Brain Trauma Guidelines for Emergency Medicine

Guidelines for the prehospital management of traumatic brain injury

by ANDY JAGODA, MD; BEN BOBROW, MD; AL LULLA, MD; JAMSHID GHAJAR, MD; GREG HAWRYLUK, MD

In April 2023, the third edition of the Brain Trauma Foundation’s evidence-based guidelines for the prehospital management of traumatic brain injury (TBI) was published in Prehospital Emergency Care. The practice guidelines were written by a multi-disciplinary group of experts and went through an extensive peer review process. This document is an update of guidelines first published in 2000, and then updated in 2007. These guidelines present the best available evidence to support clinical decision making in the prehospital setting when TBI care may have the most significant impact on outcomes; they also establish a research agenda for future investigations.

TBI is a major public health concern and...
**DON’T MISS FASTER RESULTS FOR GI PATHOGENS.**

**Make more informed treatment decisions.**

Compared with traditional testing, the BIOFIRE® FILMARRAY® Gastrointestinal (GI) Panel has been shown to:

- Reduce the likelihood of antibiotic prescriptions by **11%**.
- Increase targeted therapy by **41%**.
- Reduce laboratory tests on average from **3 to 1**.
- Lead to more patient discharges **~50%** more likely than traditional testing.
- Decrease time to result **84%**.

When patients present with gastrointestinal symptoms, you have important decisions to make—quickly. Which diagnostic tests should be ordered? Should the patient be admitted or discharged? Is antimicrobial therapy appropriate? When you need answers fast, turn to the BIOFIRE GI Panel.


Product availability varies by country. Consult your bioMérieux representative.

BIOFIRE® FILMARRAY® GASTROINTESTINAL PANEL

1 test. 22 targets. ~1 hour.

Scan for More Information.
DON’T MISS
FASTER discharges? Is antimicrobial therapy appropriate? When you tests should be ordered? Should the patient be admitted or have important decisions to make—quickly.


Compared with traditional testing, the BIOFIRE® FILMARRAY® Gastrointestinal (GI) Panel has been shown to:

- Reduce the likelihood of 3
- Lead to more patient discharges 41%

Which diagnostic

84%

PIONEERING DIAGNOSTICS
Scan for More Information.

Lead to more patient discharges

41%

more likely than

3

4

3

2 023

Oct

ber 2023

@WILEY

acepnow.com. Paid subscriptions are available to all others for $334/year individual. To initiate a paid subscription, members of ACEP and SEMPA. Free access is also available online at www.

the Editors of the products advertised.

publication, including any claims related to the products, drugs, or services mentioned herein. ACEP Now do not necessarily reflect those of the American College of Emergency Physicians or the Editors, neither does the publication of advertisements mean to communicate our messages, including practice-changing tips, regulatory updates, and the daily practice. Written primarily by the physician for the physician, ACEP Now is the most effective and correspondence to acepnow

90

ASSOCIATE DIRECTOR, ADVERTISING SALES
Tracey Davies

tdavies@wiley.com

EXECUTIVE DIRECTOR/CHIEF EXECUTIVE OFFICER
Susan Sedory, MA, CAE

ssedney@acep.org

CHIEF OPERATING OFFICER
Robert Heard, MBA, CAE

rheard@acep.org

PUBLICATIONS STAFF
Lisa Dionne Lento

idionnelle@wiley.com

ADVERTISING STAFF
DISPLAY & CLASSIFIED ADVERTISING
Kelly Miller

kmiller@mmrvica.com

(856) 768-9360

EDITORY ADVISORY BOARD
James J. Augustine, MD, FACEP

Richard M. Cantor, MD, FACEP

Anthony Ciofu, MD, FACEP

Jonathan M. Glauser, MD, MBA, FACEP

Michael A. Gramovsky, MD, FACEP

Sarah Hopfer, MD, JD, FACEP

Mitchell Kentor, MD

Philip Luke Leffes, MD, FACEP

Ricardo Martinez, MD, FACEP

Sandra M. Schneider, MD, FACEP

Jeremiah Schuur, MD, MHS, FACEP

Robert C. Solomon, MD, FACEP

Annalisse Sorrentino, MD, FACEP

Peter Vincello, MD, FACEP

Rade B. Vulmir, MD, JD, FACEP

EDITORIAL STAFF
MEDICAL EDITOR
Cedric Dark, MD, MPH, FACEP
cdark@acep.org

ASSOCIATE EDITOR
Catherine A. Marco, MD, FACEP
cmarco@acep.org

ASSISTANT EDITOR
Amy Faith Ho, MD, MPH, FACEP

amyho@acep.org

EXECUTIVE STAFF
EXECUTIVE STAFF
S ENIOR VICE PRESIDENT, COM MUNICAT ION
Jana Nelson

jnelson@acep.org

MANAGING DIRECTOR, CONTENT AND COMMUNICATION INTEGRATION
Nancy Calaway, CAE

ncalaway@acep.org

SENIOR CONTENT MANAGER
Jordan Grantham

jgrantham@acep.org

PUBLISHING STAFF
PUBLISHING DIRECTOR
Lisa Dionne Lento

idionnelle@wiley.com

EXECUTIVE STAFF
EDITOR
Danielle Gallian, MPS
dgallian@wiley.com

ART DIRECTOR
Chris Whissen

chris@quilandcode.com

RESIDENT EDITOR
Carmen Marie Lee, MD, MAS

carmen.marie.lee@gmail.com

ACEP STAFF

WHAT ARE YOU THINKING?

SEND EMAIL TO ACEPNow@ACEP.ORG;

LETTERS TO ACEP Now, P.O. BOX 619911, DALLAS, TX 75261-9911;

AND FAXES TO 972-580-2816, ATTENTION ACEP NOW.
IMPORTANT SAFETY INFORMATION FOR ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)

WARNING: THROMBOEMBOLIC RISKS, ISCHEMIC RISKS, CARDIAC ARREST, AND SUDDEN DEATHS

Treatment with ANDEXXA has been associated with serious and life-threatening adverse events, including:

- Arterial and venous thromboembolic events
- Ischemic events, including myocardial infarction and ischemic stroke
- Cardiac arrest
- Sudden deaths

Monitor for thromboembolic events and initiate anticoagulation when medically appropriate. Monitor for symptoms and signs that precede cardiac arrest and provide treatment as needed.

WARNINGS AND PRECAUTIONS

- Arterial and venous thromboembolic events, ischemic events, and cardiac events, including sudden death, have occurred during treatment with ANDEXXA. To reduce thromboembolic risk, resume anticoagulant therapy as soon as medically appropriate following treatment with ANDEXXA. The safety of ANDEXXA has not been evaluated in subjects who experienced thromboembolic events or disseminated intravascular coagulation within two weeks prior to the life-threatening bleeding event requiring treatment with ANDEXXA. Safety of ANDEXXA also has not been evaluated in subjects who received prothrombin complex concentrates, recombinant factor VIIa, or whole blood products within seven days prior to the bleeding event.

- Re-elevation or incomplete reversal of anticoagulant activity can occur.
- ANDEXXA may interfere with the anticoagulant effect of heparin. If anticoagulation is needed, use an alternative anticoagulant to heparin.

ADVERSE REACTIONS

The most common adverse reactions (≥ 5%) in bleeding subjects receiving ANDEXXA were urinary tract infections and pneumonia. The most common adverse reactions (≥ 3%) in healthy volunteers treated with ANDEXXA were infusion-related reactions.

INDICATION

ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo) is a recombinant modified human factor Xa (FXa) protein indicated for patients treated with rivaroxaban or apixaban, when reversal of anticoagulation is needed due to life-threatening or uncontrolled bleeding.

Rely on the only antidote for the reversal of Eliquis® or Xarelto® in patients with acute major bleeding.8

<table>
<thead>
<tr>
<th>Important Safety Information</th>
<th>SHUT OFF FXa INHIBITOR ACTIVITY WITH ANDEXXA™</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMPORTANT SAFETY INFORMATION FOR ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
<td><strong>SHUT OFF FXa INHIBITOR ACTIVITY WITH ANDEXXA™</strong></td>
</tr>
<tr>
<td><strong>WARNING: THROMBOEMBOLIC RISKS, ISCHEMIC RISKS, CARDIAC ARREST, AND SUDDEN DEATHS</strong></td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>Treatment with ANDEXXA has been associated with serious and life-threatening adverse events, including:</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td>• Arterial and venous thromboembolic events</td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>• Ischemic events, including myocardial infarction and ischemic stroke</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td>• Cardiac arrest</td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>• Sudden deaths</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td>Monitor for thromboembolic events and initiate anticoagulation when medically appropriate. Monitor for symptoms and signs that precede cardiac arrest and provide treatment as needed.</td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td><strong>WARNINGS AND PRECAUTIONS</strong></td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td>• Arterial and venous thromboembolic events, ischemic events, and cardiac events, including sudden death, have occurred during treatment with ANDEXXA. To reduce thromboembolic risk, resume anticoagulant therapy as soon as medically appropriate following treatment with ANDEXXA. The safety of ANDEXXA has not been evaluated in subjects who experienced thromboembolic events or disseminated intravascular coagulation within two weeks prior to the life-threatening bleeding event requiring treatment with ANDEXXA. Safety of ANDEXXA also has not been evaluated in subjects who received prothrombin complex concentrates, recombinant factor VIIa, or whole blood products within seven days prior to the bleeding event.</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td>• Re-elevation or incomplete reversal of anticoagulant activity can occur.</td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>• ANDEXXA may interfere with the anticoagulant effect of heparin. If anticoagulation is needed, use an alternative anticoagulant to heparin.</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td><strong>ADVERSE REACTIONS</strong></td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>The most common adverse reactions (≥ 5%) in bleeding subjects receiving ANDEXXA were urinary tract infections and pneumonia. The most common adverse reactions (≥ 3%) in healthy volunteers treated with ANDEXXA were infusion-related reactions.</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
<tr>
<td><strong>INDICATION</strong></td>
<td><strong>IMPORTANT SAFETY INFORMATION FOR</strong></td>
</tr>
<tr>
<td>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo) is a recombinant modified human factor Xa (FXa) protein indicated for patients treated with rivaroxaban or apixaban, when reversal of anticoagulation is needed due to life-threatening or uncontrolled bleeding.</td>
<td><strong>ANDEXXA® (coagulation factor Xa [recombinant], inactivated-zhzo)</strong></td>
</tr>
</tbody>
</table>
ANDEXXA is the only reversal agent for Eliquis and Xarelto patients with acute major bleeds with prospective data and confirmatory real-world evidence.

An improvement in hemostasis has not been established

1 In ANNEXA-A (N=31) and ANNEXA-R (N=39), randomized, double-blind, placebo-controlled studies in healthy volunteers, ANDEXXA bolus followed by continuous infusion reduced the primary endpoint of mean percent change in anti-FXa activity from baseline to nadir by 95% in Eliquis-treated subjects and 97% in Xarelto-treated subjects receiving low and high dose, respectively [P<0.0001].1,2

2 ANNEXA-4 was a phase 3b/4, multicenter, prospective, single-arm, open-label study evaluating ANDEXXA in patients with acute major bleeding within 18 hours of FXa inhibitor administration (N=352). ANDEXXA was administered as a bolus dose followed by a 2-hour infusion as a low- or high-dose regimen depending on the identity, timing, and dose of the last FXa inhibitor received. The low-dose regimen consisted of a bolus dose of 400 mg at a target rate of 30 mg/minute, and an infusion dose of 480 mg at 4 mg/minute for 2 hours. The high-dose regimen consisted of a bolus dose of 800 mg at a target rate of 30 mg/minute, and an infusion dose of 960 mg at 8 mg/minute for 2 hours. Co-primary efficacy endpoints: percent change in anti-FXa activity from baseline to the nadir between 5 minutes after the end of the bolus up until the end of the infusion, and rate of effective hemostasis within 12 hours after infusion.1,2

3 Coleman et al 2020 was a multicenter, retrospective analysis that captured electronic medical records for adult patients hospitalized for FXa inhibitor-related bleeding between January 2016 and September 2019. Records from the 45 US-based hospitals that agreed to participate included 3030 FXa inhibitor-related hospitalizations for major bleeds. At baseline, 49% of patients had been treated with Xarelto and 45% of patients had been treated with Eliquis.4

4 Cohen et al 2022 was a retrospective, indirect, comparative analysis of results from the ANNEXA-4 and ORANGE studies that used propensity score matching to compare all-cause 30-day mortality by overall cohort and by type of bleed: ICH, GI bleed, and other major bleeds as the primary analysis. ORANGE was an observational prospective registry study that collected information from 32 UK hospitals on the presentation and clinical outcomes of patients who were admitted for a FXa inhibitor-related major bleed (N=2912). Only patients on apixaban or rivaroxaban from both studies were included in this analysis.1,7

1 Wholesale Acquisition Cost (WAC) as of April 1, 2022.6 FXa, factor Xa; GI, gastrointestinal; ICH, intracranial hemorrhage.

IMPORTANT SAFETY INFORMATION (cont’d)

INDICATION (cont’d)

This indication is approved under accelerated approval based on the change from baseline in anti-FXa activity in healthy volunteers. An improvement in hemostasis has not been established. Continued approval for this indication may be contingent upon the results of studies that demonstrate an improvement in hemostasis in patients.

Limitations of Use

ANDEXXA has not been shown to be effective for, and is not indicated for, the treatment of bleeding related to any FXa inhibitors other than apixaban or rivaroxaban.

You are encouraged to report the negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

Please see additional Important Safety Information throughout and brief summary, including Boxed WARNING, on the following page.


©2023 AstraZeneca. All rights reserved. US-77990 Last Updated 8/23

ANDEXXA is a registered trademark of the AstraZeneca group of companies. Other brands noted herein are the property of their respective owners.
ANDEXXA® (coagulation factor Xa (recombinant), inactivated-anzho) Lyophilized powder for solution for intravenous injection

Initial U.S. Approval: 2018

Brief Summary of Prescribing Information. For complete prescribing information consult official package insert.

WARNING: THROMBOEMBOLIC RISKS, ISCHEMIC RISKS, CARDIOVASCULAR ARREST, AND SUDDEN DEATH

Treatment with ANDEXXA has been associated with serious and life-threatening adverse events, including:

- Arterial and venous thromboembolic events
- Ischemic events, including myocardial infarction and ischemic stroke
- Cardiac arrest
- Sudden deaths

Monitor for thromboembolic events and initiate anticoagulation when medically appropriate. Monitor for symptoms and signs that precede cardiac arrest and provide treatment as needed.

INDICATIONS AND USAGE

ANDEXXA is indicated for patients treated with rivaroxaban or apixaban, when reversal of anticoagulation is needed due to life-threatening or uncontrolled bleeding.

This indication is approved under accelerated approval based on the change from baseline in anti-FXa activity in healthy volunteers (see Clinical Studies (14) in the full Prescribing Information). An improvement in hemostasis has not been estimated. No approval for this indication may be contingent upon the results of studies that demonstrate an improvement in hemostasis in patients.

Limitations of Use

AnDEXXA has been shown to be effective for, and is not indicated for, the treatment of bleeding related to any FXa inhibitors other than rivaroxaban or apixaban.

CONTRAINDICATIONS

None.

WARNINGS AND PRECAUTIONS

Thromboembolic and Ischemic Risks

The thromboembolic and ischemic risks were assessed in 352 bleeding subjects who received ANDEXXA. Of the 71 subjects who were anticoagulated with rivaroxaban and had elevated baseline anti-FXa activity levels >300 ng/mL, 19 subjects (26%) experienced a >90% decrease from baseline anti-FXa activity level at the time of ANDEXXA administration.

Nineteen subjects who were anticoagulated with rivaroxaban had elevated baseline anti-FXa activity levels >300 ng/mL. Forty-eight of the 71 apixaban-treated subjects (68%) experienced a >90% decrease from baseline anti-FXa activity level after discontinuation of ANDEXXA.

The ANNEXA-4 study is an ongoing multinational, prospective, open-label study using ANDEXXA in subjects presenting with acute coronary syndrome (ACS) who were on dual antiplatelet therapy and who were at risk of ischemic events. ANDEXXA was administered to 104 subjects at the time of acute coronary intervention (ACI), 74 of whom were in the ACS group and 30 of whom were in the PCI group.

ADVERSE REACTIONS

The most common adverse reactions (≥5%) in bleeding subjects receiving ANDEXXA were urinary tract infections and pneumonia.

The most common adverse reactions (≥3%) in healthy subjects treated with ANDEXXA were infusion-related reactions.

Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be compared directly to the rates in clinical trials of another drug and may not reflect the rates observed in clinical practice.

In the pooled safety analysis of clinical trials of ANDEXXA, 223 healthy volunteers received FXa inhibitors, followed by treatment with ANDEXXA. The frequency of adverse reactions was similar in the ANDEXXA-treated group (15/223; 54%) and in the placebo-treated group (5/49; 10%). Infusion-related adverse reactions occurred in 18% (39/223) of the ANDEXXA-treated group and were the only type of adverse reaction that occurred more frequently than in the placebo group. No serious or severe adverse reactions were reported.

The ANNEXA-4 study is an ongoing multinational, prospective, open-label study using ANDEXXA in subjects presenting with acute major bleeding and who have recently received a FXa inhibitor. To date, safety data are available for 352 subjects. Sixty-three percent of the 352 subjects were 75 years or older. Subjects had received either apixaban (194/352; 55%) or rivaroxaban (128/352; 36%) as an anticoagulation treatment for atrial fibrillation (286/352; 81%) or venous thromboembolism (67/352; 19%) and 87% of subjects were taking concomitant antiplatelet therapy. The median time to event was seven days. A total of 30% of subjects with thromboembolic events (21/63) experienced the thromboembolic event during the first three days. Of the 352 subjects who received ANDEXXA, 223 received at least one anticoagulation dose within 30 days after treatment. Of these 223, 18 subjects (8%) had a thrombotic event and/or ischemic event after resumption. Of the 352 (0.6%) subjects in the ANNEXA-4 study expected an infusion-related reaction.

Immunogenicity

As with all therapeutic proteins, there is the potential for immunogenicity using an electrochemiluminescence (ECL)-based assay. 145 ANDEXXA-treated healthy subjects were tested for antibodies to ANDEXXA as well as for antibodies cross-reacting with factor X (FX) and FXa. Low titers of anti-ANDEXXA antibodies were observed in 26/140 healthy subjects (18%). 6% (9/145) were first observed at Day 30, with 20 subjects (14%) still having titers at the last time point (Days 44 to 46). To date, the pattern of antibody response in subjects in the ongoing ANNEXA-4 study has been similar to that observed in healthy volunteers. Of the 236 subjects with available samples, 6.8% (16/236) had antibodies against ANDEXXA. None of these anti-ANDEXXA antibodies were neutralizing. No neutralizing antibodies cross-reacting with FX or FXa were detected in healthy subjects (0/14) or in bleeding subjects (6/236) to date.

Detection of antibody formation is highly dependent on the sensitivity and specificity of the assay. Additionally, the observed incidence of antibody (including neutralizing antibody) positivity in an assay may be influenced by several factors, including assay methodology, sample handling, timing of sample collection, concomitant medications, and underlying disease. For these reasons, comparison of the incidence of antibodies to ANDEXXA with the incidence of antibodies to other products may be misleading.

USE IN SPECIFIC POPULATIONS

Pregnancy

Risk Summary

There are no adequate and well-controlled studies of ANDEXXA in pregnant women to inform patients of associated risks. Animal reproductive and developmental studies have not been conducted with ANDEXXA.

In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2% to 4% and 15% to 20%, respectively.

Labor or Delivery

The safety and effectiveness of ANDEXXA during labor and delivery have not been evaluated.

Lactation

Risk Summary

There is no information regarding the presence of ANDEXXA in human milk, the effects on the breastfed child, or the effects on milk production.

The developmental and health benefits of breastfeeding should be considered along with the mother’s clinical need for ANDEXXA and any potential adverse effects on the breastfed child from ANDEXXA or from the underlying maternal condition.

Pediatric Use

The safety and efficacy of ANDEXXA in the pediatric population have not been studied.

Geriatric Use

Of the 71 subjects in the ANNEXA-4 study of ANDEXXA, 314 were 65 years of age or older, and 231 were 75 years of age or older. No overall differences in safety or efficacy were observed between these subjects and younger subjects, and other reported clinical experience has not identified differences in responses between elderly and younger subjects; however, greater sensitivity of some older individuals cannot be ruled out.

The pharmacokinetics of ANDEXXA in healthy older (≥65 years; n=10) subjects were not different compared to younger (18-45 years; n=10) subjects.

Manufactured by: Astrazeneca AB, Södertälje, Sweden SE-15185 Distributed by: Astrazeneca Pharmaceuticals LP, Wilmington, DE 19850 U.S. License No. 2059 Product of Spain

ANDEXXA is a registered trademark of the Astrazeneca group of companies. ©Astrazeneca 2023 02/23 US-76398 5/23

No thromboembolic events were observed in 223 healthy volunteers who received FXa inhibitors and were treated with ANDEXXA.

Infusion-Related Reactions

Infusion-related reactions occurred in 18% (39/223) of ANDEXXA-treated healthy volunteers vs. 6% (6/94) of placebo-treated subjects. These reactions were characterized by a range of symptoms, including flushing, feeling hot, cough, dyspnea, and tachycardia. Symptoms were mild to moderate in severity, and 90% (35/39) did not require treatment. One subject with a history of hives prematurely discontinued ANDEXXA after developing mild hives. Two of 306 (0.6%) subjects in the ANNEXA-4 study experienced an infusion-related reaction.

Thromboembolic events occurred in 18% (37/205) of healthy volunteers vs. 6% (6/94) of placebo-treated subjects. These reactions were characterized by a range of symptoms, including flushing, feeling hot, cough, dyspnea, and tachycardia. Symptoms were mild to moderate in severity, and 90% (35/39) did not require treatment. One subject with a history of hives prematurely discontinued ANDEXXA after developing mild hives. Two of 306 (0.6%) subjects in the ANNEXA-4 study experienced an infusion-related reaction.
In 2022, Spectrum Health and Beaumont Health integrated to create one system, Corewell Health. We continue to provide the same educational excellence that fosters innovation to always remain at the forefront of medicine.

Corewell Health—Grand Rapids/Michigan State University Emergency Medicine Residency

What does your program offer that residents can’t get anywhere else?

Our residency program is dedicated to producing safe, competent and qualified individuals in emergency medicine. As the seventh oldest emergency medicine program in the United States, we have spent decades fine-tuning our program into a compassionate, comprehensive training experience for our residents. The emergency medicine residency program at Corewell Health in West Michigan provides a well-developed foundation of skills integral in our residents’ journeys. Additionally, our vast network of program alumni allows residents ample opportunity to secure jobs throughout the country.

What are some fun activities residents like to partake in or recently participated in?

Our program is primarily based at the heart of West Michigan in the city of Grand Rapids, the second largest city in the state. For those who enjoy exploring, West Michigan is home to countless attractions; from scenic trails and the beaches of Lake Michigan to a variety of museums and festivals, there is something of interest for people of all ages, identities, and interests. In fact, not only is Grand Rapids well known for its food and arts scenes, but the city has recently been declared the second-best place to live in Michigan and the 20th in the entire country by U.S. News and World Report.

How should potential applicants learn more about your program?

Learn more about the program by visiting spectrumhealth.org.

—Katie Stallard; Ilaine Snoeyink; Matt Singh, MD; Jason Seamon, DO

TOXICOLOGY Q&A

QUESTION: Can coming into contact with this chemical compound result in mortality?

SEE THE ANSWER on page 20

FINGERS COUNT

AND YOUR PATIENTS ARE COUNTING ON YOU

EMERGENCY & TRAUMA CARE (ELSEVIER, Sept. 2019)

“Traditional methods of tourniquet application to digits (e.g. silicon ring, surgical glove, Penrose drain) all exceed the pressure required for digital hemostasis, and dramatically increase the risk of neurovascular injury. These potential injuries can be devastating for the patient.”

“THE T-RING™ TOURNIQUET is now used to replace these other methods. It applies even pressure to any digit, creating the required bloodless field with minimal pressure.”

MAKE EVERY FINGER COUNT

Start using the T-RING, the ONLY tourniquet for digits proven to apply a safe pressure on all digit sizes.”

www.theTring.com
info@theTring.com

©2020 Tring. All Rights Reserved.
The last few years have been a tumultuous time for the emergency medicine (EM) specialty, especially as it pertains to our workforce. Per Medscape, emergency physicians have the highest burnout rate—65 percent—among all surveyed specialties.1 Attrition rates within the profession are high and rising, especially for female physicians and those working in rural settings.2–5

By the time online, the EM marketplace still functions much like it did in the last century. ACEP is identifying and addressing the factors harming the EM job marketplace through advocacy work while also developing new resources.

At the most fundamental level, emergency physicians cannot change jobs if they are legally prevented from doing so by non-compete agreements. In March 2023, ACEP sent a letter to the Federal Trade Commission strongly supporting the FTC’s proposal to ban non-compete agreements from employment contracts.6 Per ACEP President Christopher S. Kang, MD, FACEP, “ACEP supports the Commission’s proposal to categorically ban non-compete clauses, and we urge it to finalize the regulation as proposed to help address the current anti-competitive conditions faced by many emergency physicians that limit their right to freely practice medicine in their communities.”7

Other core elements of a well-functioning job market are supply, safety, transparency, and simplicity. The EM job market could be improved in all four of those dimensions. The EM job market’s lack of transparency is especially striking. Even figuring out which medical practice staffs a particular emergency department is challenging. As job boards post only about one-fifth of emergency department jobs at any given time, the emergency-physician application process often still relies heavily on word of mouth. In an era when we can do almost anything online, the EM marketplace still functions much like it did in the last century.

The EM job market’s opacity and inefficiency have led to the growth of expensive intermediaries. EM practices spend upward of $50,000 per hire in recruitment costs, while locum tenens companies charge up to 30 percent commissions.8

ACEP is actively addressing the safety, transparency, and simplicity of the EM job market. ACEP has recently partnered with Ivy Clinicians to create ACEP Open Book, the core of which is a survey of employers about their practices and characteristics. The survey results will be easily searchable through ACEP’s Career Center.

For those looking to find more information about specific emergency departments, Open Book will grant all ACEP members free access to Ivy Clinicians’ platform. Ivy has connected every emergency department with its employer group, as well as size-level demographics, quality, and efficiency. Searching for potential employers through Open Book will be as simple as searching for houses on Zillow.

Because ACEP strongly values its members’ data privacy, Open Book and its partners will share physician information only with employers specifically chosen by that physician. Using the platform will not lead to unsolicited spam.

The EM job market has significantly changed over the past decade. ACEP’s advocacy and technology have evolved along with those market changes. One of ACEP’s primary goals is to improve how the EM job market functions so every emergency physician can find work in a setting that gives them meaning and satisfaction. Explore this new resource by visiting openbook.acep.org.

References
Quickly & efficiently fulfill the 8-hour DEA required SUD training for new & renewing licensees.

Expert Faculty
Experience instruction by an energetic and knowledgeable faculty of “been there, done that” physicians who are experts in the recognition and care of substance use disorder.

8-Hour Online Course
Our 8-hour course covers everything needed by physicians, NPs, PAs, dentists, and podiatrists to meet the DEA requirements.

Focused SUD Content
The course will update clinicians on the optimal treatment of outpatient pain, how to screen patients for SUD, and how to effectively treat and/or refer these patients.

Watch or Listen Instantly
Watch or listen instantly and earn up to 8.00 AMA PRA Category 1 Credits™ and ACEP Category 1 Credit. Approved for 6.00 hours of pharmacology.

Visit www.DEAcourse.com Today
or Call 1-800-458-4779 (9:00am-5:00pm EDT, M-F)
Using Civic Engagement and Voter Registration to Fight My Burnout

Are you intentionally missing the elephant in the trauma bay?

by CLAIRE ABRAMOFF, MD

At times, I want to give up this crazy, broken career as an emergency physician. We all recognize that our jobs have become more challenging since COVID-19 broke down our health care system and destroyed many of our social safety nets. COVID-19, vaccines, and health care in general have become more and more politicized, and I think that anyone who continues to deny the role politics and policy play in the health of our patients is intentionally missing the elephant in the trauma bay.

Observations on Shift and on the Street

I see the consequences of political decisions and policies. The elderly woman about to lose a foot due to complications of her diabetes? She is unable to afford the monthly cost of her prescription medications, despite having insurance and being employed her entire adult life, and so rations her insulin. Teen pregnancies, recurrent sexually transmitted disease exposures and infections, injuries due to intimate partner violence? Data clearly suggest that abstinence-only sexual education in our public school systems has resulted in astonishing rates of teen pregnancy, abortions, and sexually transmitted disease infections.4

The most dramatic example of the interplay between politics and medicine in the ever-increasing gun violence in my home city, Philadelphia. 2021 was a remarkably violent year in the city—there were more than 590 homicides, 85 percent of which were due to shootings.1,2 There was a total of more than 2,300 shootings in the city in 2021—that shows up in the trauma bays and resuscitation rooms in our emergency departments.

A resident once told me that in emergency medicine, “we carry our graveyard with us.” Well, unfortunately my graveyard is bursting at the seams. Eventually, they chip away at our ability to work in this field.

Doing Something Different

In a moment of burnout, desperate to change something, I signed up for a civic health fellowship through Vote-ER: Vote-ER is a nonpartisan organization that works to bring voter registration into health care settings, with the goal of giving patients a voice in the policies that directly impact them. This fellowship has reinvigorated me and given me a way to funnel my anger into action.

There are 51 million unregistered voters in the United States, the vast majority of whom are young, low-income people of color—a huge chunk of the patient population that we serve on a daily basis.3 When patients do not vote, political campaigns are less likely to address their needs. In Philadelphia specifically, neighborhoods with higher voter turnout have higher life expectancies in comparison with areas with lower voter activity.4

Our patients desperately need their voices heard by those in political power: they need political action and policy that will address gun violence, crime, education, access to health care, and countless other challenges that negatively impact their health. Using the tools learned in my fellowship, we have had tremendous success registering our patients to vote. We have run educational sessions for our emergency medicine faculty and residents to present the concept of voting as a social determinant of health, and teach methods and strategies for registering patients in an emergency department setting. Vote-ER has provided us with badges printed with QR codes, which patients can scan and check their voter registration in real time. We have worked with our registration staff, and have successfully integrated a voter registration prompt into the emergency department registration process. We have also added a voter registration QR code to all discharge instructions printed from the emergency department.

In the fall of 2022, we organized and ran a city-wide voter registration day in health care centers across Philadelphia. Working with colleagues in other hospitals to set up a unified event was an incredibly energizing and satisfying project that helped reinvigorate and inspire me as a physician. The health care field can often feel very competitive, especially in academia. This event, though, was a true collaboration to help the underrepresented patients of Philadelphia. We worked across five major academic institutions to co-run voter registration drives at our hospitals and clinics for National Voter Registration Day in September. At my hospital alone, we registered nearly 50 new voters in this single event.

We have expanded our project from last year, and plan to include more clinics, hospitals, and medical schools. Please consider planning an event at your hospital—you may be surprised at the amount of support and satisfaction you receive.

Impactful Work... Everywhere

In some ways, this feels more impactful than a lot of my clinical work. I can fix the electrolyte derangements and acidosis of my patient presenting in diabetic ketoacidosis, but I cannot fix the social issues that led to their near-monthly hospital presentations for the same issue. However, by empowering the community to participate in our democratic process, hopefully systematic change can occur and help make our country a healthier place to live. This has re-inspired me as a physician, and has helped me find meaning and purpose in the often heartbreaking reality of our profession.

References

DR. ABRAMOFF (@CLAIRENTO) is an assistant director of the Office of Emergency Medicine at Einstein Medical Center in Philadelphia.
Dr. Liz Clayborne didn’t set out to become an entrepreneur. She had her mind set on academic emergency medicine (EM), with specific interests in health policy, medical ethics, and health disparities. The spark that ignited her entrepreneurial journey was a common problem during which Dr. Clayborne raised $1.1 million. She’s been relentlessly persistent in pursuit of her dream to join the very small club of Black woman entrepreneurs, learning a lot along the way. “I really have honed my skills of being able to clearly and intellectually for what would become NasaClip, encouraging her to pursue her idea further by applying for the acceleration program during her maternity leave in 2020 because that specific program required full-time enrollment, and the only way she could pull it off was during leave. Somehow, she made it work, finishing that 12-week program with the capital and executive support she needed to get her company off the ground.

Fast-forward to July 2023, the official launch of her nosebleed management device. It came after two rounds of funding during which Dr. Clayborne raised $1.4 million. She’s been relentlessly persistent in pursuit of her dream to join the very small club of Black woman entrepreneurs, learning a lot along the way. “I really have honed my skills of being able to clearly communicate my problem, what my solution is, why my business is going to be successful, and why I am the type of founder my investors want to get behind and back financially,” she said. It hasn’t been easy, but she said it has been exciting. “That three-year period between 2020 and 2023 when I launched was still the most challenging because you are always juggling still doing clinical work, and I also think you have an internal battle—am I going to give up this profession that I spent so much time and effort to become?”

For Dr. Clayborne, she stepped down her clinical work gradually until deciding to go PRN in April 2023. Now she dedicates most of her time to growing her company and is in the middle of a $4 million seed raise to grow NasaClip into new territory, perhaps as an intranasal medication delivery platform. Her goal for the next 12 months is to grow product awareness in the clinician and consumer markets while building an internal infrastructure to sustain growth on NasaClip.com. How does Dr. Clayborne “do it all” as a business owner and mother of two kids under four? It can be exhausting, she admits, but she protects her Mondays as rest days, and she makes a point to celebrate her little wins along the way. One little win coming up that she’s looking forward to? Debuting her product as an exhibitor at ACEP23!

Though she’s focused on growing her company for now, she is already thinking about her exit strategy. Dr. Clayborne wants to use her entrepreneurial success to inspire others, both as a keynote speaker and as an angel investor. “I’d love to have that capital to reinvest in other women and people of color,” she said. “I truly think this is a way to build true generational wealth within these communities that have historically not had good access to capital historically in this country.”

She has two pieces of advice for fellow emergency physicians who have a business idea they want to pursue. “You have to believe in yourself first. If you don’t truly believe in your idea and you don’t believe in yourself, you aren’t going to get anyone else to back. You have to have that enthusiasm first. That fire has to come from you,” she said. “The second one is just take one step forward instead of thinking about the 20 steps that you need to accomplish in order to make this idea come to fruition. Think about what are the three most immediate steps I need to take to get to the next level and work on those.”

Visit acepnow.com to read the full article.
BRIDGING THE LANGUAGE GAP

Tips for working with medical interpreters

by MARC CASSONE, DO

Clinical Case

Your next patient is a Spanish-speaking 24-year-old female who begins by telling you that she is embarazada. Despite her bashfulness, you debate whether or not to call in the interpreter, since the waiting room is overcrowding and between her broken English and your high-school Spanish you think you can get by without formal interpretation.

Medical Interpreting

According to the U.S. Census Bureau, 66.6 million Americans (approximately 20.8 percent) do not speak English as a primary language, and 25 million of those speak English less than well (known as “limited English proficiency” or LEP); many indicators show this number will only continue to grow. This demographic is higher risk of adverse events during hospital encounters, often due to communication issues, leading to tragic outcomes and malpractice suits including cases of missed intracerebral hemorrhages, unnecessary or malpractice suits including cases of missed

is higher risk of adverse events during hosp-

ers in emergency departments based on prior state-level requirements have been mixed.

Many medical interpreters are certified by organizations such as the National Board for Certification for Medical Interpreters, or the Certification Commission for Healthcare Interpreters, which requires both written and oral testing and documented experience, as well as additional training in medical ethics, terminology, and patient privacy regulations. These include ASL interpreters. However, it has not been feasible to develop and validate certifications for all of the over 350 different languages spoken in the U.S., let alone find qualified interpreters for each language. Some certifying bodies may provide provisional interpreters in cases where they cannot certify an interpreter for a certain language or dialect. In other cases, medical staff may have to rely on ad hoc interpreters.

Tips for Working with Medical Interpreters

Prepare ahead before entering the patient’s room. Have an initial plan for the conversation including what information you want to convey and specific questions you want to ask. If possible, discuss these ahead with the interpreter. Being patient, using clear language, and a respectful tone will go a long way to establishing trust with the patient and their families. Beware of possible prejudices and assuming cultural values of the patient and others who speak that language. Physicians should document the interpreter’s name and identification number if available in the patient’s chart.

Telephone-Based Services

Remote tele-interpreter services have certainly improved access to certified and qualified interpreters with extended availability and a wide range of spoken languages. Users must ensure a reliable connection speed and good audiovisual capabilities (especially for the elderly and hearing- or sight-impaired), and consider the lack of visual cues such as body language and facial expressions that can be a source of misunderstandings when compared to in-person services.

Using Ad Hoc Interpreters

In emergency cases, ad hoc interpreters (friends, family, community members, or untrained staff) will need to be used because of extenuating circumstances. Ideally, medical staff should attempt some vetting of the ad hoc interpreters and confirm the patient agrees with this person to interpret in the situation. Nondocumented, non-adult children are often used as ad hoc interpreters, which can be fraught with issues. Ad hoc interpreters have a higher rate of potentially consequential errors compared to professional interpreters (22 percent versus 12 percent) and outcomes significantly are improved for individuals with over 100 hours of training (2 percent).

Although there are no current standards forbidding it, multilingual physicians may be tempted to use their own language background to forge an interpreter. Being bilingual is often not enough to be a medical interpreter, which requires precision, experience, and knowledge of medical jargon, as well as culturally specific idioms and phrases.

For example, the French-Canadian patient who claims to have chair blesseé may just chuckle and her chap’ (hat) instead.

References

2. Suireid S. Medical translation gone wrong. 7 deva-

sion: medical translation errors. K International. The


3. Joint Commission’s standards follow similar

requirements. However, actual increases in

available services in emergency departments

and assuming cultural values of the patient

and others who speak that language. Physi-

icians should document the interpreter’s name

and identification number if available in the

patient’s chart.

Telephone-Based Services

Remote tele-interpreter services have certainly

improved access to certified and qualified

interpreters with extended availability and a

wide range of spoken languages. Users must

ensure a reliable connection speed and good

audiovisual capabilities (especially for the

elderly and hearing- or sight-impaired), and

consider the lack of visual cues such as body

language and facial expressions that can be

a source of misunderstandings when compared

to in-person services.

Using Ad Hoc Interpreters

In emergency cases, ad hoc interpreters (friends, family, community members, or untrained staff) will need to be used because of extenuating circumstances. Ideally, medical staff should attempt some vetting of the ad hoc interpreters and confirm the patient agrees with this person to interpret in the situation. Nondocumented, non-adult children are often used as ad hoc interpreters, which can be fraught with issues. Ad hoc interpreters have a higher rate of potentially consequential errors compared to professional interpreters (22 percent versus 12 percent) and outcomes significantly are improved for individuals with over 100 hours of training (2 percent).

Although there are no current standards forbidding it, multilingual physicians may be tempted to use their own language background to forge an interpreter. Being bilingual is often not enough to be a medical interpreter, which requires precision, experience, and knowledge of medical jargon, as well as culturally specific idioms and phrases. For example, the French-Canadian patient who claims to have chair blesseé may just chuckle and her chap’ (hat) instead. A physician once attempted to use his limited Diné, which is notably hard to pronounce, to ask a Navajo patient for their chipotle sample and just ended up getting a chuckle and her chap’ (hat) instead.

Documentation

Providing patient-facing documentation such as procedural consent forms, discharge instructions, and medication prescriptions in the appropriate language can provide a distinct challenge. Some electronic-health record packages provide discharge instructions for common diagnoses in common languages; however, these are certainly not extensive and can lack individualized information. Although tempting to use, current online language translation programs can be inconsistent, worse than human translators, and possibly even lead to dangerous mistranslations.

Clinical Case Resolution

You decide to call in the interpreter and find out the patient was actually telling you that she was pregnant (and not embarrassed) and had heavy first-trimester bleeding. After the appropriate work-up, you learned she had the medical interpreter present to appropriate-

ly communicate the nuances of a threatened abortion and address your patient’s concerns in her primary language.
a leading cause of morbidity and mortality for both children and adults. There are at least 600 TBI-related hospitalizations and 175 TBI-related deaths per day.1,2 TBI outcomes are profoundly linked to the timing and quality of care provided before patients reach the hospital. Continuous cerebral blood flow is paramount and brief episodes of systemic hypotension, hypoxia, or inadvertent iatrogenic hyperventilation have been strongly associated with worse outcomes in both children and adults.3 Similar to out-of-hospital cardiac arrest, the actions of prehospital providers have enormous impact on survival and the degree of any long-term disability. Prehospital providers must be competent and proficient in both the recognition and the seamless management of TBI, as well as facile in determining the most appropriate receiving facility for the acutely brain injured patient.

Prognosis from brain injury results not only from the initial or primary injury, but also from secondary injury that occurs after the event, mainly, hypoxic/ischemic brain injury from under resuscitation or cerebral edema from the release of neurotoxic inflammatory mediators. These guidelines are designed to minimize secondary injury and thus maximize survival by addressing the actions that take place during that critical time from the primary event to arrival at the hospital.

This guideline revision is particularly timely as EMS systems have shown their abilities to dramatically improve survival and neurologic outcome after cardiac arrest, STEMl, acute stroke, and other time-sensitive conditions.

In creating these guidelines, the author team utilized a rigorous grading of the published evidence and provided detailed evidentiary tables that support the recommendations. Terminology used include Strength (rating of strong vs. weak) and Quality of Evidence (high, moderate, or low). These designations take into account not only the quality of the evidence based on study design but also design flaws that weaken a study’s internal or external validity.

The recommendations in the first two editions of these guidelines were all graded as “weak” due to the lack of high-quality evidence. Since the last edition, evidence has grown supporting an outcome benefit of interventions; specifically, the statewide Excellence in Prehospital Injury Care (EPIC) initiative from Arizona which documented an outcome benefit for patients with moderate and severe TBI when prehospital treatment guidelines were followed.1 In addition, a number of meta-analyses have produced a higher level of evidence that consequently support a “strong” recommendation in several areas where the previous guideline was rated “weak” in prior guidelines.

The recommendations in the guidelines are divided into sections pertaining to “Assessment,” “Treatment” and “Decision Making.” Chapters within these sections are uniformly structured to include Recommendations, Evidence Tables, Scientific Foundations, and Key Issues for Future Investigation, and References. The following

### ASSESSMENT

#### Oxygenation, Blood Pressure, Ventilation

- **Patients with suspected traumatic brain injury (TBI)** should be carefully monitored in the prehospital setting for hypoxemia (90% arterial hemoglobin saturation), hypotension (<100 mmHg systolic blood pressure [SBP]), hypertension (150 mmHg SBP or higher), hyperventilation (end tidal CO2 reading less than 35) and hypo- or hyperthermia.
- **Blood oxygen saturation** should be continuously measured in the prehospital setting with a pulse oximeter and supplemental oxygen administered to maintain blood oxygen saturation above 90%.
- **Systolic and diastolic blood pressure should be measured** in the prehospital setting using the most accurate method available and should be measured frequently (every 5-10 min) or monitored continuously if possible.
- **Ventilation should be assessed** in the prehospital setting for all patients with an altered level of consciousness with continuous capnography to maintain end tidal CO2 values between 35 and 45 mmHg.
- **Temperature should be measured** in the prehospital setting and efforts should be undertaken to maintain euthermia in the patient equaling to temperatures of 36-37 degrees Celsius.
- **In non-resource-limited settings**, appropriately sized equipment to measure oxygenation, blood pressure, and temperature in children and adults should be maintained and available for routine use by trained prehospital professionals.

#### Glasgow Coma Scale Score

- The adult protocol for standard GCS measurement should be followed in children over 2 years of age. In pre-verbal children, the P-GCS should be employed.
- The GCS score should be reported every 30 minutes in the prehospital setting and whenever there is a change in mental status to identify improvement or deterioration over time. Confounders to the GCS such as seizure and post-ictal phase, ingestions and drug overdose, as well as medications administered in the prehospital setting that impact GCS score should be documented.
- The GCS must be obtained through interaction with the patient (i.e., by giving verbal directions or, for patients unable to follow commands, by applying a painful stimulus such as nail bed pressure or axillary pinch).
- The GCS should be measured after airway, breathing, and circulation are assessed, after a clear airway is established, and after necessary ventilatory or circulatory resuscitation has been performed.
- The GCS should be measured prior to administering sedative or paralytic agents when possible and when not delaying airway stabilization, or after these drugs have been metabolized as they may obscure correct scoring.
- The GCS should be measured by prehospital professionals who are appropriately trained in how to administer the GCS to both adults and children.
- The GCS of the prehospital patient, including any changes in score, should be communicated to receiving facilities during all communications and upon arrival.
- Prehospital assessment of neurologic status using the Simplified Motor Score (SMS), or the isolated motor component of the GCS may provide similar diagnostic and prognostic utility to the complete GCS in adults and may be used in trauma systems organized to incorporate these measures.

#### Pupil Examination

Pupils should be assessed in the prehospital setting after the patient has been resuscitated and stabilized, with the examination recorded and relayed to the receiving facility. When assessing pupils, the following should be examined for and documented:

- Evidence of orbital and ocular trauma
- Comparison of left and right pupillary findings. Clinically significant asymmetric pupils are defined as 1 mm difference in diameter
- Presence of unilateral or bilateral dilated pupil(s)
- Presence of fixed and dilated pupil(s). A fixed pupil is defined as ≤ 1 mm response to bright light
- Confounders to pupil exam

### TREATMENT

#### Airway, Ventilation, and Oxygenation

- All patients with suspected severe TBI should be placed on continuous oxygen supplementation via nasal cannula or face mask in the prehospital setting in order to minimize secondary insults related to hypoxia.
- Hypoxemia (oxygen saturation [SpO2] < 90%) should be monitored using continuous pulse oximetry and corrected immediately upon identification by 1) ensuring appropriate airway positioning and 2) administering continuous, supplemental oxygen.
- If signs of hypoxia persist (central cyanosis and/or hypoxemia on pulse oximetry) despite increasing the flow and concentration of continuous supplemental oxygen, the following stepwise strategies should be undertaken with re-evaluation of oxygen saturation and respiratory effort following each strategy:
  - airway re-positioning,
  - positive pressure ventilation as with bag-valve-mask ventilation in conjunction with appropriate airway monitoring (e.g., airway tube), and/or
  - supraglottic airway or endotracheal intubation by a trained health care professional.
- An airway should be established, by the most appropriate means available, in patients who have signs of severe TBI, GCS < 9, or and decompressing, the inability to maintain an adequate airway, or of hypoxemia is not corrected by supplemental oxygen.
- Emergency Medical Service (EMS) systems implementing endotracheal intubation protocols including the use of rapid sequence intubation (RSI) protocols should confirm endotracheal tube placement in the trachea by the presence of bilateral breath sounds on auscultation, ETCO2 detection and/or capnography. Intubated patients in the prehospital setting require continuously monitored oxygenation, ETCO2, and frequent blood pressure monitoring.
- Patients requiring respiratory support with positive pressure ventilation should be maintained with normal breathing rates (approximately 10 breaths per minute with ETCO2 35-45 mmHg), and hyperventilation (ETCO2 < 35 mmHg) should be avoided. Ventilatory adjuncts such as pressure-controlled bags, ventilation-rate timers, ETCO2 monitoring, and ventilators should be used to support appropriate ventilation and minimize the risk of secondary insults by avoiding hypo- and hyperventilation.

#### Fluid Resuscitation

- **Intravenous fluids** should be administered in the prehospital setting to treat hypotension and/or limit hypotension to the shortest duration possible.
- **Hypotensive patients** should be treated with blood products and/or isotonic fluids in the prehospital setting.
- **Hypertonic fluid resuscitation** may be administered to patients with a Glasgow Coma Scale Score (GCS) ≤ 8 in whom increased ICP is suspected in the prehospital setting.

#### Hyperventilation and Hyperosmolar Therapy for Suspected Increased Intracranial Pressure (ICP)

- Hyperventilation should be avoided in the prehospital care of children and adults with TBI in the absence of signs of active cerebral herniation.
- Ventilation strategies should target eucapnia and avoid hypocapnia (i.e., ETCO2 of 35-40) and be monitored using capnography.
- When used to address signs of active and imminent herniation, hyperventilation should target an ETCO2 of 30-35 using capnography.
- **Hyperosmolar therapy** should not be administered for the prophylactic treatment of suspected elevated ICP, with or without signs of cerebral herniation, in the prehospital setting at this time.
- Prehospital administration of TXA therapy is not generally and widely indicated for the prophylactic treatment of suspected ICH or elevated ICP at this time.
is a summary of the guidelines; An algorithm that synthesizes best practice recommendations based on the guidelines is available at https://doi.org/10.1080/10903127.2023.2187905 and from the Brain Trauma Foundation at www.braintrauma.org.

SUMMARY

The Brain Trauma Foundation's guidelines for prehospital management of traumatic brain injury patients provide evidence-based recommendations for assessment, treatment, and transport decisions. The guidelines emphasize the importance of monitoring and treatment of airway, oxygenation, and ventilation, with caution against hyperventilation and recommendations for the use of ETCO2 to ensure appropriate ventilation. Close monitoring of oxygenation and blood pressure is also stressed, with interventions recommend based on the results of this monitoring. The guidelines also address issues related to EMS provider skill level, transportation modality, and destination for the patient. The recommendations are applicable to all types of EMS systems.

DECISION-MAKING WITHIN THE EMS SYSTEM

Dispatch and Destination, On-scene, and Transportation

- All regions should have an organized trauma care system with comprehensive documentation of each encounter including time, assessment, and care provided.
- Emergency Medical Services (EMS) should establish specific protocols directing destination decisions for patients with suspected traumatic brain injury (TBI).
  - Pediatric patients with suspected TBI should be treated in a pediatric trauma center or in an adult trauma center with added qualifications to treat children in preference to a Level 1 or II adult trauma center without added qualifications for pediatric treatment.
  - Patients with suspected moderate-severe TBI should be transported directly to a facility with immediately available computed tomography (CT) neuroimaging capabilities, prompt neurosurgical care, and the ability to monitor intracranial pressure and treat intracranial hypertension.
  - While direct transport to a trauma center is preferable for most patients, in the event that this transport is not possible, stabilization at a non-trauma center with subsequent transfer within an established trauma system may occur.
  - In a metropolitan area, pediatric patients with severe TBI should be transported directly to a pediatric trauma center if available.
  - The mode of transport should be selected to minimize the time to definitive interventions for the patient with TBI.

REFERENCES


Dr. Bobrow is professor and chair of the McGovern Medical School at UTHealth Houston department of emergency medicine and The John P. and Katherine G. McGovern distinguished chair in emergency medicine.

Dr. Lulla is an assistant professor of emergency medicine in the Department of Emergency Medicine within the Division of Emergency Medicine at UT Southwestern Medical Center.

Dr. Haşrylu is a neurosurgeon at Cleveland Clinic and medical director of the Brain Trauma Foundation.

Dr. Ghajar is president and founder of the Brain Trauma Foundation at the Stanford Brain Performance Center.

Dr. Jagoda is professor and chair emeritus of emergency medicine at the Icahn School of Medicine at Mount Sinai.

Dr. Haukoos is professor and chair of the McGovern Medical School at UTHealth Houston department of emergency medicine and The John P. and Katherine G. McGovern distinguished chair in emergency medicine.

Chart Your Own Course with the Independent EM Group Master Class

February 6-8, 2024

Irving, Texas

The emergency medicine paradigm is changing.

If you want more than restrictive, limited business models dictating how emergency physicians can practice, you have options. More and more entrepreneurial emergency physicians are creating or joining independent, physician-owned groups – with policies and practices that matter most to them.

And they are succeeding.

Get the inside scoop from those who have achieved and can set you on a similar path!
“What are you doing?” “Pupils equal and reactive.” “Those are mine!”

She was an elderly woman with head trauma after a fall. We thought we were saving her life with a trauma activation. She thought we were robbing her of precious life possessions.

For years I have stripped trauma patients, probing their painful wounds for elusive injuries and examining them with a level of detail usually reserved for mothers studying their newborn babies. Patient after patient, trauma activation after activation, my trauma surveys became rote and depersonalized by necessity. Yet, I could never shake the nagging feeling that I was performing exams without patients’ explicit consent. Or even worse, against their will. I asked what questions he had and the only one was about his sweatshirt. His wife had died six months earlier and I had destroyed her last remaining possession, one that he kept with him.

These days, I attempt to balance a less morbid approach to trauma resuscitation with the need for rapid stabilization and treatment. The other night I stood in the trauma bay, listening to rain patter against the automatic doors, awaiting an ambulance. The doors slid open and above the rain I heard a woman yelling—“Those are mine!”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.

The salvage of life and limb is the purpose of trauma activations and surveys, but it assumes that moral injury is an appropriate sacrifice in pursuit of that goal. Many of my colleagues fear personally experiencing a trauma activation—not due to personal injury, but because they know about the process and alternatives seldom happens. Too many times we offer, in place of full disclosure, a simple statement—“I’m going to examine you head to toe for injuries”—and accept fearful silence as voluntary agreement. This process is worse for systemically marginalized populations, including people with mental-health comorbidities, primary languages other than English, minorities, and those who have experienced assault.
Implementing goal-oriented, bundled care for intracerebral hemorrhage improve outcomes

by KEN MILNE, MD

Case

A 76-year-old female presents to the emergency department obtunded with left hemiplegia. Symptoms began just prior to presentation. Her blood pressure (BP) is 135/104 mmHg. The CT scan reveals a hemorrhage in the right internal capsule, suggestive of acute hypertensive hemorrhagic stroke. Should the BP be treated aggressively, what is the target, and how quickly should we achieve that target?

Background

There have been a couple of large and influential trials published on BP management after an intracranial hemorrhage (ICH). Both INTERACT-2 and ATACH-2 showed no statistical difference in their primary outcome between intensively lowering the BP and a less-intensive strategy.

The 2022 AHA/ASA Guidelines give several recommendations on this topic. The class (strength) of their recommendation is 2a/2b based upon Level B and Level C quality of evidence. The language used in the guidelines is important. The specific language used in the AHA/ASA guidelines is as follows:

- “In patients with spontaneous ICH in whom acute BP lowering is considered, initiating treatment within 2 hours and reaching target within 1 hour can be beneficial to reduce the risk of HE [hematoma expansion] and improve functional outcome.”
- ■ Class 2a recommendation, “Moderate”: is reasonable, can be beneficial, level of evidence C-LD (limited data)
- ■ “In patients with spontaneous ICH of mild to moderate severity presenting with SBP [systolic BP] between 150 and 220 mmHg; acute lowering of SBP to a target of 140 mmHg with the goal of maintaining in the range of 130 to 150 mmHg is safe and may be reasonable for improving functional outcomes.”
- ■ Class 2b recommendation, “Weak”: may be reasonable, may be beneficial, effectiveness not well established; level of evidence B-R (randomized; moderate quality evidence from 1 or more randomized controlled trials or meta-analyses of moderate-quality randomized controlled trials)
- “In patients with spontaneous ICH presenting with large or severe ICH or those requiring surgical decompression, the safety and efficacy of intensive BP lowering are not well established.”
- ■ Class 2b recommendation, “Weak”: may be reasonable, may be beneficial, effectiveness not well established; level of evidence C-LD (limited data)

Clinical Question

Can the implementation of a goal-directed care bundle, incorporating protocols for early, intensive BP lowering in addition to management algorithms for hyperglycemia, pyrexia, and abnormal anticoagulation, implemented in a hospital setting, improve outcomes for patients with acute spontaneous intracerebral hemorrhage?

Reference


• Population: Patients 18 years of age and older, presenting within six hours after the onset of ICH

• Exclusions:
  - Definite evidence that the ICH is secondary to either a structural abnormality in the brain or previous thrombolyis
  - Attending clinician felt there was a high likelihood that the patient would not adhere to the study treatment and follow-up regimen

• Intervention: Bundled care per a goal-directed intensive care protocol to correct hypertension, hyperglycemia, pyrexia, and hypercoagulability, with the goal of achieving treatment targets within one hour of initiating treatment and maintaining them for seven days (or until discharge or death, whichever came first)

• Comparison: Usual care at the discretion of the treating physician

• Outcome:
  - Primary Outcome: Functional recovery measured at six months according to the modified Rankin Scale (mRS) score and analyzed as an ordinal outcome (shift across all categories)
  - Secondary Outcomes:
    - Functional recovery according to a shift analysis of scores on the National Institutes of Health Stroke Scale at seven days
    - Dichotomous mRS outcomes at six months (0-2 versus 3-6, and 0-2 versus 3-5)
    - Death at six months
    - Death or neurological deterioration at seven days
    - Health-related quality of life using the EuroQol Group 5-Dimension self-report questionnaire
    - Residence at six months (own home versus other)
    - Time to hospital discharge

• Safety Outcomes: All-cause and cause-specific severe adverse events, recorded for the duration of follow-up

Type of Study: A pragmatic, international (10 countries), multicenter (121 hospitals), unmasked, stepped-wedge, cluster randomized, controlled trial

Authors’ Conclusions

“Implementation of a care bundle protocol for intensive blood pressure lowering and other management algorithms for physiological control within several hours of the onset of symptoms resulted in improved functional outcome for patients with acute intracerebral haemorrhage. Hospitals should incorporate this approach into clinical practice as part of active management for this serious condition.”

Results

A total of 7,036 patients were recruited from 121 hospitals that could be included in the modified intention-to-treat analysis. The mean age of patients was 62 years with 36 percent female. Most of the patients (over 90 percent) were Chinese.

Key Results

The odds of a poor functional outcome were lower in the care bundle group compared to usual care.

• Primary Outcome: mRS favored the care bundle group (OR, 0.86; 95 percent confidence interval, 0.76-0.97; P = 0.015), consistent across all adjustments and calculations.

• Secondary Outcomes: Most secondary outcomes did not show a statistically significant difference. Some showed trends in a positive direction. Patients who received the intervention were statistically more likely to be discharged by day seven. The EuroQol Group 5-Dimension self-report questionnaire quality of life assessment was a mixed bag, but the effects on this scale diminished when they made the various statistical adjustments in their post-hoc analysis.

• Safety Outcomes: There were significant fewer severe adverse events in the bundled care group.

EBM Commentary

1. External Validity: It is unclear if this data
applies to patient you see in your emergency department. One reason is where these patients were recruited to be included in the trial. The cohort came from nine low- and middle-income countries and one high-income country. Most of the patients were recruited from China (90 percent) with only 1 percent coming from Chile (the only one classified as a high-income country).

2. **Medications** used to lower BP are also important. The majority of patients’ BP was lowered with urapidil (66 percent) with a minority being treated with nicardipine (8 percent). How would this data extrapolate to North America, where nicardipine is a commonly used medication, while urapidil is not available in the United States or Canada?

3. **Bundle**: The bundle treatment included addressing hypertension, hyperglycemia, pyrexia, and hypercoagulability. Which part of the intervention caused the benefit? We have seen other bundles, in conditions like sepsis, that did not ultimately turn out to be better than usual care (ARISE, ProMiSe and ProCESS). There could also be a Hawthorne Effect because this was unmasked trial and participants and clinicians knew whether they were receiving bundled care or usual care.

4. **Outcome Assessment**: The primary outcome in this trial was an ordinal analysis of outcome. Participants and clinicians knew whether they were receiving bundled care or usual care (ARISE, ProMiSe and ProCESS).

---

### Table: Method of assessment of 6-month outcomes

<table>
<thead>
<tr>
<th>ASSESSMENT TYPE</th>
<th>CARE BUNDLE (N=3221)</th>
<th>USUAL CARE (N=3815)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone to caregiver</td>
<td>2470/3121 (79.1)</td>
<td>2913/3683 (79.1)</td>
</tr>
<tr>
<td>Phone to patient</td>
<td>247/3121 (7.9)</td>
<td>255/3683 (6.9)</td>
</tr>
<tr>
<td>Phone to patient’s doctor or medical practitioner</td>
<td>115/3121 (3.7)</td>
<td>110/3683 (3.0)</td>
</tr>
<tr>
<td>Face to face</td>
<td>32/3121 (1.0)</td>
<td>6/3683 (0.2)</td>
</tr>
<tr>
<td>Other</td>
<td>33/3121 (1.0)</td>
<td>23/3683 (0.6)</td>
</tr>
<tr>
<td>Refused to receive follow-up assessment</td>
<td>11/3121 (0.4)</td>
<td>39/3683 (1.0)</td>
</tr>
<tr>
<td>Lost to follow-up</td>
<td>213/3121 (6.8)</td>
<td>337/3683 (9.2)</td>
</tr>
</tbody>
</table>

Data are n/N (%)

---

5. **Conclusion**: The primary outcome in this trial was an ordinal analysis of outcome. Participants and clinicians knew whether they were receiving bundled care or usual care.

---

**References**


---

**Meet Your State CME Requirements With NEW, On-Demand Course Bundles**

Learn the latest about some of the most common, yet most difficult presentations you will experience. Trusted EM experts teach more than 20 courses in each comprehensive bundle on:

- **Cardio**
- **Neuro**
- **Trauma**

PURCHASE TODAY!

acep.org/OLC-bundles
The treatment of diabetic ketoacidosis (DKA) is, in many ways, unchanged: intravenous fluids, electrolyte repletion, insulin, and treatment of any precipitating factors. However, as with many treatments, there has been substantial de-escalation in intensity of therapy over time. Historically, patients were given a bolus of intravenous insulin followed by an insulin infusion. In 2009, a consensus statement from the American Diabetes Association (ADA) discussed using a low-dose infusion (0.1 to 0.14 units/kg/hour) rather than a bolus.2,3 Additionally, the consensus statement discussed the emerging use of subcutaneous insulin to treat DKA. More recently, evidence has mounted demonstrating that DKA can be managed with subcutaneous insulin in many patients, which is endorsed in the most recent iteration of the Standards of Care in Diabetes from the ADA.2,3 In fact, traditional insulin infusions do not result in quicker closure of the anion gap or lowering of the serum glucose below 250 mg/dL.3,4

Logistics of Subcutaneous Insulin Pathways
The eligibility criteria for entry into a subcutaneous insulin pathway for DKA varies. All pathways exclude those who are obtunded (Glasgow Coma Scale below 8) or have another critical illness necessitating intensive care. In some studies, individuals with mild to moderate DKA are eligible (pH at least 7.0, bicarbonate at least 10 mEq/L) whereas some studies have included any non-critically ill patient otherwise eligible, regardless of DKA severity.5,6 Notably, patients weighing 166 kg or more may have altered absorption of insulin and were eventually excluded from one hospital study.7

In subcutaneous insulin protocols, patients receive the same supportive care as in infusion pathways—a couple of liters of intravenous fluids (depending on comorbidities) and electrolyte repletion. In addition, patients receive a hefty dose of a short-acting insulin every four hours, as long as the glucose is above 250 mg/dL (e.g., lispro 0.3 units/kg subcutaneous). In a recent protocol that included noncritically ill patients across the spectrum of DKA severity (that is, inclusive of severe DKA), patients also received a dose of long-acting insulin (e.g., glargine 0.3 units/kg subcutaneously or the patient’s usual home dosage) alongside the short-acting insulin. Point-of-care glucose monitoring can be conducted less frequently than in infusion pathways, every two hours until four hours after the last “big” dose of short-acting insulin.

What’s the Advantage?
Intravenous insulin infusions typically require treatment in highly monitored settings, such as an intensive care unit (ICU) or step-down unit for safety and due to the frequency and intensity of monitoring. ICU and step-down beds are a limited resource and generate higher hospital charges. One study found a 57 percent reduction in ICU admissions among patients with DKA at a site that implemented a subcutaneous insulin protocol compared with 21 control sites. However, this profound reduction has not been seen in all studies, possibly due to differences in protocols or, more likely, local comfort and adjusting to a different process of care. Additionally, in the current era of ubiquitous emergency department (ED) boarding, ED length of stay is of critical importance. A single-institution study found an approximately three-hour reduction in ED length of stay after implementation of a subcutaneous protocol.

Management of DKA using insulin exclusively through the subcutaneous route is safe, acceptable, and can have system-level benefits. As protocolized care has improved the quality of care of patients with DKA, it is critical to adapt institutional protocols to ensure safe implementation of subcutaneous pathways.

References

Dr. Lauren Westafar is an attending physician and research fellow at Baystate Medical Center, clinical instructor at the University of Massachusetts Medical School in Worcester, and co-host of FOAMCoast.
Pears from EM Literature

Are opiates futile in low back pain?

by Ryan Radecki, MD, MS

There is no shortage of evidence regarding the harms of opiate use and misuse. With this in mind, prescriptions for opiates have been dropping in the United States, but were still dispensed at a rate of 4.34 prescriptions annually per 100 persons in 2020. The emergency department remains an important frontier for work in judicious prescribing, but opiate analgesia remains a valuable tool for the initial treatment of a variety of presentations.

Which brings us to acute back pain, a frustrating and challenging condition to manage for patients and physicians alike. Recently, substantial media coverage summarized the OPAL trial published in The Lancet, concerning the use of opiates for acute “spinal” pain—inclusive of both back and neck pain. The lay media spin on the article fell onto side of universally negative against the use of opiates. While this reporting is superficially true, it tells only part of the story, and little regarding its relevance to emergency-department practice.

Patients included in this Australian trial were recruited in both the emergency department and in general practice, and were eligible if the current episode of pain began within the past 12 weeks. The authors define this as “acute” pain, and while we certainly see a share of patients in the emergency department suffering from months of pain, we consider these patients as a distinct presentation from those whose pain has rapidly escalated in the preceding 24 to 48 hours. In fact, the original trial protocol required patients to have had pain for at least two weeks prior to recruitment, further limiting generalizability to the scope of patients presenting to the emergency department.

After enrollment, patients were randomized either to a modified release oxycodone/naloxone combination opiate, starting with an initial dose containing 5 mg of oxycodone, or placebo. Patients were prescribed a schedule of twice-daily analgesia, and were allowed to increase the dose from 5 mg to 10 mg if pain was not initially well-controlled. This may contrast from typical practice using immediate-release preparations to manage severe pain, or from use of oxycodone-acetaminophen or hydrocodone-acetaminophen combination products. The addition of naloxone to the tablets may also provide a confounder in terms of the analgesia provided.

The trial analgesia protocol also differs from typical prescribing in which acute pain is managed by starting from a maximal dose, determined by the clinically necessary analgesic effect, then rapidly decreased as pain improves. Rather, the research protocol describes a prolonged six-week program of follow-up and repeated prescribing. From an emergency department perspective, the scope of initial treatment is rarely, if ever, intended to involve a six-week period of treatment. The treatment response for any six-week program is of limited relevance to the acute treatment provided in the emergency department.

Regardless, the reason this study became widely discussed is because the primary outcome of the trial was negative, concluding there was “no evidence that opioids should be prescribed for people with acute non-specific low back or neck pain.” It is worth parsing this statement semantically, noting the authors do not conclude opioids should not be prescribed, only that evidence is lacking in support. In this respect, the conclusion is absolutely true.

Only one other study of reasonable quality informs practice with respect to opiate analgesia for low back pain in the emergency department. Published in JAMA in 2015, the authors conducted a three-arm trial comparing cyclobenzaprine, oxycodone-acetaminophen, and placebo. In contrast to the OPAL study, this trial specifically excluded patients whose pain had persisted for more than two weeks. Patients were all prescribed naproxen in addition to the study medication, and were able to take one or two tablets of these immediate-release preparations up to every eight hours, as needed.

The primary outcome was a more relevant seven-day outcome, rather than six-week follow-up. Like OPAL, this was a “negative” trial, in which there was no “statistically significant” difference between functional outcomes between any groups. It is worth noting, however, that the group with the least pain, the greatest improvement, and the fewest days off work was the group taking oxycodone-acetaminophen. A frequentist approach to this trial would conclude, if the trial were to be repeated many times, nearly all the trials would replicate the favorable effects seen for oxycodone-acetaminophen. A Bayesian approach to interpretation would depend on your prior assumptions regarding the efficacy of opiates for treating acutely painful conditions, and may also support the differences favoring oxycodone-acetaminophen, as well.

Finally, even though a seven-day outcome is more relevant, successful acute treatment in emergency medicine may be better measured by time frames of 72 hours or less. In that respect, these trials, particularly OPAL, provide very little insight into whether opioid analgesia supports this early recovery. Only exploratory outcomes provide some supporting evidence that opiate analgesia may improve return to activities and work, but these observations are weak enough they are best represented as equipoise for future research.

After much ado, we may finally arrive back where we started, with little relevant evidence on this specific topic capable of informing our practice in the emergency department. The analgesic options available to us in the emergency department remain limited, as are the options readily prescribed in oral form for discharge. Attempts to discern an advantage associated with skeletal muscle relaxants were unable to find benefit relating to metaxalone, tizanidine, or baclofen. In a similar fashion, even the addition of acetaminophen, or the addition of diazepam, to a non-steroidal anti-inflammatory did not show an advantage in function or analgesia.

Frankly, the only reliable option for improving low back pain appears simply to be time, an unsatisfying situation for both patient and practitioners. Opiate analgesia lacks evidence of both efficacy and inefficacy. However, what has been clear and repeatedly proven are adverse effects and downstream harms from opioid prescribing. Better evidence directly informing the immediate post-encounter period is sorely needed to either confirm or refute what likely remains widespread and common use in the acute setting.

References
An Illustrated Case of Ethylene Glycol, Direct and Indirect Clues and discussion

by JASON HACK, MD

Ethylene glycol (EG), also known as ethane-1,2-diol, with the molecular formula C₂H₄(OH)₂, is a colorless, odorless, water-soluble liquid commonly used as antifreeze fluid in automobile radiators, and remains an important cause of significant and sometimes fatal toxicity in the United States, with approximately 6,000 exposures and 20 deaths reported to poison centers in 2021. After possible exposures, early diagnosis and treatment are critical for preventing morbidity and mortality. However, the diagnosis of EG exposures continues to be problematic due to inconsistent history, restricted availability of EG-specific testing, and inconsistent time-sensitive indirect clues in laboratory analysis.

Case
A young adult male with a prior history of self-harm presented 30 minutes after stating he “might have drunk half a gallon of antifreeze.” Physical examination revealed an awake, anxious-appearing, tachycardic man with no other abnormalities. Laboratory data were notable for normal renal function, osmol gap 24 (normal range, 14 to 11), anion gap 10 (normal range, 3 to 13), and normal urine without crystals. He was empirically loaded with fomepizole (15 mg/kg). The patient’s urine was obtained and compared with the urine of his emergency physician using a Wood’s lamp, and the patient’s was found to be brightly fluorescent, supporting the presumptive diagnosis of EG poisoning. After 12 hours, his initial EG level returned 130 mg/dL. After resolution of EG poisoning, he was transferred to psychiatry and ultimately discharged home without complication.

Discussion
The diagnosis of EG ingestion is problematic, often made on suggestive indirect information, and must be made quickly because time represents renal injury. The bedside physician must gather as many direct and indirect, classically suggestive data as possible and decide which are “bad” (they probably drank it), or “good” (they probably didn’t). The presence of urine fluorescence might be additive to this data collection.

History
Someone saw them drink the EG. This is bad (direct evidence). Their experience drinking the liquid. For example: Doctor: I bet it was (direct evidence). Their experience drinking the EG. This is bad (indirect evidence). Someone saw them drink the EG. This is bad (indirect evidence). Their experience drinking the EG. This is bad (indirect evidence). Someone saw them drink the EG. This is bad (indirect evidence). Someone saw them drink the EG. This is bad (indirect evidence).

Laboratory Results
Osmol gap: If the gap is large—this is bad (indirect evidence). However, it is the parent alcohol that causes the gap, and with a typical half-life of three to six hours (peaking at 30 to 60 minutes) once it has been metabolized, the gap goes away. Additionally, there are large variations in the range of osmol gaps depending on the equation used to calculate osmolality and the fact that some people naturally have negative osmol gap. Because of this large range of values, small osmol gaps cannot be used to eliminate the possibility of toxic alcohol ingestion. Anion gap metabolic acidosis: if this is large—very bad (indirect evidence). The toxic metabolites of EG ingestions are what cause the acidosis (glycolic, glyoxylic, and oxalic acids as well as lactate) and present later in the ingestion after EG is metabolized to these bad actors. Once there is an anion gap, the horse has left the barn and the remaining definitive treatment is hemodialysis. Additionally, anion gap acidoses occur for other reasons (recall the mnemonic MUDPILES: methanol, uremia, diabetic or alcoholic ketoacidosis, paraldehyde, isoniazid, lactic acidosis, ethanol/ethylene glycol, or salicylates).

Urine crystals: presence of octahedral or needle-shaped calcium oxalate crystals in the urine—very bad (direct finding). The precipitation of oxalate crystals in the renal tubular lumens resulting in blockage is the primary cause of renal injury. Unfortunately, urinary crystal absence does not rule out EG ingestion. Urine fluorescence: if the urine is fluorescent—very bad (direct finding). Sodium fluorescein (uranine yellow), is a fluorescent dye that is added to some commercial antifreeze preparations to assist in the location of engine coolant leaks. It is found in concentrations typically between 15 and 20 µg/mL. It causes a yellowish-green fluorescence that is visually detectable to a lower limit of 20 ng/mL in liquid when exposed to ultraviolet light. When these excited photons relax they produce (emit) light of a different color. The re-emitted photons, or fluorescence, have no heat, a longer wavelength, lower energy, and a different color that disappears when the exciting light is removed. This light reaction is used in medicine for many purposes, including detection of dermatoxic abnormalities in skin and nails by making them glow, such as dermatomyxoses (Tinea versicolor, etc.), bacterial infections (Pseudomonas, etc.) and porphyria (porphyria cutanea tarda, etc.). It is also used in ophthalmologic diagnostics of retinal vasculature imaging and corneal insult assessment. Other uses include detection of scorpions and semen. Urine may also fluoresce under this “black light” after ingestion of riboflavin and niacin, amoxicillin, and carbamazepine. Research into urine fluorescence to help EG diagnosis has been both supportive and dismissive. Winter, et al., in 1990 showed nearly 100 percent detection after volunteer ingestion of fluoresceine at zero to two hours and...
Laryngeal Injuries: An Introduction

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

Case

A 37-year-old female was walking home from grocery shopping when she had an encounter with a stray pit bull. For obvious reasons, all history was obtained via emergency medical services and Cleveland police. They were called to the scene to find her with a blood pressure of 135/85, pulse of 110 beats per minute, and respiratory rate of 26 per minute. The major injury was to her face and neck, with lacerations and bites to her legs.

On arrival to the emergency department (ED) she was awake and breathing with stridor. A tracheostomy was considered, but her trachea appeared to be grossly intact and her vocal cords were visible through her wounds. She was intubated with the assistance of boul- je and ketamine, and her appearance after intubation is pictured above.

Overview

Laryngotracheal wounds occur rarely, whether blunt or penetrating. The larynx is generally protected from blunt injury by the mandible and sternum. These injuries’ significance lies, of course, in their high mortality rate. While they constitute less than one percent of all traumatic injuries, laryngeal injury is the second most common cause of death (after intracranial injuries) in patients with head and neck injuries. Missing a significant laryngotracheal injury can lead to airway obstruction and death. Injuries involving the cricoid cartilage are particularly lethal because of asphyxia from airway obstruction, edema, or hematomata. Patients with small lacerations or abrasions of the larynx or trachea may be managed conservatively with close observation, steroids, and serial endoscopy.

Laryngotrauma occurs in one in 14,000 to one in 30,000 ED visits. Laryngotracheal trauma has been cited as accounting for less than one in 100,000 hospital admissions. As noted above, one major reason for its rarity is that the larynx is protected by the mandible, sternum, and cervical spine. In children, the larynx is at the level of C4, and protected by the mandible. Fracturing the larynx requires considerable force, and the great majority of fractures are from blunt high-velocity trauma. These include motor vehicle crashes, sports injury, and penetrating neck injuries.

The most severe occurrence is generally the “clothesline” injury, in which a motorcyclist, dirt biker, or snowmobiler hits a fixed

The patient was intubated successfully as the vocal cords were visible through the wound and the trachea appeared to be intact.
item such as barbed wire, fencing net, or a tree branch, thus striking the front of the neck below the helmet. This mechanism may cause crumbling injury to the cartilage or a laryngeal-gotracheal separation. It is noteworthy that trauma to the trachea and larynx may be accompanied by vascular damage to the carotid arteries, jugular veins, or esophagus. The example in this case notwithstanding, motor vehicle crashes are the most common cause of laryngeal injuries.

Blunt laryngeal injuries may occur from blunt trauma during fights or sports. Airway obstruction may be immediate or delayed. Unstable patients should have an airway established, generally by tracheostomy or cricothyrotomy. Devascularization and scarring of tissue might result in long-term obstruction. Any intralaryngeal mucosal injury is likely to produce some degree of granulation tissue, which may lead to scarring or obstruction. Prompt repair of the mucosa and avoidance of exposed cartilage is critical. Even with optimal care, patients may become dependent on a tracheostomy and/or gastrostomy in the long term.

Laryngeal injuries may also be classified based on the anatomical site and the structures involved:

- **Type 1**: Supraglottic: epiglottic hematoma or avulsion; hyoid bone fracture; thyroid cartilage fracture; arytenoid dislocation or avulsion; hyoid bone fracture; thyroid alae
- **Type 2**: Glottic injuries: hoarseness (generally associated with thyroid-cartilage fracture); vocal-cord edema; endolaryngeal lacerations; or avulsion of vocal cords from the anterior commissure
- **Type 3**: Subglottic injuries: involvement of the cricoid cartilage and trachea with airway compromise; complete cricotracheal separation
- **Type 4**: Posterior displacement of the epiglottis and laryngeal inlet
- **Type 5**: Cricotracheal separation
- **Type 6**: Vertical midline fracture, damaging the anterior commissure and separating the thyroid alae
- **Type 7**: Comminuted fracture: more commonly encountered in the older, rigid, and calcified larynx.

Initial evaluation starts with the history: blunt or penetrating, polytrauma or other injuries, and whether the patient is coherent and cooperative or has an altered voice. Does the patient have difficulty breathing or swallowing? The primary management of laryngeal injuries is to evaluate and establish an airway.

The physical examination, as always, follows airway, breathing, circulation, evaluation of cervical spine. Is the patient stridorous or hoarse? The thyroid cartilage should be checked for prominence or loss thereof. The neck should be palpated for subcutaneous air. Is there respiratory distress or a neck hematoma? Is there an open neck wound or palpable cartilage fracture? The patient should be evaluated for hemoptysis, cough, sternal retractions, thrill, or bruit.

Flexible laryngoscopy, CT scan, direct laryngoscopy under general anesthesia, esophagoscopy, ultrasound, or chest X-ray may all be requested by the surgical consultant. If the airway is deemed to be stable, flexible fiber-optic laryngoscopy and computed tomography of the neck may be appropriate initial studies. Flexible laryngoscopy is used to evaluate mucosal tissues of the larynx and upper digestive tract after the primary and secondary trauma surveys are completed. Edema, laryngeal lacerations, mucosal tears, hematomas, exposed muscle, and vocal-cord paralysis or paralysis may be diagnosed in such fashion.

Reconstructive computed tomography can assess the laryngeal framework to avoid missing laryngeal fracture and, hopefully, long-term comorbidities. Non-contrast CT can evaluate the cartilaginous and bony components of the hyoid and larynx. Depending on availability and local expertise, videostroboscopy of the larynx and electromyography of the larynx may be performed by the appropriate consultants.

For Schaefer type 1 and 2 injuries, close monitoring is recommended, along with intravenous dexamethasone and nebulized steroids. Conservative management entails observation, elevation of the head of the bed, steam inhalation, voice rest, and IV corticosteroids.

If the patient needs surgical exploration, tracheostomy is the recommended intervention to secure the airway. Early exploration and reconstruction of the laryngeal framework is generally recommended to preserve laryngeal function and to restore normal phonation. Surgical exploration and correction of fractures may utilize mini-plates, Y-plates, bioresorbable plates, Montgomery intralaryngeal stent, thread, steel wires, titanium mesh to fix fractured laryngeal cartilage, or titanium plates.

The patient was intubated successfully, in
The ED under direct vision, as the vocal cords were visible through the wound and the trachea appeared to be intact. An endotracheal tube (ETT) was placed over a bougie. She was transported to the operating suite where a tracheostomy was performed. Significant mucosal lacerations were encountered. The mucosa was repaired to ensure coverage and to prevent scar-ring. Reduction of laryngeal fractures with fixation was accomplished. A minor esophageal injury was repaired. Soft tissue and skin were repaired last. She was given tube feedings for approximately one week. Major vessels were unharmed per neck CT with contrast. The tracheostomy was kept in place until the larynx was fully healed. She is currently undergoing therapy with a speech pathologist.

While her long-term result is still evolving, it is important to note that complications of laryngeal injuries may be both acute and chronic. Acute complications are upper-airway obstruction and asphyxia. Recurrent nerve injury, hematoma, infection, and death are possible. Chronic complications may cause patients to present to the ED: vocal-cord paralysis; chronic aspiration; recurrent granulation formation; hoarseness; supraglottic, glottic, subglottic, or tracheal stenosis; and recurrent laryngeal nerve dysfunction.

---

**References**

RESUSCITATE YOUR RETIREMENT PLAN

USACS: YOUR LIFELINE WITH AN ADDED 10% TO YOUR 401(k)

I love seeing patients now, and I love that we’re setting ourselves up for a great retirement later.

Kendall Rockler, MD, FACEP
Residency: University of South Florida, 2014
National Director of STAT Traveling Physicians

EM CAREERS NATIONWIDE

All full-time physicians are provided:
Company stock ownership | 10% company-funded 401(k) | 24/7 on-shift clinical support
Great locations nationwide | The best health and wellness benefits | A mission that has real meaning

Learn more at: usacs.com