of their lives that can be acute (less than four weeks' duration), subacute (four to 12 weeks' duration), and chronic (greater than 12 weeks' duration). More than 85% of these patients will have nonspecific musculoskeletal pain that can be treated with conservative management and multimodal analgesia.[2]

However, not all back pain is simple lumbago, and as emergency physicians, it is crucial to be aware of more insidious causes of back pain and to be able to recognize red flag characteristics that, if overlooked, can lead to dire consequences.

Red flag historical features include pain greater than 6 weeks, history of trauma or intravenous drug use, and pain at night. Concerning symptoms include urinary retention, fecal incontinence, and saddle anesthesia. Frequently discussed "can't-miss diagnoses" include cauda equina syndrome, conus medullaris, malignancy, and spinal epidural abscesses. However, in the evaluation of an undifferentiated patient in the ED, we must keep a wide differential.

Our case highlights a rare presentation of acute back pain.

CASE

An 80-year-old female with a past medical history of multinodular goiter status post partial thyroidectomy, hypothyroidism, obesity, hypertension, hyperlipidemia, coronary artery disease, and supraventricular tachycardia presented to the ED for evaluation of back pain onset one hour prior to arrival. Earlier that morning, she was bending down to feed her cat and as she was getting up, she developed paresthesias originating in her lower back radiating down to her bilateral lower extremities that was worse with movement. She also reported associated numbness. Recent outpatient workup for chronic lower back pain with MRI demonstrated findings significant for a synovial cyst localized at the L5 vertebral body.

On review of systems, the patient denied intravenous drug use, weight

References available online.

FIGURE 1: Ultrasound of right CFA

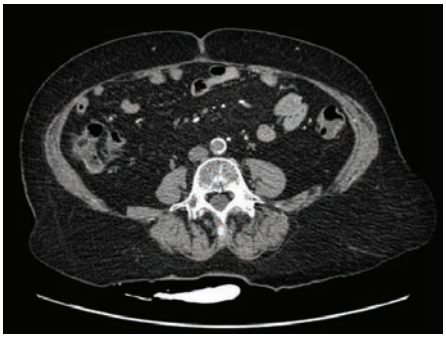


FIGURE 2: CTA occluded aorta

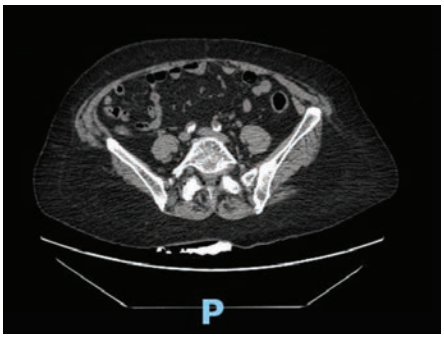


FIGURE 3: CTA occluded iliacs

loss, recent trauma, saddle anesthesia, fecal incontinence, urinary retention, fevers, chills, headaches, chest pain, dyspnea, abdominal pain, nausea, vomiting, constipation, diarrhea, dysuria, hematuria, seizure-like activity, recent sick contacts, or recent travel.

On initial presentation, the patient's vitals were blood pressure of 164/94 mmHg, pulse of 91 bpm, respiratory rate of 18, temperature of 37.1°C, and oxygen saturation of 96% on room air. The patient was laying on her right side, writhing in pain, and complaining of severe pain in her lower back and leg. On exam, the patient had exquisite tenderness to palpation localized to her lower back and lower extremities and decreased tactile sensation localized to her entire right leg as compared to the left leg. Lower extremities were cool to the touch and bilateral pedal pulses were absent on palpation and on Doppler.

A decision was made to administer 8 mg of morphine, which led to minimal relief of her symptoms. Due to the clinical concern for vascular or neurological etiologies, likely requiring emergent surgical intervention, presurgical labs were drawn including troponin, PT/INR, and type and screen. All lab results were unremarkable, except the initial high sensitivity troponin result significant for a value of 682.7. However, the patient had no ischemic changes on her ECG.

Given the patient's sudden onset of back pain, past medical history significant for extensive cardiovascular comorbidities, cool extremities, and absent pedal pulses on physical exam, there was considerable concern for significant vascular compromise including aortic dissection, abdominal aortic aneurysm, and lower extremity ischemia. Point-of-care ultrasound study of the abdominal aorta showed absent flow in bilateral common femoral arteries, but no dissection flap or aneurysm (**Figure 1**).

Due to concern for impending limb ischemia, the patient underwent emergent CT angiography studies of the chest, abdomen, and pelvis, which was significant for atherosclerosis and abdominal aortic occlusion extending into the bilateral common iliac arteries (**Figures 2 and 3**).

Vascular surgery was emergently consulted given the finding of an acute aortic occlusion and recommended anticoagulation with heparin with plan for emergent surgical intervention. After a long discussion about risks and benefits of surgical intervention, the patient consented for emergency surgery. The patient received left axillary to bifemoral bypass using polytetrafluoroethylene graft, which was well tolerated with minimal complications. She was subsequently admitted to SICU for hemodynamic monitoring and hourly neurologic checks.

DISCUSSION

Back pain is a common chief complaint in the emergency department, and this case illustrates the importance of always having a wide differential. In this case, the patient's lower back pain was a result of complete aortic occlusion extending into both lower extremities.

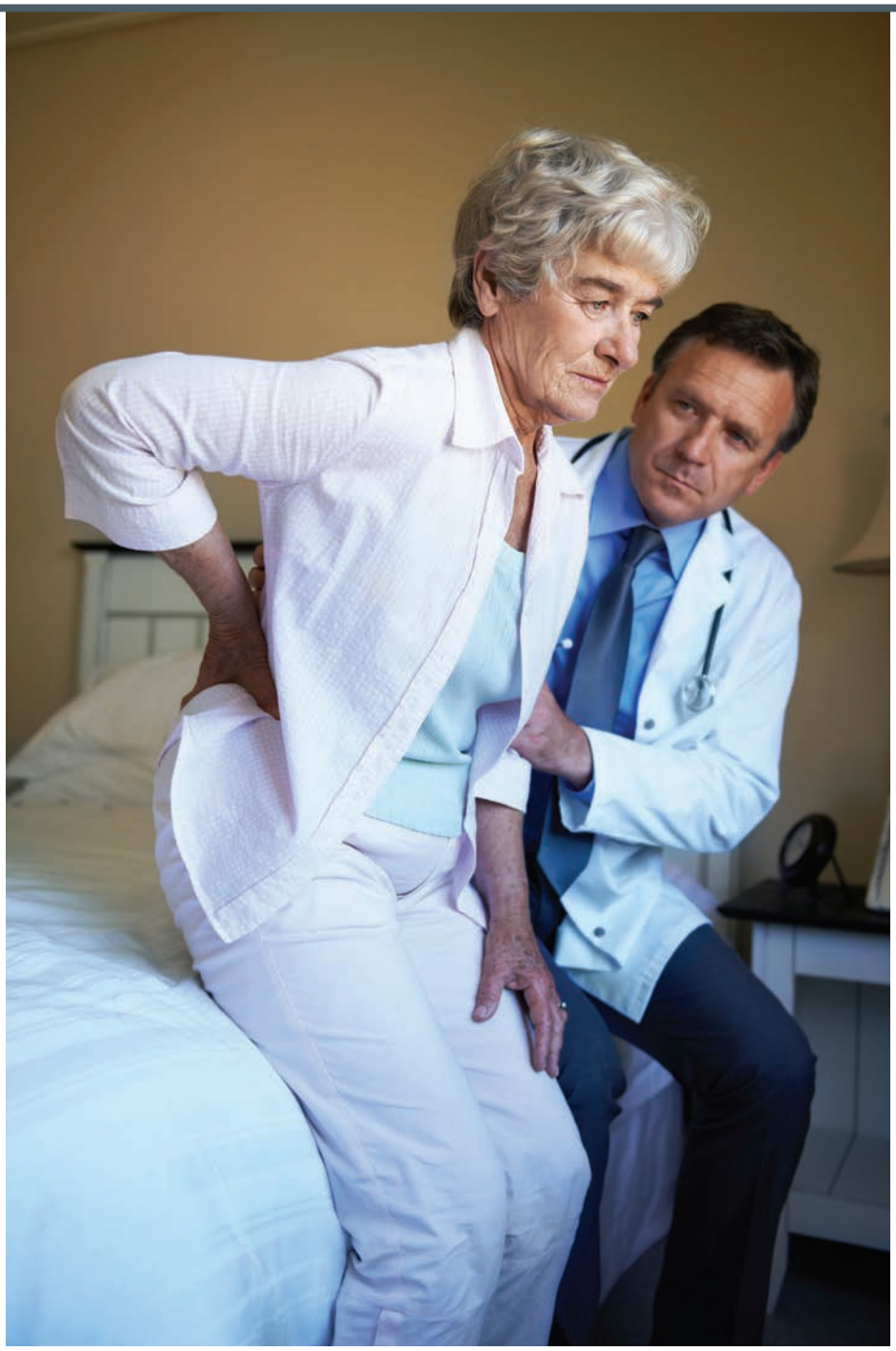
Complete aortic occlusion is an extremely rare condition but is potentially catastrophic if missed, as it can lead to loss of limb or life. This condition can be extremely difficult to diagnose as collateral circulation can allow for just enough perfusion to conceal acute ischemia for extended periods of time. Lumbar, intercostal, epigastric, circumflex iliac vessels, and visceral-systemic pathways of the celiac, superior, and inferior mesenteric arteries over time form extensive collateral networks that can perfuse the abdomen and pelvis.[3]

Acute occlusion of the aorta carries a mortality rate of 31-52%.[4] The early mortality rate of acute occlusion of the aorta tends to be high, as it can initially be mistaken for cerebrovascular accident or a primary central nervous system lesion, leading to a delay in diagnosis. This delay in diagnosis can lead to critical gastrointestinal malperfusion, renal infarction, and even paralysis resulting from malperfusion of the spinal cord, thereby increasing morbidity and mortality.[5]

Acute aortic occlusion can be caused by large saddle embolic occlusion of aortic bifurcation, acute in situ thrombosis of the atherosclerotic abdominal aorta, or acute occlusion of an abdominal aortic aneurysm.[5] About 75-80% of cases of aortic occlusion present in the setting of extensive aorto-iliac occlusive disease.[4] In their 2015 article, "A modern series of acute aortic occlusion," Crawford et al.[5] identified that 76% of cases of acute aortic occlusion were secondary to acute thrombosis, 7% secondary to embolic etiology, and 17% had indeterminate etiology.

Ischemic manifestations of aortic occlusion in patients with severe atherosclerosis can be precipitated by low flow states or dehydration. Common presenting features of acute aortic occlusion include acute claudication and uncontrolled hypertension. Acute

References available online.



claudication is characterized by cramping of buttocks, hips, and thighs that is reproducible with exercise and improves with rest.[6]

Moreover, acute aortic occlusion can also present with ischemic rest pain. Ischemic rest pain is a result of severe malperfusion of the lower limbs causing diffuse pedal ischemia. This type of pain is mainly localized to forefoot or toes but can present more proximally; the pain is worsened by elevation of the lower extremity and periods of recumbency, and does not improve with analgesia.[6,7]

It is highly likely that our patient was experiencing ischemic limb pain given the fact that her pain did not improve after administration of an appropriate weight-based dose of morphine. Aortoiliac occlusive disease is more prevalent in males, but its exact incidence and prevalence is unknown given that a majority of cases of peripheral artery disease are asymptomatic.[6] Leriche syndrome characterized by claudication, impotence and sexual dysfunction, and absence of femoral pulses may be present in patients with severe aortoiliac occlusive disease.[3] Of note, if identified appropriately, aortic occlusion can be diagnosed through sonographic means. Duplex scanning of the aorta, iliac, and common femoral arteries have a sensitivity of 91% and a specificity of 93% in the diagnosis of acute aortic occlusion.[4]

Surgical intervention is indicated in patients with debilitating claudication, pain at rest, and loss of tissue. The gold standard of surgical intervention for aortoiliac disease has been open repair, with patency rates as high as 72-90% at 10 years for aortobifemoral grafting. Open surgical options include aortobifemoral artery bypass grafting, aortoiliac endarterectomy, and extra-anatomic bypass.[3] Aortobifemoral artery bypass grafting is the most common approach given its long-term patency rate. Also, it is a good option if legions spare the common femoral artery as it prevents introduction into the groin, reducing infections rates. Alternatively, aortic endarterectomy is rarely used and generally is reserved for focal stenosis of the distal aorta or proximal iliac arteries.[3]

CONCLUSION

In our case, the patient's chronic atherosclerotic disease for the aortoiliac vessels eventually led to an acute occlusive episode, which manifested itself as severe lower back pain, paresthesias, numbness of the lower extremities, and absence of pulses on palpable and on Doppler. Ultrasound and angiography studies played a significant role in the eventual diagnosis, but clinical acumen and suspicion for vascular compromise steered us in the right direction with respect to making this life-saving diagnosis. Fortunately, our patient was discharged several days after her emergent surgical intervention with excellent functional status. Ultimately, this case presents a rare and life-threatening diagnosis for a common emergency department chief complaint and reminds us that thorough history and physical and broad differentials are of vital importance in our fast-paced work environment. ✶

References available online.

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Making the Model: Fast-Prep POCUS DIY Mock-ups

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A leading goal for any point-of-care ultrasound (POCUS) curriculum is creating excellent, low-cost, rapid-assembly models for teaching. Associated goals include minimizing the assembly units and maximizing the number of reusable tools.

In this article, we describe three do-it-yourself models that can be used for teaching. Although initial attempts to construct the models may take up to 10 minutes, prep time for subsequent models should take approximately 5 minutes each. (Tip: A cafeteria-style tray or absorbent liner under all preparation stations is recommended to minimize cleanup.)

VASCULAR ACCESS MODEL

This vascular access model can be repeatedly accessed with peripheral intravenous lines during a learning session.

Prep time: 5 minutes

This model is created utilizing a long cotton swab, animal balloons, water, tofu, and minimal additional tools (**Figure 1**).

Supply list:

- Cotton swab (6-inch length)
- Animal balloons
- Cup of water
- Tofu (extra firm)
- Syringe
- Plastic container

Instructions:

1. Open tofu and drain liquid.
2. Place tofu on tray.
3. Thread cotton swab through 1 animal balloon. Hold grip on the wooden end. Slowly extrude the balloon through the longest side of the tofu, until the balloon exits the other side. Hold the distal balloon in place and remove the cotton swab.
4. Repeat step 3 to place the 2nd animal balloon.
5. Utilize a syringe to remove as much air as possible from the 1st animal balloon. Fill the syringe with water and fill the animal balloon with water. Tie open end of balloon.
6. Repeat step 5 with the 2nd animal balloon.
7. Place in a plastic container (**Figure 2**).

Add a small amount of water to the tofu surface to maintain moisture, which can help reduce air artifact with repeated needle punctures. The water amount should be small and should not submerge the tofu, as that would prevent the use of the gel interface.

Utilize the linear probe and a gel interface to achieve vascular access (**Figures 3 and 4**).

This model is adapted from a previous vascular access model, which utilized a narrow tongue depressor for balloon extrusion and Metamucil to fill the vessels.[1] The change was made from a narrow tongue depressor to a long cotton swab due to the ready availability of long cotton swabs in hospitals and from online suppliers. Narrow-width tongue depressors are less readily available than the standard type in many hospitals, and the standard type is too wide. The change from Metamucil to plain water was to help minimize ingredients and maximize efficiency. The addition of a small amount of water to the tofu surface was made due to the visualized air artifact with repeated punctures when water was not utilized.

FOREIGN BODY MODEL

This foreign body (FB) model can be created for the same soft tissue learner session as the vascular model.

Prep time: <5 minutes

This model is created using tofu and FBs of various materials. The benefit of creating this model for the same session as the vascular access session is that the long cotton swab can then be broken into pieces for additional wooden and cotton FBs (**Figure 5**).

Supply list:

- Tofu (extra firm)
- FBs (of multiple material types, such as wood, plastic, metal, and rock)
- Plastic container

Instructions:

1. Open tofu and drain liquid.
2. Place tofu on tray.
3. Thread various FBs from the long and short sides of the tofu.

Optimal FBs are thin on the insertion aspect to minimize air introduction to the model and minimize artifacts.

Do not insert from the superior tofu aspect to avoid revealing FB locations to scanners.

Visualization is with the linear probe and a gel interface (**Figure 6**).

This model is adapted from

References available online.

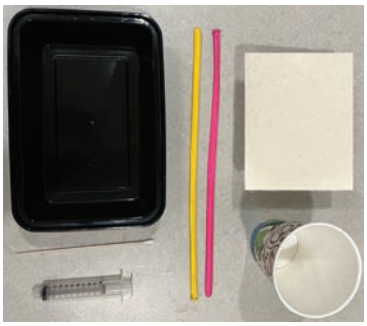

FIGURE 1: Vascular access model materials

FIGURE 2: Assembled vascular access model

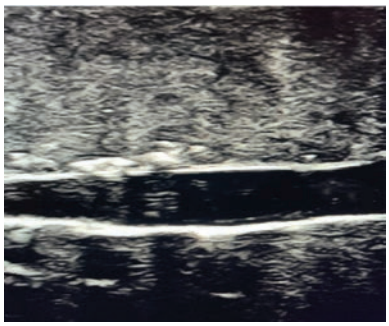

FIGURE 3: Ultrasound image. Vascular access model in long axis

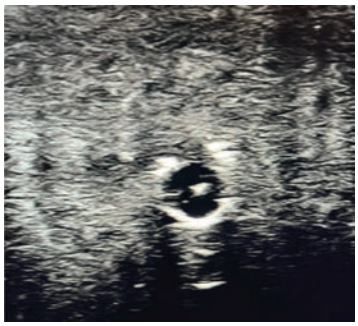

FIGURE 4: Ultrasound image. Vascular access model in short axis with needle tip in vein

previously described FB models.[1,2] The change proposed by this model is utilizing tools from the vascular model (the long cotton swabs) as foreign bodies to maximize efficient tool usage and minimize waste.

It is important to include multiple material types and sizes, as these will appear differently on ultrasound. Foreign bodies typically appear hyperechoic in relation to the surrounding tissue. Metal and glass can demonstrate reverberation artifacts and posterior acoustic shadowing to assist the scanner in locating the FBs. In contrast, other materials such as wood and plastic will demonstrate only shadowing.[3,4] Sometimes, in the case of small foreign bodies, no shadowing will be evident.[4]

PERICARDIOCENTESIS MODEL

This process describes how to create a pericardiocentesis model for a cardiac learning session.

Prep time: 5 minutes, after first preparing the hearts

Preparation of the heart models: 10 minutes. The hearts are indefinitely reusable, and completing this step first minimizes preparation time for all future models.

Subsequently, preparation of the materials for the pericardiocentesis model takes approximately 5 minutes

A leading goal for any point-of-care ultrasound (POCUS) curriculum is creating excellent, low-cost, rapid-assembly models for teaching. Associated goals include minimizing the assembly units and maximizing the number of reusable tools. In this article, we describe three do-it-yourself models that can be used for teaching.

FIGURE 5: Foreign body model. FB fragments from broken cotton swab shown pre-insertion

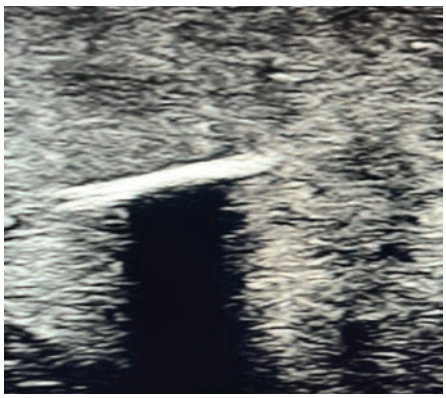

FIGURE 6: Ultrasound image. Foreign body model

(**Figure 7**), with additional time determined by sink water pressure to fill the water.

Heart supply list:
- Two ping pong balls
- Drill
- Stainless steel bolt and nut: two of each

Goal of heart model: An anchored ping pong ball that will sink when filled with water

Heart instructions:
1. Drill 3 holes in the first ping pong ball. Two holes should be on opposite sides of the ball, and at least 2mm in diameter. The third hole should be large enough to permit tight fit of the bolt.
2. Anchor creation: Spin nut onto bolt up to bolt head.
3. Tighten prepared bolt into third hole of ping pong ball. Bolt should not penetrate the opposite wall of the ping pong ball.
4. Repeat steps 1-3 for the second ping pong ball.

Pericardiocentesis supply list:
- Two prepared "hearts"
- Plastic food container (at least two times the height of ping pong ball)
- Larger plastic basin to hold plastic food container
- White plastic wastebasket bag

References available online.

FIGURE 7: Pericardiocentesis model materials

FIGURE 8: Assembled pericardiocentesis model

FIGURE 9: Ultrasound image. Pericardiocentesis model

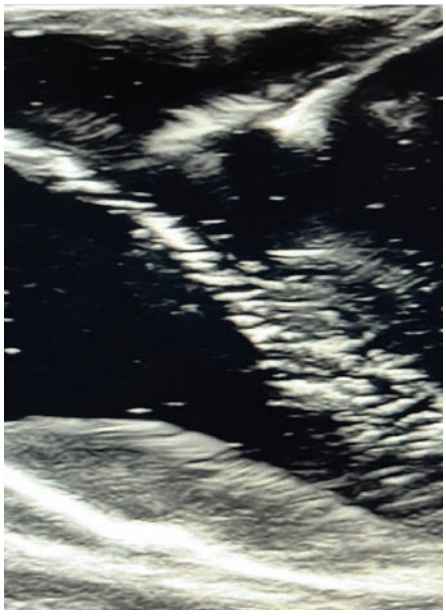

FIGURE 10: Ultrasound image. Needle approaching pericardium in pericardiocentesis model

- Two snack-sized clear plastic bags (16.5cm x 8.2cm)
- Water

Pericardiocentesis model instructions:

1. Place plastic food container in white plastic bag, then place both in larger plastic basin.
2. Fill plastic food container with water.
3. Submerge both ping pong balls in water until full.
4. Submerge both snack bags in water until full.
5. Place one ping pong ball in each snack bag; close the bags. Each ping pong ball simulates a heart, the surrounding water simulates the pericardial effusion, and the snack bag simulates pericardium.
6. Fill the white plastic bag with additional water, then close the bag tightly and tie shut. Goal is for the bag to be filled with water, so that the level of water is mildly above the level of the plastic food container (**Figure 8**). The white plastic bag simulates skin.

Visualization is with the linear probe and a gel interface (**Figures 9 and 10**).

Each ping pong ball in the snack bag model simulates one heart with effusion.

This model is a two-heart model. The presence of two hearts helps to fill the surface area of the plastic food container, thus minimizing the motion of each heart in the water.

This model is adapted in part based on previous pericardiocentesis models.[5,6]

Water is utilized in this model as the pericardial effusion and soft tissue medium to minimize ingredients and reduce preparation time. Water includes no organic ingredients, and so this also permits the indefinite use of the ping pong balls for future models. The ping pong balls just need to be held in air to be emptied, then left to dry on a flat surface.

The ping pong heart model was revised to ensure it would fill and empty with water effectively without the use of a syringe. This was accomplished by increasing the number and size of the holes. The two empty holes are placed 180 degrees from each other to permit rapid water-filling and emptying via submersion and removal from the water respectively. To fill: The ball is submerged in water, with one hole on the superior aspect and one hole on the inferior aspect. Air escapes superiorly while water fills inferiorly.

An anchor was developed for the heart model, as a ping pong ball filled with water is still buoyant in water.

White plastic bags are used as the skin as these are relatively opaque, preventing scanners from seeing the heart. A partially dimmed room is utilized as this is the optimal lighting for clinical ultrasound procedures.

The benefit of the white bag being additionally filled with water is that the bag surface is thus mildly elevated above the plastic food container. This creates a taut skin surface for scanning, to better imitate pericardiocentesis conditions.

CONCLUSION

These three ultrasound models have been adapted from prior suggested models to optimize efficiency and minimize costs for POCUS curriculums. They are currently in use for teaching at the author's academic institution.

The author would like to thank Enrique Vega, MSChemE, for his critical contributions to the development of the anchored ping pong ball for the heart model. ✶

References available online.

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Management of Concomitant Stroke and Pulmonary Embolism

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Case Presentation

A 69-year-old female presented to the emergency department for altered mental status and respiratory distress. Approximately one month prior, she had been struck by a vehicle and admitted for multiple traumatic injuries including: multiple left-sided subarachnoid hemorrhages, open mandible fracture, left Lefort I fracture, right Lefort II fracture, inferior orbital fracture, left iliac wing fracture, left tibia and fibula fracture, right knee full thickness tear of the anterior cruciate ligament, posterior cruciate ligament, lateral collateral ligament, and biceps femoris tendon. The patient had undergone multiple surgeries for the orthopedic injuries, and her hospital course was complicated by new onset atrial fibrillation. She was discharged from the hospital to a rehabilitation center four days before this presentation.

The rehabilitation facility called EMS because staff found her with right-sided paralysis, altered mental status, and saturating at 80% on room air. She was at her baseline and was working with physical therapy four hours earlier.

Initial vital signs at 15:05 in the ED reveal tachypnea to 28 breaths per minute, oxygen saturation of 91% on 15L supplemental oxygen, BP 130/85 mmHg, and heart rate 80 bpm. She had spontaneous respirations and lung sounds were clear bilaterally. Her initial GCS was 7 (E2, V2, M4). She had a leftward gaze deviation and flaccid paralysis of the right upper extremity; no response to painful stimuli in the right lower extremity. She had a knee immobilizer on the right lower extremity and long leg splint on the left lower extremity with swelling in bilateral lower extremities. Capillary refill in her feet was fewer than 2 seconds. The patient had undergone maxillomandibular fixation; she had a healing scar to her anterior mandible and multiple healing contusions to her face.

A non-contrast CT of the brain showed evidence of an occlusion of the large middle cerebral artery (MCA) stroke. CTA of the head and neck as well as CT perfusion studies were subsequently obtained to further evaluate the stroke. CTA of the head and neck showed hypoattenuation of the left intracranial internal carotid artery (ICA) and MCA M1 segment, highly concerning for acute thromboembolic disease. The CT perfusion also showed large acute left MCA infarction. CTA of the chest showed a saddle pulmonary embolism (PE) with evidence of right heart strain. Her initial high-sensitivity cardiac troponin was significantly elevated to 363 ng/L.

Management Considerations

There are few reported cases of concomitant acute ischemic stroke and pulmonary embolism. Given the rare presentation, there are no guidelines on how to manage such a situation. This case was further complicated by the fact that it was a submassive saddle PE with right heart strain and a difficult airway, in addition to the large ischemic stroke.

Recent intracranial hemorrhage was an absolute contraindication for alteplase administration and thus narrowed down the management choices. The remaining considerations included systemic anticoagulation, catheter-directed arterial thrombolysis, endovascular embolectomy, and IVC filter placement.

References available online.

Neurology recommended against systemic anticoagulation secondary to ischemic lesions with high risk of conversion to hemorrhagic stroke over the next few days.

The best course of action at this time was to have interventional radiology (IR) attempt endovascular thrombectomy and embolectomy. Regardless of the outcome of the IR procedures, she would ultimately require an IVC filter for long-term prevention against recurrent emboli.

Airway Considerations

Interventional radiology was consulted and agreed with the plan for ICA and MCA thrombectomy, followed by PE embolectomy. The patient was at high risk of deterioration and needed a definitive airway. Vital signs remained stable with no evidence of obstructive shock from the saddle pulmonary embolism.

Intubating a patient with right heart strain from pulmonary artery clot burden can trigger a downward spiral of cardiovascular collapse. The right ventricle (RV) outlet obstruction causes decreased RV output, which leads to decreased cardiac output from the left ventricle and decreased coronary perfusion. This can lead to cardiovascular collapse. Positive pressure ventilation increases intrathoracic pressure and can further potentiate the RV failure. The sedation may also lead to hypotension and further decreases in cardiac output.

In addition to the very high risk of cardiovascular collapse, this patient also had an anatomically complex airway that further complicated the situation.

Case Timeline

Despite removal of the maxillomandibular fixation wires, the patient was not able to open her mouth greater than 1 centimeter. A cricothyrotomy kit was brought to the bedside in case of rapid decompensation.

IMAGE 1: Coronal view, CTA chest demonstrating saddle pulmonary embolism

The anesthesiologist came to evaluate the patient for potential nasotracheal intubation and agreed that her recent multiple facial fractures made her anatomy for orotracheal or nasotracheal intubation nearly impossible. Her oxygen saturation remained in the low to mid-90s on 15L non-rebreather.

Day 1, 18:43: At this point, the neurointerventionalist did not want to further delay the ICA and MCA thrombectomy; thus the patient was

References available online.

brought to the interventional suite on the non-rebreather. Unfortunately, the IR team was unable to retrieve the thrombus.

19:45: Immediately after the thrombectomy attempt, the patient was brought to the OR with ENT for an urgent awake tracheostomy and subsequently brought to the ICU.

22:20: The patient returned to the IR suite for an embolectomy. At the beginning of the procedure, she desaturated and became hypotensive, leading to a PEA cardiopulmonary arrest. Return of spontaneous circulation was achieved after one dose of epinephrine and one round of chest compressions. She returned to the ICU for hemodynamic stabilization.

Day 2: The patient decompensated and was in obstructive shock with vasopressor support. Embolectomy was attempted again after hemodynamic stabilization. IR successfully decreased the clot burden and placed an IVC filter.

The patient's hemodynamics and mental status gradually improved and after approximately one month in the hospital, she was able to respond to commands and nod in response to questions. She had residual hemiplegia and aphasia, but was ultimately discharged to a long-term care facility with a tracheostomy and PEG tube.

Take-Home Points

- Concurrent acute ischemic stroke and submassive PE is a rare occurrence, and there is no sufficient evidence to support a particular method of management. It is important to weigh the benefits and risks of the various options for each patient presentation. The most common options based on literature review are IV thrombolysis, mechanical thrombectomy, or catheter directed thrombolysis. Some case reports recommend heparin after thrombolysis; however, our patient was at too high of risk for hemorrhagic conversion of the ischemic stroke.
- Positive pressure ventilation can worsen cardiac output and cause cardiovascular collapse in cases of right heart strain from pulmonary embolism. Consider embolectomy to help improve oxygenation prior to intubation when possible.
- If possible, utilize hospital resources (such as anesthesiology, surgery, or ENT) to help manage a difficult airway before resorting to emergent cricothyrotomy. ✶

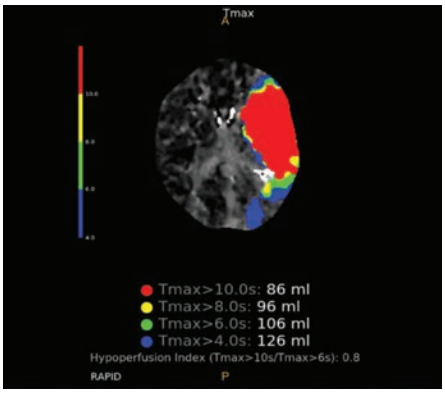

FIGURE 2: CT Perfusion demonstrating significant hypoperfusion to the left MCA territory

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Surf Medicine: Perspectives, Potential Hazards, and the Importance of Preparedness

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Surfing is a widely popular water sport, with an estimated 35 million surfers worldwide.[1] Numerous surf competitions are held each year, showcasing the sport's most popular athletes. The sport even made its Olympic debut at the 2020 Tokyo Games and has been approved by the International Olympic Committee for future Olympics. Surfers can be found from the warm tropical waters of Hawaii to the frigid waters of the Kamchatka Peninsula in Russia and everywhere in between.

Surfing, like most sports, does not come without risk. With its ever-growing popularity, considerations of potential injury and safety in the water should be recognized by the emergency physician.

"Surf medicine" refers to the field of medicine focused on the trauma and diseases that affect surfers.[2] There are many perspectives within the surfing community about the potential hazards of time spent in the water; these perspectives, along with potential hazards, vary with location and setting. Those who manage these conditions range from "barefoot doctors" — surfers with the training and skills to respond to injuries in remote locations without immediate access to medical facilities — to medical professionals in the emergency department.[2]

Knowledge and awareness about the breadth of potential injuries that may present to an ED is essential to preparedness among care providers in surfing communities around the globe.

CAUSES OF CONCERN

Popular surf websites provide insight into what surfers think about before entering the water. The number one most referenced concern is marine life, specifically sharks and the fear of an unprovoked attack.[4,5]

In 2021, there were 107 reported shark attacks worldwide, 22 of which occurred while surfing, and two of which were fatal. An analysis of global shark attack data from 1900 to 2014 showed that the highest proportion of attacks occurred while swimming (30.5%), followed by surfing (22.5%).[13]

While this concern regarding shark attacks is certainly valid, it may not reflect the most common hazards specific to riding a wave. Two separate studies have found that less than 3% of injuries are caused by marine life, and the most common marine life injuries are from jellyfish, sea urchins, and

References available online.

stingrays.[7] Furthermore, compared to other mechanisms of surf injuries such as lacerations and ligamentous sprains, shark attacks are a disproportionate concern when considering risk level.

The second-highest cited concern in the surfing community is in regard to waves and rip currents — the fear of drowning and osseous injuries from impact. Wave size varies dramatically by location, from the 50-foot waves of Nazaré, Portugal, to the average 3- to 4-foot waves seen in San Diego.[8-9] The difference in wave size will influence the type of injury and its severity. As mentioned by Nathansan et al, tube riding has a drastically different level of risk than open-face riding due to the changes in energy and force of the wave.[7]

Additional concerns include wounds from rocks and coral; sunburns; dehydration; collisions with other surfers; and injuries stemming from the leashes that connect surfers with their boards, as these can become tangled around limbs.[4,5]

COMMON INJURIES

A literature review of surfing injuries provides insight into the epidemiology of injury. Contrary to popular perceptions, marine wildlife attacks and drowning do not make up the majority of surf injuries.[7] The most common cause of trauma during surfing is from the surfboard itself.

Lacerations account for the largest portion of surf injuries — largely to the head and neck, with the scalp and face being particularly vulnerable.10 These lacerations generally result from collisions with the rider's own board, coral reefs, and rocks.[7]

One particular study found that the majority of head injuries suffered were mild traumatic brain injuries (concussions), and less commonly tympanic membrane rupture and fractures involving the jaw, skull, and teeth.[10]

Severe neck injuries include cervical spine fractures.

It is important to note that the use of protective head gear is not yet commonplace in surfing, even considering the demonstrated risk.[11] Injuries to the head and neck — such as brain injury, cranial fractures, and vertebral fractures — require more extensive treatment, including hospital admission and surgical intervention. This demonstrates a key area where immediate recognition and intervention, such as in the ED, can have a large impact on morbidity. This also presents an opportunity where a shift among surf culture toward protective headgear could reduce the incidence of severe head injuries.

Trauma from the force of the wave itself includes ruptured tympanic membranes, near drownings, shoulder dislocations, and sprains to the lower limbs from bodily force during turns.10 Many of these injuries are treatable in an ED setting and do not result in inpatient admission.[12]

In EDs where surfers are a common demographic, an awareness of potential injuries and their possible sequelae can help determine the level of care needed.

Interestingly, the more experienced or the older a surfer is, the higher the risk of significant injury.[10] Additionally, the frequency of surf injuries requiring hospital admission is higher for older patients, an important consideration in determining a patient's disposition.[14] These factors necessitate a need for risk stratification based on patient demographic, not dissimilar to the triage and management of other sports injuries.

SIGNIFICANCE FOR THE EM PHYSICIAN

As the popularity of surfing grows, the incidence of surf injuries — both minor and traumatic — will increase accordingly. Surfers will present to the ED with a wide range of pathologies, from head wounds to ligament sprains.

An understanding of the mechanisms of these injuries and location-specific hazards is important. This will allow for increased alertness of, and preparedness for, possible life-threatening presentations. In emergency departments likely to see surf-injury patients, education could be incorporated into simulations and didactic sessions focused on sports injuries.

Emergency physicians are masters at taking care of anything and everything that comes through the door, and continued exploration of surf medicine increases this diversity. ✶

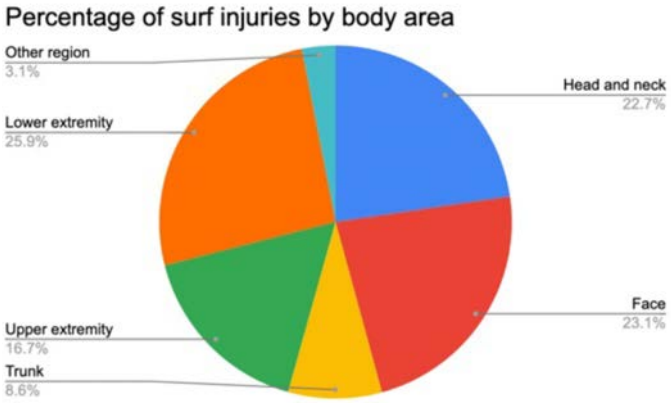

FIGURE 1: Percentage of surf injuries by body area. Data presented from Klick et al's study of surf injuries.[14]

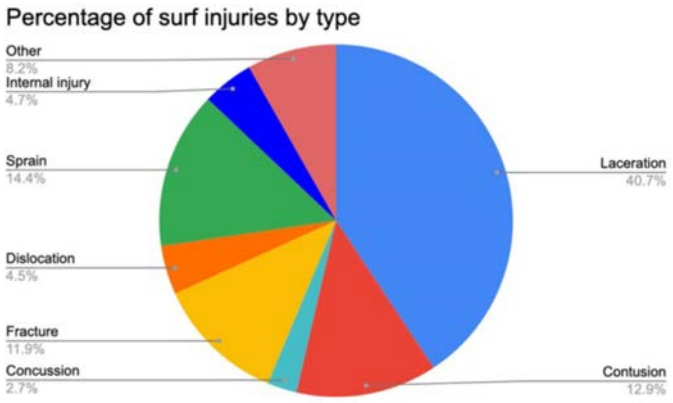

FIGURE 2: Percentage of surf injuries by type. Data presented from Klick et al's study of surf injuries.[14]

References available online.

From Weight Loss to Neurological Deficits

A Case of Wernicke's Encephalopathy Stemming From Prescription Weight Loss Medication

Wernicke's encephalopathy can have a subtle presentation and should be considered in any patient with altered mental status who is at risk for nutritional deficiency.

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INTRODUCTION

Wernicke's encephalopathy (WE) is named after Carl Wernicke. More than 100 years ago, the German physician noted a combination of ophthalmoplegia, ataxia, and "mental compromise" in a woman with chronic malabsorption from severe pyloric stenosis.[1]

Since then, a deficiency of thiamine (vitamin B1) has been determined to be the primary factor causing WE, with alcohol abuse being the primary etiology of thiamine deficiency considered.[2] However, there are numerous other conditions that predispose patients to thiamine deficiency, and these are not always obvious to the clinician.

CASE

A 45-year-old female with obesity and a past medical history of hypertension and obstructive sleep apnea presented to the emergency department for generalized weakness and intermittent confusion gradually worsening over two months, as described by her family. On physical examination, she was oriented only to person. She stated she was in a library and when told she was at the hospital, she did not understand why. She had no complaints at the time. Her gait was ataxic, favoring her right, and she exhibited bidirectional nystagmus.

Stroke, specifically involving the posterior circulation, was considered; however, it was much lower on the list of differentials. Initial workup was notable for a slightly low potassium of 3.3 mmol/L in the setting of hydrochlorothiazide use. The patient's CMP and CBC were otherwise unremarkable. HIV, RPR, TSH, and ammonia testing were all normal. A head CT demonstrated no acute findings to explain her symptoms.

The patient was admitted for altered mental status. Neurology was consulted and recommended an MRI and EEG. The MRI, performed while the patient was boarding in the ED, was normal. The EEG demonstrated nonspecific moderate diffuse background slowing indicative of diffuse cerebral dysfunction seen with various etiologies of encephalopathy.

Further review of records and discussion with the patient's family showed that she had lost approximately 70 pounds in the past three months since starting semaglutide, a prescription weight loss medication. The medication had significantly impacted her appetite. In addition, four days prior, she had presented to an outside ED for concerns by family that she was having trouble walking and seemed confused. She was discharged from that ED given reassuring vitals, a non-focal

References available online.

exam, and a normal head CT. Two weeks prior, she was seen at the same ED twice in one week, both times for GI complaints. During the first visit, she had an abdominal CT demonstrating diverticulitis. She was discharged at that time on oral antibiotics and, after the second visit, a proton pump inhibitor.

Given this history, with the triad of altered mental status, bidirectional nystagmus, and ataxia, a presumptive diagnosis of WE was made, and high-dose IV thiamine was started. After a single high dose (500mg) was given, thiamine was not continued by the admitting team, as the patient did not appear malnourished and lacked a history of alcohol abuse.

DISCUSSION

WE is a frequently missed diagnosis. In part, this is because the classic triad of confusion, gait or truncal ataxia, and eye movement abnormalities are present less than 20% of the time. The confusion may present as only a subtle "mental sluggishness," and eye movement abnormalities may present as either nystagmus or ophthalmoplegia.[2]

Subclinical thiamine deficiency is incredibly difficult to diagnose, as only nonspecific symptoms such as headache, fatigue, irritability, and abdominal discomfort are present. It may be impossible to make the diagnosis in an intoxicated, alcoholic patient.[3] The diagnosis is more likely to be missed in patients without a history of alcohol abuse. In one study over five years, 52 cases of WE were discovered on autopsy, with only four diagnosed clinically beforehand — all in patients with alcohol use disorders, while 23% of cases were in those without.[4]

With the trends of slowly increasing alcohol consumption among Americans in the past 30 years and a 100,000-fold increase in bariatric surgery over a decade, we can expect the rate of WE to increase.[5-6]

Bariatric surgery is an increasingly recognized risk factor for WE. Other risk factors to consider include anorexia nervosa, hyperemesis gravidarum, and prolonged parenteral feeding, as well as AIDS, malignancy, ESRD, and heart failure, particularly with diuretic use.[7]

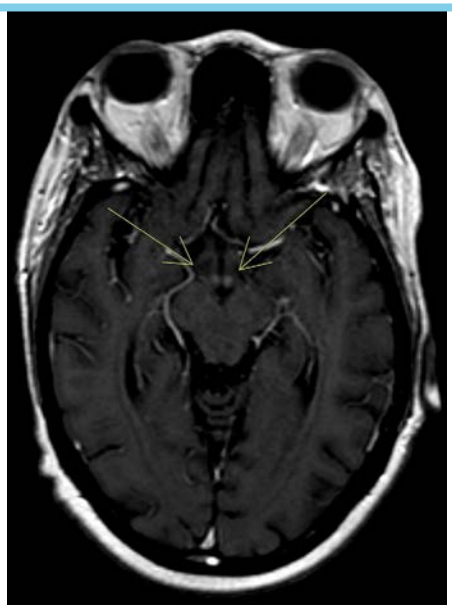

FIGURE 1: Post-contrast axial view demonstrating increased signal intensity involving the mamillary bodies.

Our patient is suspected to have developed WE in the setting of prominent weight loss since starting semaglutide. Further thiamine deficiency was likely triggered by her GI illness in the weeks prior to presentation.

Semaglutide is a once-weekly injectable glucagon-like peptide-1 receptor (GLP-1) agonist, a class initially developed for type-2 diabetes. This class is now a first-line option for both type-2 diabetes and for inducing weight loss in patients with obesity. The most common side effects are mild nausea and diarrhea, which tend to improve over time.[8] Sold under the brand names Wegovy and Ozempic, these drugs have become increasingly popular after celebrities claimed their use on social media.

There are case reports of patients receiving the diagnosis of WE in the setting of restrictive diets and non-FDA-approved supplement use.[9] However, this is the first case of WE attributed to prescription weight loss medication that we know of in the literature.

Typically, lab test results for thiamine are delayed and MRI is not readily available to the emergency physician, nor is it particularly sensitive for the disease.[3] Therefore, the diagnosis is clinical and should be made if the patient has two of the following: dietary deficiency, oculomotor abnormality, cerebellar dysfunction, and either altered mental status or mild memory impairment.[10] Eventually, low blood thiamine levels — as well a bilateral, symmetrically increased T2 signal on MRI involving the mamillary bodies, hypothalamus, or paraventricular thalamus — support the diagnosis.[3]

Delays in treatment or under-dosing parenteral thiamine may result in coma and death. Therefore, if suspected, empiric treatment should be initiated with high-dose IV thiamine therapy, 500mg every eight hours for three days.[11] Glucose before thiamine may precipitate WE, but do not withhold glucose for the unstable hypoglycemic patient while ordering thiamine.[7] Magnesium deficiency should be treated to prevent refractory encephalopathy, and expect concurrent deficiencies of vitamins B6, B12, and folate.[12]

With parenteral treatment, oculomotor changes are expected to resolve quickly, within days. In fact, if you do not see oculomotor improvements, the diagnosis is unlikely and supplementation may be stopped. Variable degrees of ataxia and cognitive impairment may persist permanently.[13]

CASE CONCLUSION

While the patient was boarding in our ED, a second opinion on the MRI was requested specifically to evaluate for mamillary body changes, and our neuroradiologist noted enhancement around the mamillary bodies consistent with WE (**Figure 1**). A thiamine level was sent, which ultimately resulted low. B12 and folate levels also returned low. The patient was restarted on high-dose IV thiamine, and by day two, her horizontal nystagmus had resolved. Her confusion persisted for more than a week, but ultimately, she was discharged to a skilled nursing facility for rehab with improved cognition. At neurology follow-up two months later, there was no comment of visual or gait disturbances. The patient is experiencing ongoing issues with short-term memory but is otherwise doing well at home. ✶

References available online.

To Be, or Not To Be: An Esophageal Perforation Story

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CASE SUMMARY

A 74-year-old male presents to the emergency department with dysphagia after accidentally swallowing a chicken bone five days ago. He is only able to swallow small pieces of food and water. The patient reports a hoarse voice but denies fevers, difficulty breathing, or chest pain. He was evaluated by otolaryngology and underwent a laryngoscopy, but no bone was visualized. On physical examination, no foreign body is visualized and the oropharynx is clear. The patient's lungs are clear in all fields without wheezing. Vitals are BP 166/109 mmHg; HR 68/minute and regular; RR 19/min and unlabored; T 97.3F; and SpO2 95% on room air.

A CT of the neck shows a radiopaque foreign body in the upper to mid-esophagus at the level of C6-C7 vertebral bodies and the cricoid bone, extending anteriorly and down toward the right, with a contained perforation.

The patient is admitted for emergent surgery to remove the foreign body and repair the perforation. In the OR, an esophageal perforation is not found. Instead, the chicken bone is lodged transversely on top of the cricopharyngeal muscle and a small Zenker's diverticulum. There is a small ulcer at the diverticulum, but no frank perforation or purulence. Chicken bone fragments are successfully removed.

A post-op esophagram shows a small anterolateral outpouching of the proximal esophagus likely reflecting a contained perforation versus Killian Jamieson diverticulum. No evidence of contrast extravasation outside of the outpouching is visualized.

The patient is discharged on amoxicillin-clavulanic acid, a soft food diet, and follow-up with thoracic surgery.

DISCUSSION

This patient presented with dysphagia due to a foreign body ingestion five days prior. The main concern on arrival

References available online.

to the ED was esophageal perforation with resulting mediastinitis. Initial CT imaging demonstrated esophageal perforation; however, in the OR, the foreign body was found to be lodged in a Zenker's diverticulum.

What appeared to be a contained perforation was, in actuality, a Zenker's diverticulum. This diagnosis explains why this patient presented in a much more stable condition than one would expect for a true esophageal perforation.

Foreign body (FB) ingestion in the emergency department can have a variety of presentations, from benign to life-threatening. The majority of foreign bodies (80–90%) pass through the gastrointestinal tract spontaneously and without complications.[1] Most commonly, a patient will present with an acute onset of dysphagia after ingestion of the FB. They may also have odynophagia, neck pain, sore throat, and, in more serious presentations, choking, stridor, dyspnea, fever, and/or crepitus.[1,2]

Esophageal perforation is a life-threatening condition caused by FB ingestion and can easily be missed. Therefore, suspicion for perforation should remain high until proven otherwise. This is a time-sensitive diagnosis and requires immediate surgery consultation.[3,4] Even when identified and treated early, mortality from esophageal perforation is as high as 25%. If treatment is delayed more than two days from time of injury, mortality can reach 50-60%.[5] Unfortunately, there are no pathognomonic signs or symptoms of perforation; therefore, a thorough history and physical exam are imperative. If there is a delay in diagnosis, a patient can become critically ill and septic.

Initial recommended labs include CBC, CRP, and VBG. Initial imaging should include an X-ray of the neck, chest, and abdomen; however, be aware that if suspicion is high and X-ray results are negative, it is prudent to follow up with a CT scan for further evaluation.[2] Case in point: Fish bone sensitivity on an X-ray is as low as 32%, while on CT it's higher than 90%.[1] Therefore, CT of the neck, chest, and abdomen is recommended if clinical suspicion remains high. CT can also detect and elucidate findings such as aspiration,

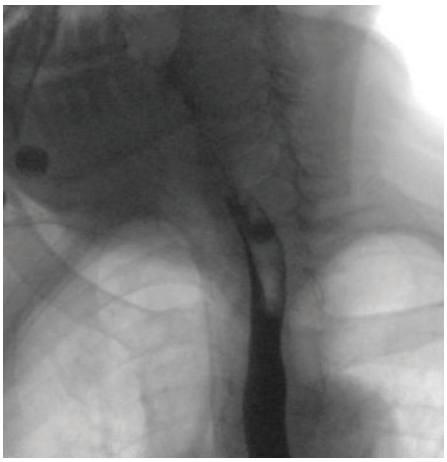

IMAGE 1

IMAGE 2

free mediastinal or peritoneal air, or subcutaneous emphysema.[1]

If a patient has persistent esophageal symptoms, endoscopy should be

Mechanical and Neuromuscular Dysphagia

Two Considerations When no Foreign Body is Found

Although foreign body (FB) ingestion is an important etiology for acute dysphagia, when no FB is identified, there are two main etiologic categories to consider: mechanical and neuromuscular. Mechanical causes account for the majority of cases and include malignancy, esophageal stricture, scleroderma, a Schatzki ring (esophageal web), thyroid enlargement, Zenker's diverticulum, and foreign body ingestion. Neuromuscular causes include CVA, achalasia, medication side effects, esophageal spasm degenerative diseases, ALS, MS, muscular dystrophy, and myasthenia gravis.[3]

Mechanical dysphagia usually presents with difficulty swallowing solids only.[4] For example, a schatzki ring often presents with food bolus impaction and regurgitation, as it is a mucosal structure that impairs passage through the gastroesophageal junction. This type of mechanical dysphagia is typically a non-progressive dysphagia and presents more intermittently. However, more concerning diagnoses, such as esophageal stricture or carcinoma, will present in a more progressive manner as the obstruction worsens over time. In the case of mechanical dysphagia, evaluation with endoscopy can be used both to diagnose and sometimes to treat.[4]

Neuromuscular dysphagia usually presents with difficulty swallowing both solids and liquids.[4] Unless a patient presents at a very late stage, neuromuscular dysphagia workup is more appropriate in the outpatient setting. This is usually a progressive presentation over time and, in most cases, is not immediately life threatening, except in the setting of a cerebrovascular accident. A more acute onset of dysphagia involving both solids and liquids should raise your suspicion for CVA and needs to be ruled out in the ED. This is the most common cause of oropharyngeal dysphagia.[3] Once a CVA is ruled out, the patient can be referred to GI or ENT for further evaluation. If a diagnosis cannot be made with endoscopy or barium swallow, the next modality for diagnosis is manometry. Manometry can be used to assess esophageal pressures and sphincter tone to identify esophageal motility disorders (EMD).[4] Treatment for EMD varies based on the diagnosis and is not typically managed in the emergency department.

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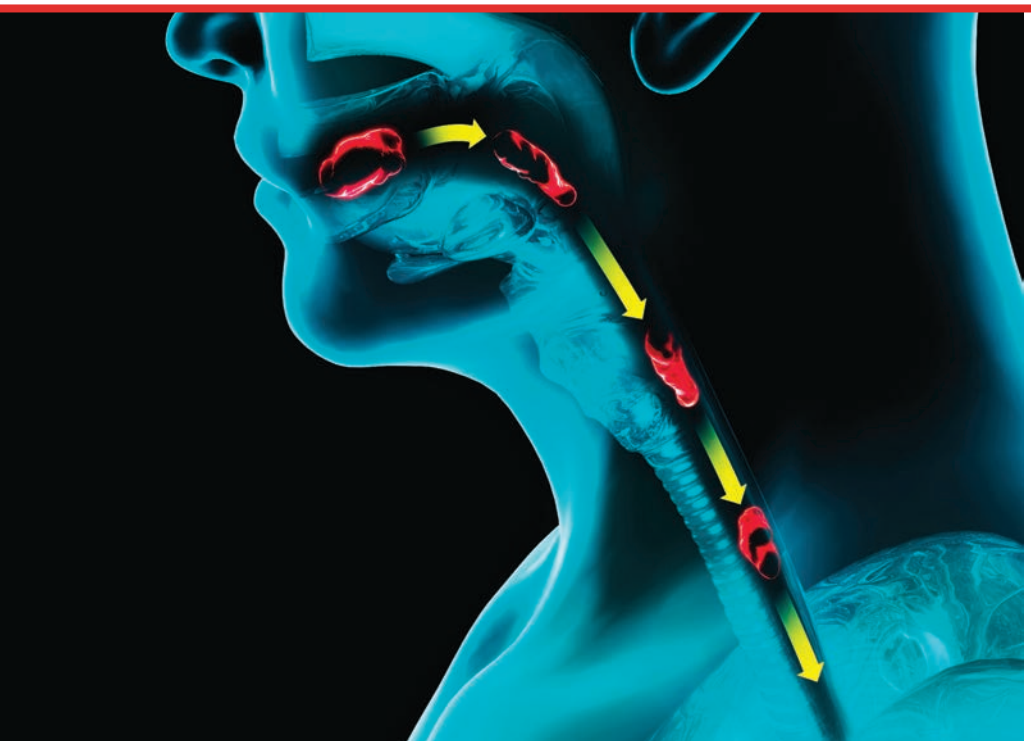

performed within 24 hours. In the event of dangerous FB ingestion such as sharp objects, magnets, or batteries, endoscopy should be performed within 6 hours, but preferably within 2 hours if possible.[2] In cases of esophageal perforation when the object cannot be retrieved by endoscopy, or if the FB is close to the aortic arch or other critical structures, immediate surgical intervention is required.

A stable patient who presents early with esophageal perforation can be observed closely. If non-operative treatment is initiated, the patient should be placed on broad-spectrum antibiotics and a proton pump inhibitor.[2]

CONCLUSION

There is a broad differential for dysphagia, and there are a few key ED pearls to remember. First, a negative X-ray does not rule out the presence of a foreign body. Second, a CT should be performed if suspicion for a FB is high, regardless of the X-ray results. Most importantly, the emergency physician must always consider esophageal perforation and assess for the presence of sharp objects, magnets, and batteries. These patients, in particular, will need intervention within a matter of hours. ✶

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EMRA

Continued from page 4

As such, for-profit hospital corporations like HCA have been implicated in the rapid expansion, with some advocates against corporate influences in medicine calling for the closure of HCA-affiliated EM programs. HCA now has 16 affiliated EM programs, the most of any hospital system, but is only responsible for 7 of the 57 programs opened in the past 5 years.[5] Due to concerns regarding HCA's rate of growth, ACEP met with HCA leadership last year and successfully advocated against the opening of a new EM program in one large urban center. Though only a first step, it does suggest organizational advocacy could play a role in ensuring responsible expansion.

Some critics of corporate influences in medicine have suggested it is the ACGME's responsibility to close programs associated with for-profit hospitals. One difficulty with this suggestion is that neither the ACGME nor any other regulatory body currently exists to monitor or accredit residencies based on job market concerns or the hospital's business model. In fact, the ACGME is legally restricted from considering these factors in its accreditation process due to antitrust regulations.[6]

The ACGME could increase residency standards such as procedure numbers and faculty requirements in order to ensure the quality of residencies remains high despite growth. This may inadvertently reduce the number of programs or downsize programs if they cannot meet more stringent ACGME standards.

As a parallel, orthopedic programs and positions have expanded more slowly than EM's. This is in part due to their ACGME requirements, which mandate, for example, that orthopedic residents log at least 1,000 procedures and 200 pediatric procedures to graduate.[7] In contrast, EM residents are only required to log 45 adult medical resuscitations and 35 intubations to graduate.[8]

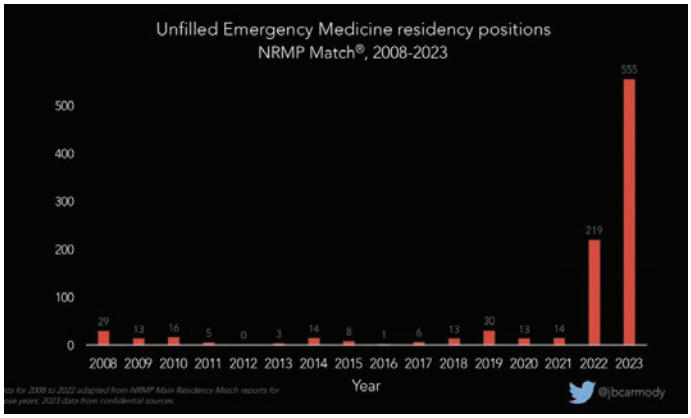
Last year, the EMRA Board of Directors submitted recommendations to the ACGME specifically requesting that certain EM residency requirements be increased. As of 2023, the ACGME is actively reviewing these recommendations.

SOLUTIONS

First and foremost, EM physicians at every level of training must accept that, unlike the rapid improvements we see when saving our patients' lives, this is not an issue we will fix immediately, or even within the next year. But there are strategies we can all adopt, regardless of our career stage, to strengthen our specialty.

On a personal level, each and every emergency physician can strengthen EM recruiting today by practicing awareness around the messaging we give students on shift and online. Opportunities to mentor, educate, and celebrate EM are available to anyone working with students in the ED or active on social media. Each EM-bound medical student also has a vested interest in bringing their dedicated, patient-centered colleagues into the specialty. EMRA's medical student leaders advocate as passionately for the specialty as our most seasoned alumni.

At medical schools, third-year EM clerkships must be accessible and meaningfully incorporate students into the team.



Graph courtesy of Bryan Carmody, DO. Used with permission.

Throughout acting internships, students need excellent, direct feedback that allows them to reach their greatest potential, reducing their risk of going unmatched. When it comes to the application process, programs unfilled by the Match must adapt quickly and consider interviewing applicants they previously would not have considered.

Regarding residency growth, program leaders at established programs have a duty to consider their communities' long-term needs when considering expansion. There is no regulatory body that currently exists to regulate expansion of programs. In 2023, however, the ACGME is reviewing EM program requirements. I have met with ACGME leadership to express our concerns and share our view that EM is overdue for a strengthening of our qualifications, procedural skills, and program support.

Moving forward, we must communicate to medical students and our colleagues that we recognize EM is in a challenging position, but we are tackling it head-on. We are united in initiatives like CORD's Match Taskforce, composed of leaders across EM organizations. EMRA is also addressing it in our own ways: EMRA held an EM Match Open Forum at our spring meeting of the Representative Council in which residents from dozens of EM programs convened to learn about the Match, share their experiences at a wide range of programs, and discuss solutions. I then shared those experiences with other EM organizations and the ACGME. Our goal is to keep the quality of our training high — regardless of the age or business model of our EDs.

And as individuals, we can start today by celebrating the wins: the gratification in resuscitating a patient in distress, the accomplishment that comes from improving care in your emergency department, the hope that a new class of emergency physicians brings, and the ability to take care of anyone, anything, anytime. These wins are what drew me to emergency medicine, and what will draw in the next class of residents as well. ✶

References available online.

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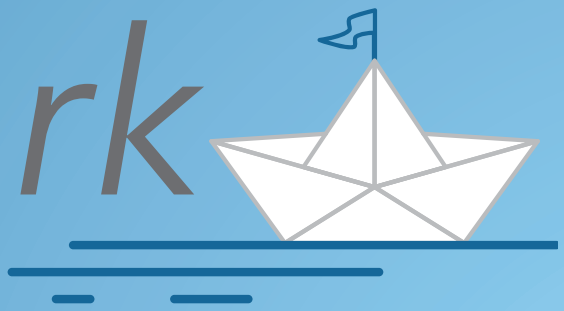

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ECG Challenge

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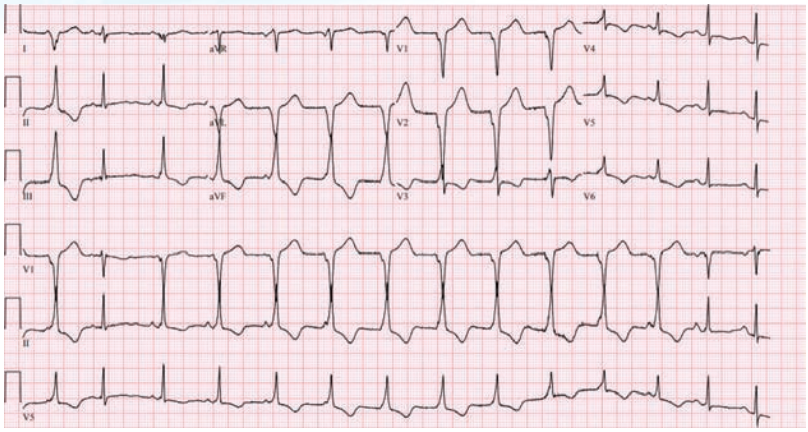
CASE

A 22-year-old female with no significant past medical history presents to the emergency department with wheezing after a recent upper respiratory infection. The patient is treated with a continuous 15 mg albuterol nebulizer, after which an ECG is obtained. The patient's respiratory status has significantly improved, and she has no new symptoms.



What is your interpretation of her ECG?
See the ANSWER on page 66.

References available online.

ECG Challenge

ANSWER

This ECG shows normal sinus rhythm at ~75 bpm followed by a regular wide complex rhythm at ~83 bpm before resuming normal sinus rhythm.

The regular wide complex rhythm starting with the 7th QRS complex is consistent with an accelerated idioventricular rhythm (AIVR), which occurs due to increased automaticity or triggered activity of a ventricular pacemaker. AIVR is commonly seen after successful reperfusion, partial or complete, of an occluded coronary vessel. The reperfusion can be spontaneous or due to an intervention such as PCI or fibrinolysis.

Other causes of AIVR include beta-sympathomimetics (as in this case), digoxin toxicity, cocaine, electrolyte abnormalities, cardiomyopathy, myocarditis, or an athletic heart with increased vagal tone.[1,2] In the past, AIVR has been referred to as non-paroxysmal ventricular tachycardia, isorhythmic slow ventricular tachycardia, and our favorite, "the curious benevolent tachycardia."

The classic teaching is that AIVR has rates between 40 and 110 bpm and VT has rates between 140 and 200 bpm, but these numbers are not strict limits. AIVR can be seen with rates as high as 130 bpm and VT can be seen with rates as slow as 120 bpm (and even slower in patients on chronic oral antidysrhythmic medications or those with severe cardiomyopathies). Although the ventricular rate in this ECG is consistent with AIVR, it's important not to anchor on the ventricular rate as the sole factor to differentiate AIVR from VT.

Another key finding in this ECG is the presence of AV dissociation in the absence of a 3rd degree, or complete, AV block. It is important to differentiate a 3rd degree AV block from AV dissociation. A 3rd degree AV block describes the absence of conduction from the atria to the ventricles via the AV node. AV dissociation describes when the atria and ventricles operate independently of each other. A 3rd degree AV block will always have AV dissociation, but there can be AV dissociation without a 3rd degree AV block (e.g., ventricular tachycardia, decreased SA node automaticity such that a junctional or ventricular site takes over pacing, or if, like this case shows, there is increased automaticity in a junctional or ventricular site that is faster than the SA node). In these cases, the AV node functions normally, but the impulses from the SA node are blocked by the retrograde conduction from the faster junctional or ventricular pacing.

Associated ECG findings seen with AV dissociation include capture and fusion beats. A capture beat is a sinus P-QRS-T complex formed by transient normal conduction amid AV dissociation. A fusion beat is caused by the simultaneous depolarization of the ventricle from both a normal supraventricular focus (e.g., a sinus beat from the SA node) and a ventricular focus. The 3rd QRS complex in this ECG, best seen in the lead II rhythm strip, is an example of a fusion beat.

AIVR is typically transient, often lasting only minutes, and unlikely to cause hemodynamic instability. In most circumstances, there is no treatment required except for observation. Patients with decreased cardiac output may benefit from a trial of atropine to increase the SA node rate in order to restore AV synchrony and the atrial kick.[4] Special consideration should be taken in the patient with apparent AIVR who presents with syncope as this could be a sign of a more malignant underlying cardiac issue.

CASE CONCLUSION

This patient was discharged after successful treatment of her respiratory symptoms.

ACCELERATED IDIOVENTRICULAR RHYTHM LEARNING POINTS

- Ectopic focus from Purkinje network or ventricular myocardium
- Also called ventricular escape rhythm
- ECG shows ≥ 3 consecutive, regular, wide complex beats with no P-waves or AV dissociation if P-waves are present
- Rates between 40-110 bpm, but can sometimes be as high as 120-130 bpm
- Mimics include hyperkalemia, sodium channel blocker toxicity, and VT in patients on antidysrhythmic medications (e.g., amiodarone, flecainide, sotalol) or with severe cardiomyopathies
- Suggests partial or complete reperfusion of an occluded coronary vessel
- Classically seen in the reperfusion phase of an MI following fibrinolysis or PCI, but can also be spontaneous
- Can also be seen with digoxin toxicity, cardiac ischemia, or electrolyte abnormalities
- Usually well-tolerated, benign, and self-limiting
- Treating as VT with antidysrhythmic medications can precipitate asystole

"AIVR is commonly seen after successful reperfusion, partial or complete, of an occluded coronary vessel. The reperfusion can be spontaneous or due to an intervention such as PCI or fibrinolysis."

References available online.

Board Review Questions

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

For complete answers and explanations, visit the Board Review Questions page at emresident.org, under "Test Your Knowledge"

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1. A 64-year-old man presents with abdominal pain and tenesmus of 3 days' duration. He recently underwent radiation treatment for prostate cancer. His vital signs include BP 126/66, P 88, R 16, and T 37.2°C (99°F). The physical examination reveals a soft, nontender abdomen without guarding or rebound tenderness. The patient has discomfort on rectal examination, which produces brown stool that is guaiac positive; Hct is at baseline. What is the next step in management?

A. Administer broad-spectrum antibiotics
B. Admit the patient for colonoscopy
C. Discharge with steroid enemas and close follow-up
D. Order an abdominal CT with rectal contrast

2. An ill-appearing 22-year-old man presents with palpable dusky pustules and joint pain. What is the most likely diagnosis?

A. Gonococcemia
B. Meningococcemia
C. Rocky Mountain spotted fever
D. Syphilis

3. In which patient with hyponatremia would rapid serum sodium correction with 3% hypertonic saline be contraindicated?

A. Coma after rapidly ingesting a large quantity of water; serum sodium 117 mEq/L
B. Delirium after running a marathon; serum sodium 118 mEq/L
C. Normal mental status; serum sodium 104 mEq/L
D. Status epilepticus; serum sodium 114 mEq/L

4. What is the first step in the out-of-hospital management of an apneic drowning victim?

A. Chest compressions
B. Postural drainage
C. Rescue breaths
D. Rewarming

5. A 6-year-old boy is brought in with a 3-day history of URI symptoms, including congestion, low-grade fever, and a nonproductive cough. The patient's mother says his temperature was 40.5°C (104.9°F) earlier in the day. On examination, the boy is lethargic but arousable, and stridor is noted. What is the most likely diagnosis?

A. Bacterial tracheitis
B. Bronchiolitis
C. Pneumonia
D. Viral laryngotracheobronchitis

PEERprep For Physicians

ANSWERS
1) C. 2) A. 3) C. 4) C. 5) D.

References available online.

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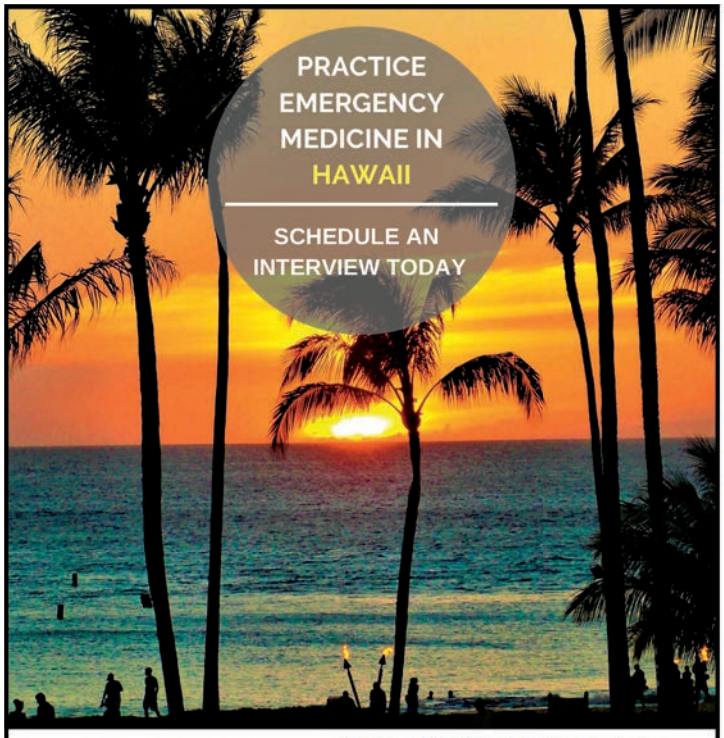

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