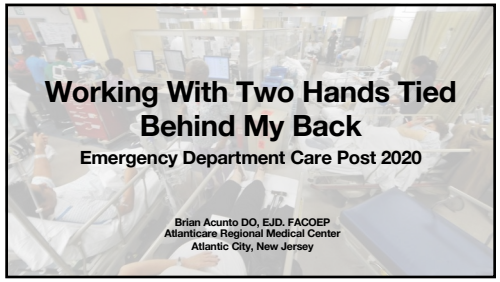
Working With Two Hands Tied Behind My Back
Emergency Department Care Post 2020
Brian Acunto DO, EJD. FACOEP
Atlanticare Regional Medical Center
Atlantic City, New Jersey

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Disclosures
Financial: None

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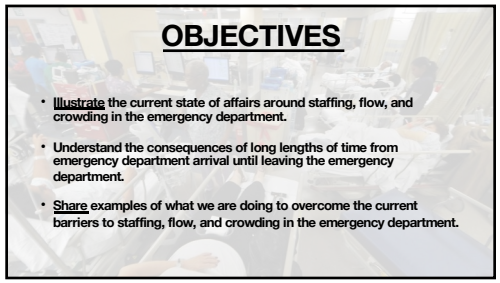
OBJECTIVES
Illustrate the current state of affairs around staffing, flow, and crowding in the emergency department.
Understand the consequences of long lengths of time from emergency department arrival until leaving the emergency department.
Share examples of what we are doing to overcome the current barriers to staffing, flow, and crowding in the emergency department.

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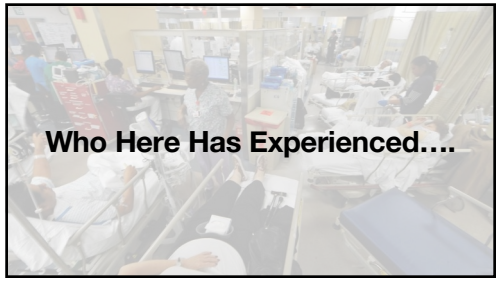

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Patients Boarding in the ED

7


Waiting Room Times
> 4 Hours

8


Your
story
matters.

9

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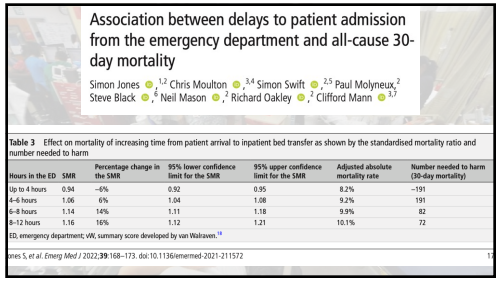

Association between delays to patient admission from the emergency department and all-cause 30-day mortality

Simon Jones ,[1,2] Chris Moulton ,[3,4] Simon Swift ,[2,5] Paul Molyneux,[2] Steve Black ,[6] Neil Mason ,[7] Richard Oakley ,[7] Clifford Mann [3,7]

Table 3 Effect on mortality of increasing time from patient arrival to inpatient bed transfer as shown by the standardised mortality ratio and number needed to harm

Hours in the ED	SMR	Percentage change in the SMR	95% lower confidence limit for the SMR	95% upper confidence limit for the SMR	Adjusted absolute mortality rate	Number needed to harm (30-day mortality)
Up to 4 hours	0.94	−6%	0.92	0.95	8.2%	−191
4–6 hours	1.06	6%	1.04	1.08	9.2%	191
6–8 hours	1.14	14%	1.11	1.18	9.9%	82
8–12 hours	1.16	16%	1.12	1.21	10.1%	72

ED, emergency department; rVW, summary score developed by van Walraven.[18]

ones S, *et al. Emerg Med J* 2022;**39**:168–173. doi:10.1136/emermed-2021-211572

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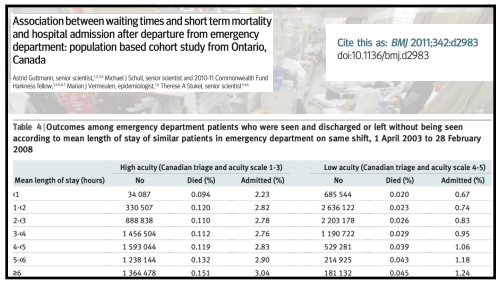

Association between waiting times and short term mortality and hospital admission after departure from emergency department: population based cohort study from Ontario, Canada

Astrid Guttmann, senior scientist,[1,2,3,4] Michael J Schull, senior scientist and 2010-11 Commonwealth Fund Harkness Fellow,[1,4,5,6,7] Marian J Vermeulen, epidemiologist,[1,8] Therese A Stukel, senior scientist[1,4,9]

Cite this as: *BMJ* 2011;342:d2983
doi:10.1136/bmj.d2983

Table 4 | Outcomes among emergency department patients who were seen and discharged or left without being seen according to mean length of stay of similar patients in emergency department on same shift, 1 April 2003 to 28 February 2008

	High acuity (Canadian triage and acuity scale 1-3)			Low acuity (Canadian triage and acuity scale 4-5)		
Mean length of stay (hours)	No	Died (%)	Admitted (%)	No	Died (%)	Admitted (%)
<1	34 087	0.094	2.23	685 544	0.020	0.67
1-<2	330 507	0.120	2.82	2 636 122	0.023	0.74
2-<3	888 838	0.110	2.78	2 203 178	0.026	0.83
3-<4	1 456 504	0.112	2.76	1 190 722	0.029	0.95
4-<5	1 593 044	0.119	2.83	529 281	0.039	1.06
5-<6	1 238 144	0.132	2.90	214 925	0.043	1.18
≥6	1 364 478	0.151	3.04	181 132	0.045	1.24

12

More Than Lost Revenue

- 3-5 fold increase in complications for Acute Coronary Syndrome patients whom present at times of overcrowding.
- ED crowding increased 28-day mortality rate in community acquired pneumonia patients.
- Increases total length of stay by 1-3 days.
- Boarding increases the number of people whom leave without being seen, some of which are serious illness.
- Boarding increases the incidence of medical error and decreases the quality of care given by overwhelmed staff.
- Boarding increases 10-day and 30-day mortality.

13

Research Letter | Health Policy

Hospital Occupancy and Emergency Department Boarding During the COVID-19 Pandemic

Alexander T. Janke, MD; Edward R. Melnick, MD, MHS; Arjun K. Venkatesh, MD, MBA, MHS

- **Boarding patients greater than 4 hours results in increase in medical errors, compromised patient privacy, and increased mortality.**
- **Hospital occupancy >85% was associated with increase bearing beyond the 4 hour standard.**
- **From 2020 and 2021, ED boarding increased even when hospital occupancy did not increase above January 2020 levels.**

JAMA Network Open. 2022;5(9):e2233964. doi:10.1001/jamanetworkopen.2022.33964

14

Research Article

Association of Emergency Department Waiting Times With Patient Experience in Admitted and Discharged Patients

Andrew Nyce, MD[1,4], Snehal Gandhi, MD[2,4], Brian Freeze, MD[1,4], Joshua Bosire[3], Terry Ricca, RN[3], Eric Kupersmith, MD[2,4], Anthony Mazzarelli, MD[1,4], and Jean-Sebastien Rachoin, MD[1,4]

- **ED discharged patient, door to doctor and total ED times were significantly lower in the patients whom reported an optimal experience.**
- **For inpatients, the shorter LOS was significant, and the ED metrics may be diluted by the impact of inpatient factors.**

Journal of Patient Experience
Volume 8, January-December 2021

https://doi.org/10.1177/23743735211011404

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What Are We Doing About It ?
What Is Working ?

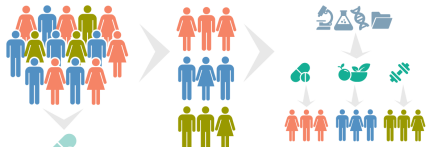
16

17

Brian's 5 Rules of Working with Your Hands Tied Behind Your Back

18

1. Cohort Admissions and Staff Accordingly



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2a. Recruit and Move Resources to the Front

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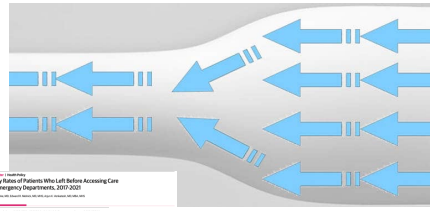
2b. Team Approach

21

4. Parallel Processes



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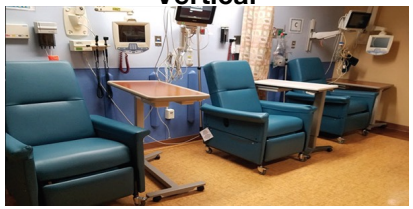
4. Vertical Patients Stay Vertical



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5. Disposition First Mentality

mergency Department: Arrivals/In-room. Becker's Hospital Review. https://www.beckershospitalreview.com/patient-flow/clinical-effi

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ACOEP
SPRING SEMINAR
PHOENIX, ARIZONA
April 1-5, 2023
ACOEP

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ACOEP
SPRING SEMINAR
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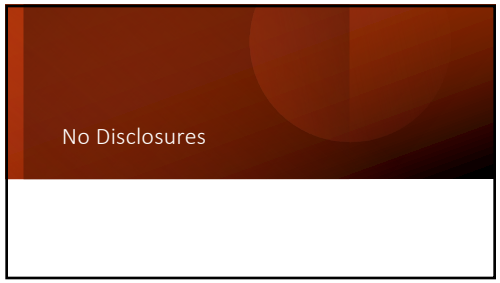
Field Triage of Injured Patients
Rachel Munn, DO

2


No Disclosures

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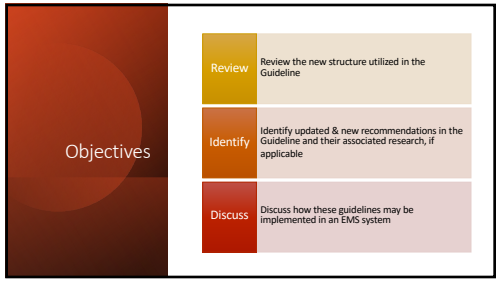
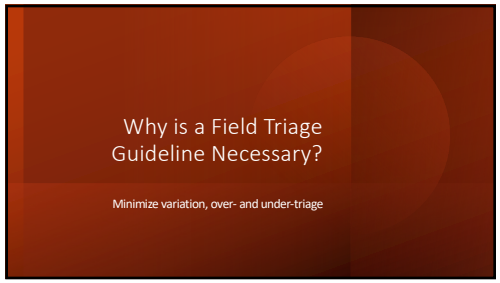

Objectives
Review
Review the new structure utilized in the Guideline
Identify
Identify updated & new recommendations in the Guideline and their associated research, if applicable
Discuss
Discuss how these guidelines may be implemented in an EMS system

4


Why is a Field Triage Guideline Necessary?
Right Patient
Right Place
Right Time

5


Why is a Field Triage Guideline Necessary?
Minimize variation, over- and under-triage

6

Who does this guideline apply to?

- Civilian 9-1-1 EMS Systems

- Not intended for mass casualty incidents
- Not intended to guide in-hospital trauma team responses

7

Time for an Update

GUIDELINE

OPEN

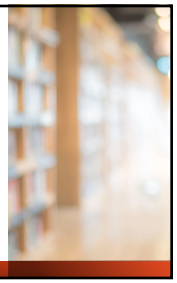
National guideline for the field triage of injured patients: Recommendations of the National Expert Panel on Field Triage, 2021

Craig D. Newgard, MD, MPH, FACEP, Peter E. Fischer, MD, Mark Gestring, MD, Holly N. Michaels, MPH, Gregory J. Jurkovich, MD, FACS, E. Brooke Lerner, PhD, FAEMS, Mary E. Fallat, MD, Theodore R. Delbridge, MD, MPH, Joshua B. Brown, MD, MSc, FACS, Eileen M. Bulger, MD, *and* **the Writing Group for the 2021 National Expert Panel on Field Triage**, *Portland, Oregon*

8

How was the Guideline Updated?

- Interdisciplinary Expert Panel
- Systematic Literature Review



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Systematic Reviews

- Glasgow Coma Scale (GCS)
- Circulatory Measures
- Respiratory Measures
- Mechanism of Injury Criteria
- Special Considerations
- Performance of the Triage Guideline

10

Statistical Criteria

TABLE 1. Statistical Criteria Used to Add and Remove Individual Triage Criteria

- To *add* a new field triage criterion: *+LR* ≥2 or *AUROC* ≥ *0.60*
  Magnitude of predictive utility:
  - Large effect: +LR ≥10, AUROC ≥0.80
  - Moderate effect: +LR 5–9, AUROC 0.7–0.79
  - Small effect: +LR 2–4, AUROC 0.6–0.69
- To *remove* a field triage criterion: *no evidence* or *+LR 1.0–1.5* or *AUROC 0.50–0.55* across multiple studies (triage criteria were not removed based on a single study)

11

Audience Feedback

- A 40-question survey was widely distributed, receiving 3958 responses.
  - Most were paramedics/EMTs and who completed scene response
- Identified that EMS provider judgment was used to override guideline recommendations < 20% of the time

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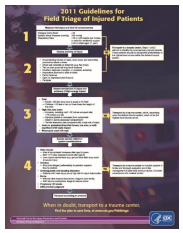


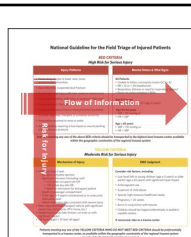
Format Change

13

New Framework

- A simplified approach that reflects how information is gathered by EMS on scene and aims to arrive at the transport destination decision sooner.

14



New
Framework

15

Injury Patterns & Mental Status & Vital Sign Criteria

Highest Risk for Serious Injury

16

High Risk for Serious Injury

National Guideline for the Field Triage of Injured Patients

RED CRITERIA
High Risk for Serious Injury

Injury Patterns	Mental Status & Vital Signs
• Penetrating injuries to head, neck, torso, and proximal extremities • Skull deformity, suspected skull fracture • Suspected spinal injury with new motor or sensory loss • Chest wall instability, deformity, or suspected flail chest • Suspected pelvic fracture • Suspected fracture of two or more proximal long bones • Crushed, degloved, mangled, or pulseless extremity • Amputation proximal to wrist or ankle • Active bleeding requiring a tourniquet or wound packing with continuous pressure	**All Patients** • Unable to follow commands (motor GCS < 6) • RR < 10 or > 29 breaths/min • Respiratory distress or need for respiratory support • Room-air pulse oximetry < 90% **Age 0–9 years** • SBP < 70 mm Hg + (2 x age in years) **Age 10–64 years** • SBP < 90 mmHg or • HR > SBP **Age > 65 years** • SBP < 110 mmHg or • HR > SBP

Patients meeting any one of the above RED criteria should be transported to the highest-level trauma center available within the geographic constraints of the regional trauma system

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High Risk for Serious Injury – Injury Patterns

Injury Patterns

- Penetrating injuries to head, neck, torso, and proximal extremities
- Skull deformity, suspected skull fracture
- Suspected spinal injury with new motor or sensory loss
- Chest wall instability, deformity, or suspected flail chest
- Suspected pelvic fracture
- Suspected fracture of two or more proximal long bones
- Crushed, degloved, mangled, or pulseless extremity
- Amputation proximal to wrist or ankle
- Active bleeding requiring a tourniquet or wound packing with continuous pressure

18

New Criterion

- Active bleeding requiring a tourniquet or wound packing with continuous pressure

19

High Risk for Serious Injury – Mental Status & Vital Signs

Mental Status & Vital Signs

All Patients
- Unable to follow commands (motor GCS < 6)
- RR < 10 or > 29 breaths/min
- Respiratory distress or need for respiratory support
- Room-air pulse oximetry < 90%

Age 0–9 years
- SBP < 70mm Hg + (2 x age in years)

Age 10–64 years
- SBP < 90 mmHg or
- HR > SBP

Age ≥ 65 years
- SBP < 110 mmHg or
- HR > SBP

20

Modified Criterion: mGCS

1	No motor response
2	Extension to pain (arm abduction, supination of forearm)
3	Abnormal flexion to pain (pronation of forearm, flexor posturing)
4	Withdrawal from pain (pulls away from pain source – pulls hand away when fingernails are pinched)
5	Localizing pain (purposeful movement toward pain – patient holds/touches head with severe headache or pain)
6	**Obeys Commands (patient can execute simple commands with ease)**

21

New & Modified Criterion: Circulatory Measures

- Shock Index
  - HR > SBP (a shock index of > 1)
  - Among out-of-hospital studies, pooled estimates showed a sensitivity of 37%, a specificity of 85%, and an AUROC of 0.72 for identifying seriously injured patients.
- Age-adjusted Vital Signs
  - SBP < 70 mm Hg + (2 × age in years) (children 0–9 years)

22

New & Modified Criteria: Respiratory

Respiratory distress or need for respiratory support replaces "ventilatory assistance"

Pulse oximetry < 90% is added

23

Mechanism of Injury & EMS Judgment

"Anatomic and physiologic criteria identify less than half of patients with serious injuries, the mechanism criteria are important in the triage process."

24

Moderate Risk for Serious Injury

YELLOW CRITERIA

Moderate Risk for Serious Injury

Mechanism of Injury	EMS Judgment
• High-Risk Auto Crash – Partial or complete ejection – Significant intrusion (including roof) • >12 inches occupant site OR • >18 inches any site OR • Need for extrication for entrapped patient – Death in passenger compartment – Child (age 0–9 years) unrestrained or in unsecured child safety seat – Vehicle telemetry data consistent with severe injury • Rider separated from transport vehicle with significant impact (eg, motorcycle, ATV, horse, etc.) • Pedestrian/bicycle rider thrown, run over, or with significant impact • Fall from height > 10 feet (all ages)	**Consider risk factors, including:** • Low-level falls in young children (age ≤ 5 years) or older adults (age ≥ 65 years) with significant head impact • Anticoagulant use • Suspicion of child abuse • Special, high-resource healthcare needs • Pregnancy > 20 weeks • Burns in conjunction with trauma • Children should be triaged preferentially to pediatric capable centers **If concerned, take to a trauma center**

Patients meeting any one of the YELLOW CRITERIA WHO DO NOT MEET RED CRITERIA should be preferentially transported to a trauma center, as available within the geographic constraints of the regional trauma system (need not be the highest-level trauma center)

25

Mechanism of Injury

- High-Risk Auto Crash
  - Partial or complete ejection
  - Significant intrusion (including roof)
    - >12 inches occupant site OR
    - >18 inches any site OR
    - Need for extrication for entrapped patient
  - Death in passenger compartment
  - Child (age 0–9 years) unrestrained or in unsecured child safety seat
  - Vehicle telemetry data consistent with severe injury
- Rider separated from transport vehicle with significant impact (eg, motorcycle, ATV, horse, etc.)
- Pedestrian/bicycle rider thrown, run over, or with significant impact
- Fall from height > 10 feet (all ages)

Moderate Risk for Serious Injury - Mechanism

26

New Criterion: Unrestrained Children

- Children who are unrestrained or improperly restrained in a motor vehicle accident have higher injury severity and the lack of restraint use predicts more seriously injured children.

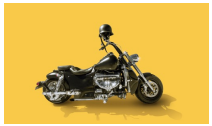
27

Modified Criterion:

- Extrication

28

Modified Criterion: Mechanisms



- Rider separated from transport vehicle with significant impact (e.g., motorcycle, ATV, horse, etc.)
- Fall from height >10 ft (all ages)
- Pedestrian/bicycle rider thrown, run over, or with significant impact

29

EMS Judgment

Consider risk factors, including:

- Low-level falls in young children (age ≤ 5 years) or older adults (age ≥ 65 years) with significant head impact
- Anticoagulant use
- Suspicion of child abuse
- Special, high-resource healthcare needs
- Pregnancy > 20 weeks
- Burns in conjunction with trauma
- Children should be triaged preferentially to pediatric capable centers

If concerned, take to a trauma center

Moderate Risk Criteria – EMS Judgment

30

Transport Recommendations

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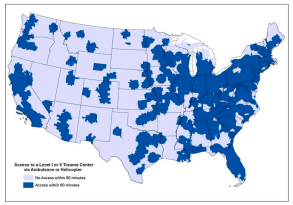

Access to Trauma Care

32

Trauma System Variability

- A one-size fits all approach is not feasible

33

Transport Type

- There is insufficient data to make recommendations regarding if / when air medical resources should be utilized; common considerations are:
  - Time to nearest trauma center
  - Availability of air medical resource
  - Skilled personnel
  - Additional resources (blood products)

34

Implementation

35

Implementation

- Guidelines only work if you implement and follow them requiring:
  - Training
  - Updating local protocols
  - Quality improvement / quality assurance
  - Coordination with local trauma centers, other hospitals, and EMS agencies

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Resources

- Arizona Department of Health Services
  - https://www.azdhs.gov/preparedness/emergency-medical-services-trauma-system/index.php#education-independent-study
- American College of Surgeons
  - www.facs.org/fieldtriageguidelines

ACS AMERICAN COLLEGE OF SURGEONS

ARIZONA DEPARTMENT OF HEALTH SERVICES

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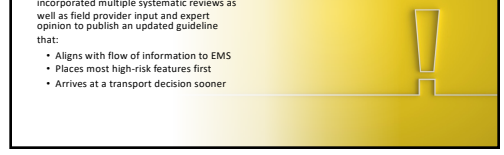
Summary

- The 2021 Field Triage Guideline incorporated multiple systematic reviews as well as field provider input and expert opinion to publish an updated guideline that:
  - Aligns with flow of information to EMS
  - Places most high-risk features first
  - Arrives at a transport decision sooner



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Questions?

National Guideline for the Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage, 2021. Journal of Trauma and Acute Care Surgery. DOI: 10.1097/TA.0000000000003427

39

TRANSFUSION GOING WRONG?

MOLLY K. ESTES, MD FAAEM FACEP
ASSISTANT PROFESSOR, LOMA LINDA UNIVERSITY

1

OBJECTIVES

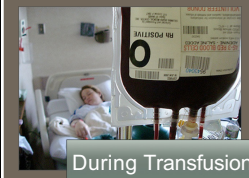
- Detail the appropriate transfusion ratios and other interventional components involved in a massive transfusion scenario.
- Describe the common transfusion reactions and how to respond to each.
- Identify and respond to acute cardiopulmonary decompensation during transfusion.

2

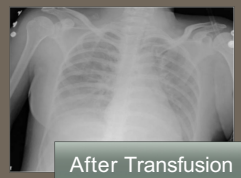
MASSIVE TRANSFUSION

3

TIMING OF PROBLEMS



During Transfusion



After Transfusion

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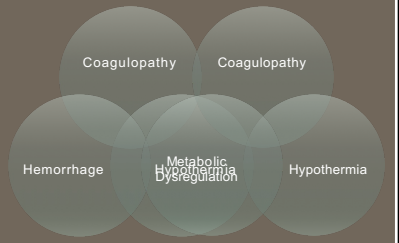
LETHAL TRIAD



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COAGULOPATHY

The Ratio of Blood Products Transfused Affects Mortality in Patients Receiving Massive Transfusions at a Combat Support Hospital

The Use of Higher Platelet:RBC Transfusion Ratio in the Acute Phase of Trauma Resuscitation: A Systematic Review*

The Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMMTT) Study

Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients With Severe Trauma The PROPPR Randomized Clinical Trial

Damage control resuscitation in patients with severe traumatic hemorrhage: A practice management guideline from the Eastern Association for the Surgery of Trauma

6

COAGULOPATHY

A new definition for massive transfusion in the modern era of whole blood resuscitation

Parker Hu[1] | Rindi Uhlich[2] | Jonathan Black[1] | Jan O. Jansen[1] | Jeffrey Kerby[1] | John B. Holcomb[1]

Re-introducing whole blood for transfusion: considerations for blood providers

Tor A. Hervig,[1] Heidi A. Doughty,[2] Rebecca A. Cardigan,[3] Torunn O. Apelseth,[4] John R. Hess,[5] Femke Noorman,[6] Miloš Bohoněk,[7] Mark H. Yazer,[8] Jia Lu,[9] Silvano Wendel,[10] Rosemary L. Sparrow[11] & Biomedical Excellence for Safer Transfusion Collaborative

WHOLE BLOOD IN TRAUMA: A REVIEW FOR EMERGENCY CLINICIANS

CPT Wells Weymouth, MD, MC, USA,* , CPT Brit Long, MD, USAF,* Alex Koyfman, MD,† and Christopher Winckler, MD, LP‡§

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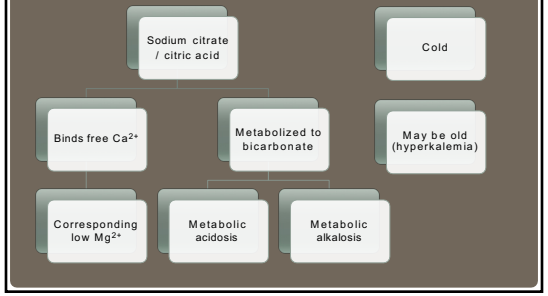
METABOLIC DYSREGULATION



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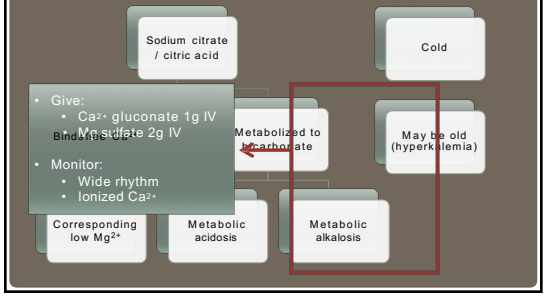
HOW TO KEEP IT ALL STRAIGHT?



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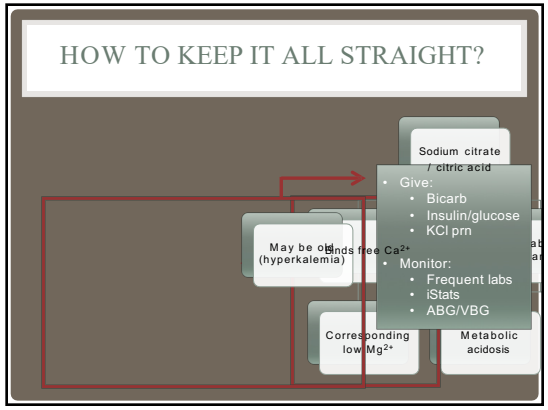
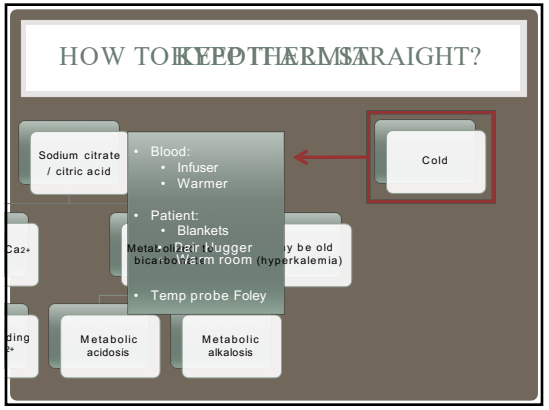

HOW TO KEEP IT ALL STRAIGHT?
Sodium citrate / citric acid
Give:
Bicarb
Insulin/glucose
KCl prn
Monitor:
Frequent labs
iStats
ABG/VBG
May be old (hyperkalemia)
Binds free Ca2+
Corresponding low Mg2+
Metabolic acidosis

10


HOW TO KEEP IT ALL STRAIGHT?
Sodium citrate / citric acid
Blood:
Infuser
Warmer
Patient:
Blankets
Bair Hugger
Warm room
Temp probe Foley
Cold
Metabolic acidosis
Metabolic alkalosis

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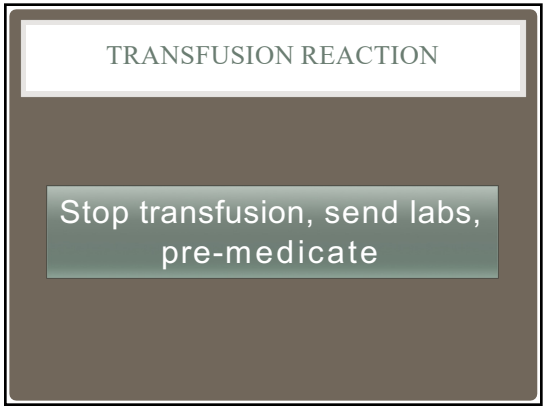

TRANSFUSION REACTION
Stop transfusion, send labs, pre-medicate

12

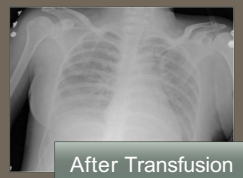
TRANSFUSION REACTION

Hemolytic	• Recipient Abs -| donor RBCs • IVF, pressors
Febrile	• Recipient Abs -| donor leukocytes • Anti-pyretics, self-limited
Allergic	• Immune reaction -| donor plasma • Antihistamines, ?anaphylaxis

13

2 GROUPS OF PROBLEMS

During Transfusion



After Transfusion

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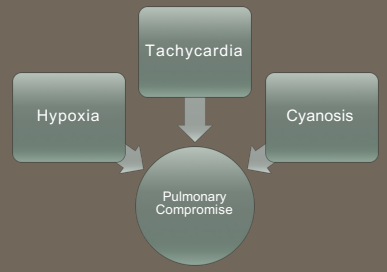
PATIENT IS CRASHING



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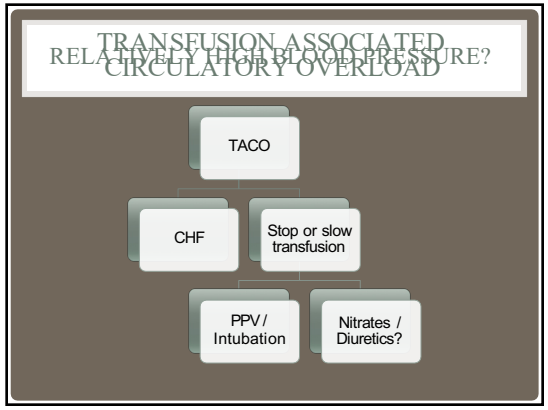
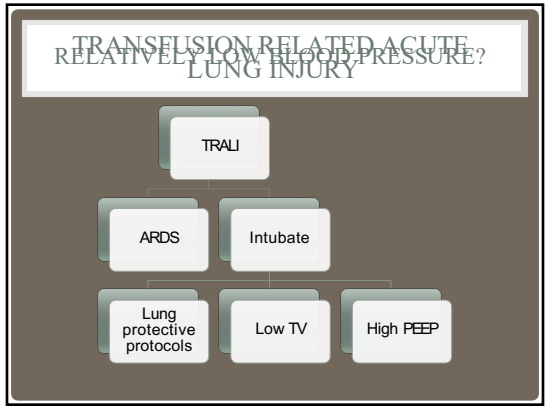
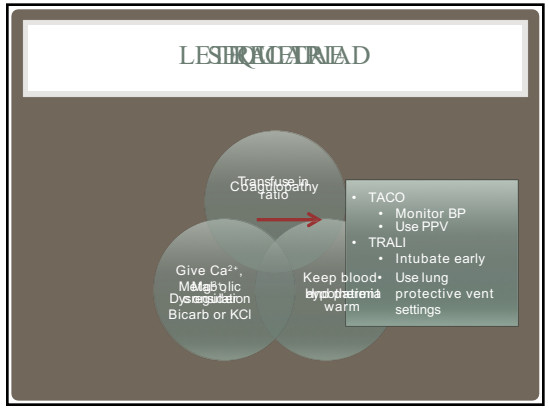

TRANSFUSION ASSOCIATED CIRCULATORY OVERLOAD
RELATIVELY HIGH BLOOD PRESSURE?
TACO
CHF
Stop or slow transfusion
PPV / Intubation
Nitrates / Diuretics?

16


TRANSFUSION RELATED ACUTE LUNG INJURY
RELATIVELY LOW BLOOD PRESSURE?
TRALI
ARDS
Intubate
Lung protective protocols
Low TV
High PEEP

17


Transfuse in Coagulopathy Ratio
Give Ca2+, Bicarb or KCl
Keep blood warm
TACO
Monitor BP
Use PPV
TRALI
Intubate early
Use lung protective vent settings

18

QUESTIONS?

19

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Hervig TA, Doughty HA, Cardigan RA, Apelseth TO, Hess JR, Noorman F, Bohonèk M, Yazer MH, Lu J, Wendel S, Sparrow RL; Biomedical Excellence for Safer Transfusion Collaborative. Re-introducing whole blood for transfusion: considerations for blood providers. Vox Sang. 2021 Feb;116(2):167-174. doi: 10.1111/vox.12998. Epub 2020 Sep 30. PMID: 32996604.

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Holcomb, JB *et al.* "Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients with Severe Trauma: the PROPPR Randomized Clinical Trial." *JAMA*. 313(5):471-82, Feb 2015.

Hu P, Uhlich R, Black J, Jansen JO, Kerby J, Holcomb JB. A new definition for massive transfusion in the modern era of whole blood resuscitation. Transfusion. 2021 Jul;61 Suppl 1:S252-S263. doi: 10.1111/trf.16453. PMID: 34269434.

Maxwell, Melanie and Matthew Wilson. "Complications of Blood Transfusion." *Cont Educ Anaes*. 6(6): 225-29, 2006.

Sihler, Kristen and Lena Napolitano. "Complications of Massive Transfusion." *Chest*. 137 (1):209-20, Jan 2010.

Weymouth W, Long B, Koyfman A, Winckler C. Whole Blood in Trauma: A Review for Emergency Clinicians. J Emerg Med. 2019 May;56(5):491-498. doi: 10.1016/j.jemermed.2019.01.024. Epub 2019 Mar 20. PMID: 30904380.

Zhao, J *et al.* "A Fresh Frozen Plasma to Red Blood Cell Transfusion Ratio of 1:1 Mitigates Lung Injury in a Rat Model of Damage Control Resuscitation for Hemorrhagic Shock." *Am J Emerg Med*. 33(6):754-9, Jun 2015.

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SAME NAME NEW FACE FENTANYL 2023

Dan Quan, DO FAAEM FACEP FACMT
Emergency Medicine/Medical Toxicology/Addiction Medicine
Creighton University Emergency Medicine Residency
Toxicology Consultants of Arizona
Phoenix, Arizona

1

DISCLOSURES

All relevant financial relationships(s) with any commercial interest to the provider name of commercial interest(s) nature of the relationship with each

NONE

2

MAKIN' FENTANYL

- Precursors are purchased from China and India
  - Governments are attempting to stop export of precursors
  - Other precursors are available that can be easily converted
- Fentanyl precursors
  - 4-anilino-N-phenethyl-4-piperidine (ANPP)
  - N-phenethyl-4-piperidone (NPP)
- Mexican labs are processing precursors to fentanyl
- Pill presses

3

FORMS

- Fentanyl pills are most common
  - Estimated 1,000 to 2,000 mcg/pill
  - Can be up to 5,000 mcg/pill
- Fentanyl powder

www.dea.gov/resources/facts-about-fentanyl

www.dea.gov/factsheets/fentanyl

4

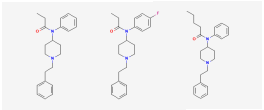
USIN' FENTANYL – THE 3S'S

- Snort
  - Not as fast or satifying
- Shoot
  - Injection is good
  - IV – access is finite, vein sclerosing
  - IM – Risk of infection, necrosis
  - Technique is not usually sterile
- Smoke
  - Fast and furious

5

ALL FENTANYL?

- Most pills contain fentanyl although fentanyl analogs have been found
  - Para-fluorofentanyl
  - Valeryl fentanyl
- And then the adulterants



6

ADULTERANTS

- Increases profits, may enhance effects
- Dipyrone or metamizole
  - NSAID sold in countries outside of North America
    - May cause agranulocytosis, aplastic anemia
- Acetaminophen

7

XYLAZINE

(U) Figure 1. DEA Forensic Laboratory Identifications of Xylazine by Region

Region	2020	2021	Percent Increase
Northeast	346	556	61%
South	198	580	193%
Midwest	110	116	7%
West	77	163	112%

Source: DEA

- "Tranq", "tranq dope", "zombie drug"
- Clonidine analog (α_2 adrenergic agonist)
- Non-opioid sedative, analgesic and muscle relaxant
- Veterinary use in the US used with ketamine for sedation
- Generally short acting in animals 30-40 minutes
- Mixed opinion about its effects
  - May cause a longer high than fentanyl
  - May decrease the euphoria

8

XYLAZINE

- Clinical effects
  - Initially: Dry mouth, sedation, hypertension, tachycardia
  - Then: **Hypotension, bradycardia,** hyperglycemia, hypothermia, respiratory depression, dysrhythmia
  - Does not respond to naloxone like clonidine
  - May experience withdrawal symptoms
    - Chest pain, seizures
  - Soft tissue necrosis and infection

9

Reyes JC, Negrón JL, Colón HM, Padilla AM, Millán MY, Matos TD, Robles RR. The emerging of xylazine as a new drug of abuse and its health consequences among drug users in Puerto Rico. J Urban Health. 2012 Jun;89(3):519-26. doi: 10.1007/s11524-011-9662-6. PMID: 22391983; PMCID: PMC3368046.

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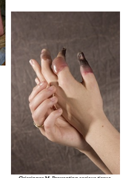
https://www.thesun.co.uk/news/6158322/colombia-krokodil-drug-epidemic-russian-cannibal-opioid/



Grissinger M. Preventing serious tissue injury with intravenous promethazine (phenergan). P T. 2009 Apr;34(4):175-6. PMID: 19561855; PMCID: PMC2697094.

11

REVERSAL AGENTS

- Naloxone
  - Metabolized to naloxone-3-glucuronide in the liver
  - Intranasal 4 mg/actuation (3.6 mg naloxone) or Kloxxado 8 mg/actuation (7.2 mg naloxone)
    - Onset 1-2 minutes, Duration 1-4 hours, Half-life 0.5 – 2 hours
    - Breaking news…it is now OTC (March 29, 2023)

12

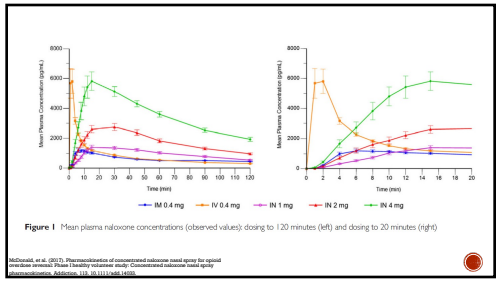


Figure 1 Mean plasma naloxone concentrations (observed values): dosing to 120 minutes (left) and dosing to 20 minutes (right)

McDonald, et al. (2017). Pharmacokinetics of concentrated naloxone nasal spray for opioid overdose reversal: Phase I healthy volunteer study. Concentrated naloxone nasal spray pharmacokinetics. Addiction, 113, 10.1111/add.14103.

13

NALMEFENE AND NALTREXONE

- Nalmefene (2 mg/2 mL) – Purdue Pharma
  - Approved in 1995 as an opioid reversal agent
  - Similar to naltrexone
  - Used in the past for alcohol consumption reduction
  - Onset 2-5 minutes, Duration 1-4 hours, Half-life 8-11 hours
  - Dose: 0.5 mg initial dose, 1 mg repeat in 2-5 minutes
  - IV/IM/SC NOT intranasal
  - May not adequately reverse buprenorphine due to slow displacement from receptors
- Naltrexone
  - Not indicated for acute opioid reversal
  - Oral or long-acting IM injectable called Vivatrol

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DISCUSSION CASE 1

- 22 year old was found down at a bus stop
- Bystanders administered naloxone nasal spray
- EMS arrives and administers another bolus dose of naloxone
- He is alert and awake, no respiratory depression.
- What is your plan?

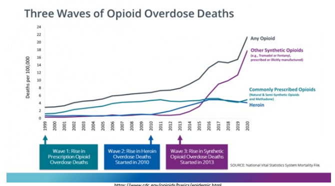
15

DISCUSSION CASE 2

- 28 year old was smoking fentanyl in an abandoned building
- Police arrest him for trespassing. He has a felony warrant.
- He has pinpoint pupils, no respiratory depression.
- He said he took 30 fentanyl pills just before the arrest
- What do you ask and what are you going to do?

16

QUESTIONS AND DISCUSSION



https://www.cdc.gov/opioids/basics/epidemic.html

17

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- www.uscc.gov/sites/default/files/2021-08/Illicit_Fentanyl_from_China-An_Evolving_Global_Operation.pdf
- www.dea.gov/sites/default/files/2022-12/The_Growing_Threat_of_Xylazine_and_its_Mixture_with_Illicit_Drugs.pdf
- www.cdc.gov/mmwr/volumes/70/wr/mm7037a5.htm
- Reyes JC, Negrón JL, Colón HM, Padilla AM, Millán MY, Matos TD, Robles RR. The emerging of xylazine as a new drug of abuse and its health consequences among drug users in Puerto Rico. J Urban Health. 2012 Jun;89(3):519-26. doi: 10.1007/s11524-011-9662-6. PMID: 22391983; PMCID: PMC3368046.
- https://www.thesun.co.uk/news/6158322/colombia-krokodil-drug-epidemic-russian-cannibal-opioid/
- Grissinger M. Preventing serious tissue injury with intravenous promethazine (phenergan). P T. 2009 Apr;34(4):175-6. PMID: 19561855; PMCID: PMC2697094.
- Nalmefene HCl Injection Full Prescribing Information. Purdue Pharma L.P.; 2022. 2. Kaplan JL, Marx JA, Calabro JJ, et al. Double-blind, randomized study of nalmefene and naloxone in emergency department patients with suspected narcotic overdose. *Ann Emerg Med*. 1999;34(1):42-50. doi:10.1016/s0196-0644(99)70270-2
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ACOEP
SPRING SEMINAR
PHOENIX, ARIZONA
April 1-5, 2023
ACOEP

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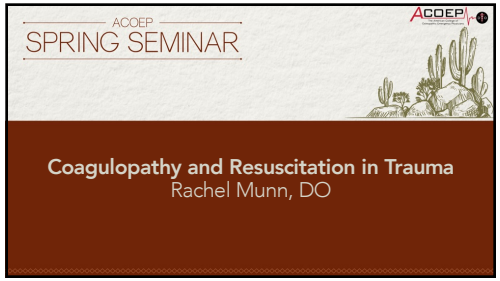
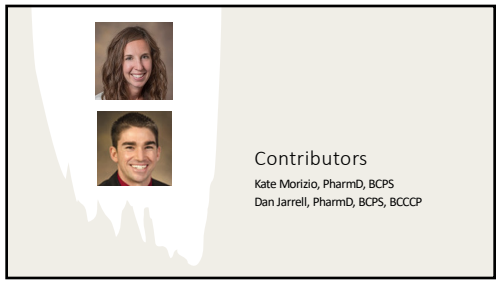

ACOEP
SPRING SEMINAR
ACOEP
Coagulopathy and Resuscitation in Trauma
Rachel Munn, DO

2


Contributors
Kate Morizio, PharmD, BCPS
Dan Jarrell, PharmD, BCPS, BCCCP

3

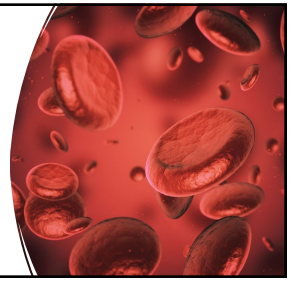
Objectives

Review	Identify	Discuss	Reference
Review basic physiology of coagulation and associated disorders	Identify commonly used anticoagulants, their mechanism of action, monitoring parameters, and reversal agent (if available)	Traumatic coagulopathy and its treatment	Reference guidelines for coagulopathy treatment in traumatic injuries

4

Pathophysiology

... and definitions surrounding bleeding & coagulopathy



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What is Coagulopathy?

- A defect in any of the components of hemostasis:
  - Vasculature
  - Platelets
  - Coagulation factors
  - Fibrinolytic proteins

6

Pathophysiology of Coagulation

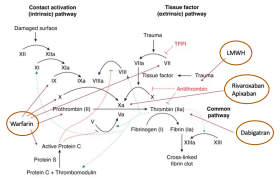


image: Adapted from Wikimedia Commons

7

What is Major Bleeding?

Definitions differ in non-surgical, surgical, and trauma patients:

In non-surgical patients:

1. *Fatal bleeding, and/or*
2. *Symptomatic bleeding in a critical area or organ, such as intracranial, intraspinal, intraocular, retroperitoneal, intra-articular or pericardial, or intramuscular with compartment syndrome, and/or*
3. *Bleeding causing a fall in hemoglobin level of 2g/dL or more, or leading to transfusion of 2 or more units of whole blood or RBCs.*

International Society of Thrombosis and Hemostasis

8

What is Major Bleeding?

- A patient who requires massive transfusion?
- A patient who fits into the ACS classification of hemorrhagic shock?

Class	Volume Loss	HR	BP / PP	RR	Other
I	15% (750mL)	Normal to ↑	Normal	Normal	
II	15 – 30% (750 – 1500mL)	↑	Normal to ↓ / Narrow	↑	
III	30 – 40% (1500 – 2000mL)	↑↑	↓ / Narrow	↑	AMS ↓ UOP ↓ Capillary refill
IV	> 40% (> 200mL)	↑↑	↓↓ / Narrow	↑	AMS ↓ UOP ↓ Capillary refill

Heart rate (HR); Blood pressure (BP); Pulse pressure (PP); Respiratory rate (RR); Altered mental status (AMS); Urinary output (UOP)

Adapted from: Hooper N, Armstrong TJ. Hemorrhagic Shock. [Updated 2022 Sep 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-.

9

Hemophilia A, B		Clinical Presentation
Mild	5-40 U/dL, 5-40% normal activity	Prolonged bleeding with major trauma or surgery Rare spontaneous bleeding
Moderate	1-5 U/dL, 1-5% normal activity	Severe bleeding with minor trauma or surgery Occasional spontaneous bleeding
Severe	<1 U/dL, <1% normal activity	Spontaneous bleeding

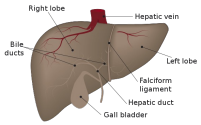
Hereditary Disorders

- **Von Willebrand Disease** – deficiency or dysfunction of vWF (the most common bleeding disorder, found in up to 1% of the U.S. population)
- **Hemophilia A** – deficiency of Factor VIII, most common (~1 in 5000 male births), generally males are affected; female carriers may have mild disease and rarely severe disease
- **Hemophilia B** – deficiency of Factor IX, less common (~1 in 15 – 30,000 male births), generally less severe disease

10

Cirrhosis

- Advanced cirrhosis is another frequent cause of coagulopathy in ED patients.
- Complex pathophysiology with varied levels of both pro and anti coagulant factors.
- INR is frequently elevated, but does not correlate with degree of coagulopathy.



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Class & Medication	Monitoring Parameter	Reversal	Onset & Half-life
Vitamin K Antagonists			
Warfarin	PT/INR	Vitamin K, 4-Factor PCC	1 – 3 days & 2 – 5 days (PO)
Heparins			
UFH	aPTT	Protamine sulfate	Immediate & Avg 90 min. (IV)
LMWH	Anti-Factor Xa*	Protamine sulfate	3 – 5 hrs & 4.5 – 7 hrs (SubQ)
Factor Xa Inhibitors			
Fondaparinux	Anti-Factor Xa	rFVIIa	2– 3 hrs & 17 – 21 hrs (SubQ)
Rivaroxaban, Apixaban, Edoxaban, Betrixaban**	Anti-Factor Xa	Andexanet alfa, 4-Factor PCC	2 – 4 hrs & 5 – 9 hrs (rivaroxaban, PO) 2 – 4 hrs & 8 - 15 hrs (apixaban, PO)
Direct Thrombin Inhibitor			
Dabigatran*** Argatroban, Bivalirudin	Thrombin Time (TT) / dilute Thrombin Time (dTT) / Ecarin Clotting Time (ECT)	Idarucizumab	1 – 2 hrs & 12 - 17 hrs (dabigatran, PO)
Antiplatelets			
Aspirin	Platelet Function Assay	Platelets / DDAVP	20 min. – 4 hrs & 3– 10 hrs**** (PO)
Clopidogrel	Platelet Function Assay	Platelets	Dose dependent; 2 hrs – 2 days & 4 hrs – 14 days

Anticoagulants

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Traumatic Coagulopathy

- Multifactorial:
  - Shock & hypoperfusion
  - Tissue injury-related thrombin generation
  - Activation of anticoagulant & fibrinolytic pathways & factor consumption
  - Acidemia
  - Hypothermia
  - Hemodilution

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Coagulopathy in the ED

- Relevant in the ED when a patient has symptomatic bleeding plus:
  - Hereditary disorder
  - Anticoagulant use
  - Traumatic coagulopathy
  - Chronic medical condition (i.e., cirrhosis)
  - Requires an urgent procedure

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Tests

Test	Characteristics
PT/INR	Measures extrinsic and common pathways INR is calculated and standardized for warfarin
aPTT	Measures intrinsic and common pathways
Anti-Factor Xa	Must be calibrated for specific anticoagulants
Thrombin Time / Ecarin Clotting Time	Measures fibrin formation
Viscoelastic assays (VEAs) (TEG®, ROTEM®)	Measure a variety of coagulation steps
Platelet aggregation	Evaluates platelet function

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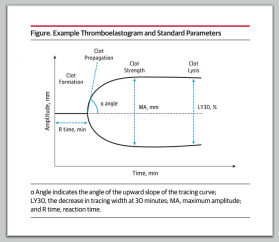
Thromboelastogram (TEG)

- R value = reaction time (s)
- K = kinetics (s)
- alpha = angle (slope of line between R and K)
- TMA = time to maximum amplitude(s)
- MA = maximum amplitude (mm)
- A30 or LY30 = amplitude at 30 minutes
- CLT = clot lysis time (s)



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The Fall of FFP

- "In contrast to FFP, PCCs require a lower infusion volume and shorter infusion time, are associated with a lower risk of pathogen transmission, and have a more rapid impact on INR."

19

Prothrombin Complex Concentrate

- FDA approved for reversing warfarin-induced coagulopathy.
- 3F- PCC includes factors II, IX, and X (inactive)
- 4F-PCC includes factors II, VII, IX, and X (inactive); small amounts of heparin and protein's C and S
- aPCC includes inactive factors II, IX, and X but activated factor VII
  - FEIBA (factor eight inhibitor bypassing activity) is the only approved product in the U.S. and is approved for prevention & treatment of surgical bleeding in hemophilia patients.

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Certain factors may be utilized independently for hereditary coagulopathies.

Single Factors

Type	Factor deficiency
Haemophilia A	Factor VIII
Haemophilia B (or Christmas disease)	Factor IX
von Willebrand's disease	von Willebrand's factor leading to low factor VIII activity and reduced platelet adhesion

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Vitamin K

- IV administration recommended for major bleeding associated with warfarin-induced coagulopathy.
- Necessary to allow activation and utilization of coagulation factors.

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Platelets

- The 2016 PATCH trial did not demonstrate improved outcomes with platelet transfusion in spontaneous cerebral hemorrhage in patients on aspirin or clopidogrel.
  - Excluded trauma patients, patients on warfarin, or with thrombocytopenia.
- A 2019 meta-analysis of 10 studies failed to demonstrate consistently improved outcomes with platelet transfusion in patients with TBI.
  - A single study demonstrated improved outcomes, a retrospective database review done at the U of A:
    - Decreased progression of ICH
    - Decreased neurosurgical intervention
    - Decreased discharge to SNF
    - Decreased mortality

23

Platelets

Transfusion Thresholds	
Active bleeding	goal > 50,000/microL
Major surgery	goal > 50,000/microL
Central line	goal > 20,000/microL
Lumbar puncture	goal > 10,000 to 20,000/microL in patients with hematologic malignancies and >40,000 to 50,000 in patients without hematologic malignancies
Neurosurgery or ocular surgery	goal > 100,000/microL
Preventative (spontaneous bleeding)	goal > 10,000/microL (some recommend 15 – 20,000/microL in patients with sepsis)

24

DDAVP

- Standard use is in von Willebrand's disease and hemophilia A.
  - Increasing serum level of vWF and factor VIII and enhances platelet adhesion.
- Interest in its use in other conditions including drug-induced coagulopathy and bleeding occurred due to observations of a shortened aPTT and bleeding time in patients given DDAVP.
  - Recent studies in TBI patients taking antiplatelet agents have reported mixed results.

25

TXA

- Inhibits fibrinolysis
- Robust efficacy and safety data in bleeding secondary to acute trauma, reduces mortality if given within 3 hours of injury:
  - MATTERS trial
  - CRASH-2 trial
- Safe to administer in the pre-hospital setting
  - STAAMP trial
- 2g bolus non-inferior than original 1g bolus + 1g infusion dosing regimen
  - Rowell et al. 2020

26

Idracuzimab

- RE-VERSE AD Study
- "…among 503 patients who were receiving dabigatran, had uncontrolled bleeding or were about to undergo an urgent procedure, and had a prolonged diluted thrombin time at baseline, idarucizumab reversed anticoagulation rapidly and completely (to a median maximum percentage of 100%) in more than 98% of the patients."
- 4.8% rate of thrombotic complications

27

Andexanet Alfa

- ANNEXA-4 study
- "In patients with acute major bleeding associated with the use of a factor Xa inhibitor, treatment with andexanet markedly reduced anti–factor Xa activity, and 82% of patients had excellent or good hemostatic efficacy at 12 hours"
- 10% rate of thrombotic complications

28

Up & Coming

- **Ciraparantag** as a reversal agent for Factor Xa inhibitors (Phase 2 Clinical Trial):
  - Jack Ansell, Sasha Bakhru, Bryan E Laulicht, Gregory Tracey, Stephen Villano, Daniel Freedman, Ciraparantag reverses the anticoagulant activity of apixaban and rivaroxaban in healthy elderly subjects, *European Heart Journal*, Volume 43, Issue 10, 7 March 2022, Pages 985–992, https://doi.org/10.1093/eurheartj/ehab637

29

Clinical Scenarios

... and society recommendations & guidelines

30

Intracranial Hemorrhage

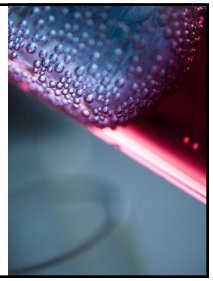
- 2016 Neurocritical Care Society & Society of Critical Care Medicine Guideline
- 2020 AHA Guidelines

- Reversal recommended in most cases of intracranial hemorrhage.
- Agent utilized depends on the anticoagulant.
- Risk : benefit ratio should be assessed in patients with critical thrombotic complication (limb ischemia) or high-risk feature (mechanical heart valve).

31

Major Trauma

- Acute traumatic coagulopathy is common.
- One study noted 34% of trauma patients had coagulopathy (abnormal PT) upon presentation to the ED.
  - Associated with increased prehospital IVF and injury severity score.
- How are we evaluating for and treating this type of coagulopathy?



33

What comes first?

- Are patients with critical injury requiring MTP at higher risk of acute traumatic coagulopathy?
- Is this a combination of separate processes:
  - Acute traumatic coagulopathy
  - Resuscitation induced coagulopathy

34

Major Trauma

- Can we predict who will be at risk? Who will need massive transfusion?
- Assessment of Blood Consumption (ABC) Score
  - Penetrating mechanism of injury
  - Positive FAST
  - SBP of < 90
  - HR > 120
- If 2 or more checked, predicts the need for massive transfusion with 75% sensitivity and 86% specificity.

35

Balanced resuscitation…

- PROPPR Trial
- Among patients with severe trauma and major bleeding, early administration of plasma, platelets, and red blood cells in a 1:1:1 ratio compared with a 1:1:2 ratio did not result in significant differences in mortality at 24 hours or at 30 days.

36

Is a "one size fits all" approach best?

- A 2016 RCT found that using TEG-guided MTP improved survival and led to less utilization of plasma and platelets.
- ITACTIC Trial (2021)
  - Examined if VEA utilization vs conventional coagulation tests in patients requiring MTP improved mortality and other patient outcomes.
  - Negative study.

37

PROCOAG Trial

- Published March 21, 2023
  - France, 2017 – 2021, at 12 level 1 trauma centers
  - Trauma activations age >18
    - receiving at least 1 unit pRBCs prehospital or within 1 hr
    - ABC score > 2,
    - clinical assessment by physician of at risk for massive transfusion
  - Primary outcome: total units of blood products consumed in the first 24 hrs
  - 324 patients randomized / 308 received the study intervention (73% men, mean age 39)

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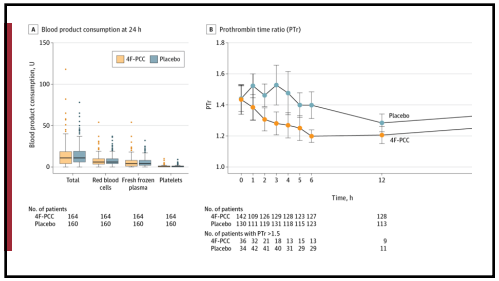

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PROCOAG Trial

- No reduction in 24 hr blood product consumption or other secondary outcomes
- Higher risk of thromboembolic complications with PCC
- Limitations include giving FFP and PCC may increase thrombotic events
- "These findings do not support systematic use of 4F-PCC in patients at risk of massive transfusion."

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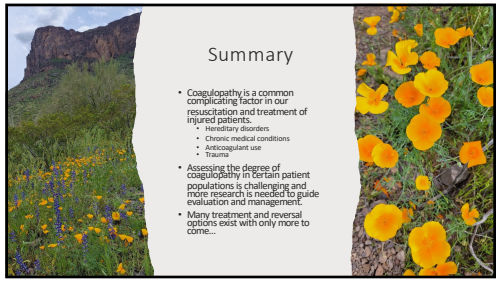
Summary
Coagulopathy is a common complicating factor in our resuscitation and treatment of injured patients.
Hereditary disorders
Chronic medical conditions
Anticoagulant use
Trauma
Assessing the degree of coagulopathy in certain patient populations is challenging and more research is needed to guide evaluation and management.
Many treatment and reversal options exist with only more to come…

41


Questions?

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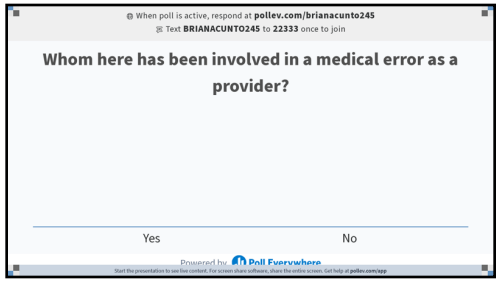

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Oh SH!T

I Made a Mistake !

Brian Acunto DO, EJD
Medical Safety Officer
Atlanticare Health System

2

3

OBJECTIVES

- Understand the various types of errors and their causes
- Describe the appropriate steps to take after an error has occurred
- Discuss the AHRQ report on Diagnostic Error in the ED

4

Dr. Goodguy

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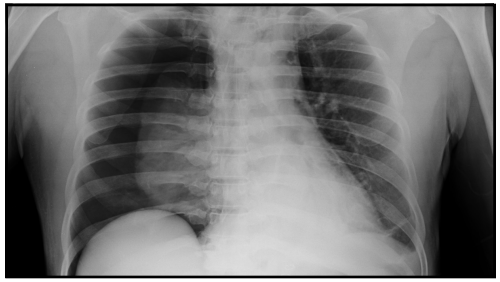

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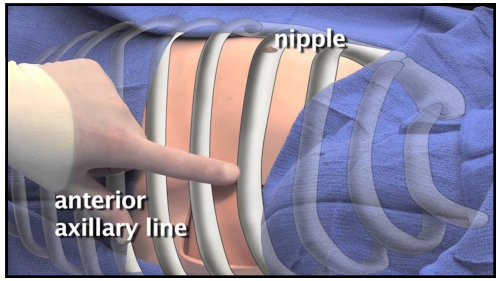

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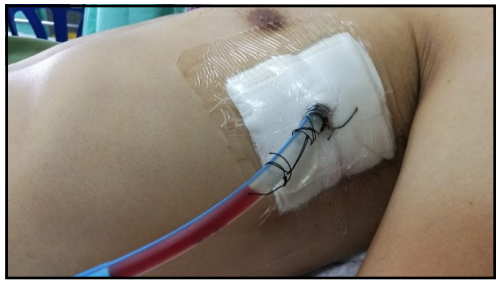

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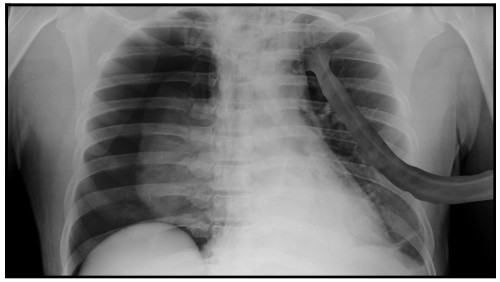

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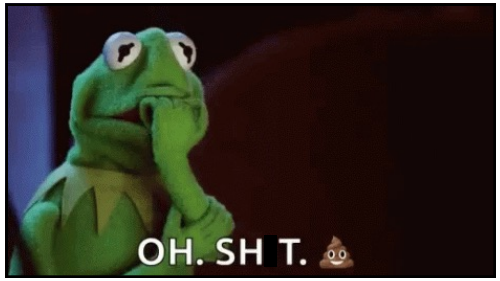
OH. SH T.

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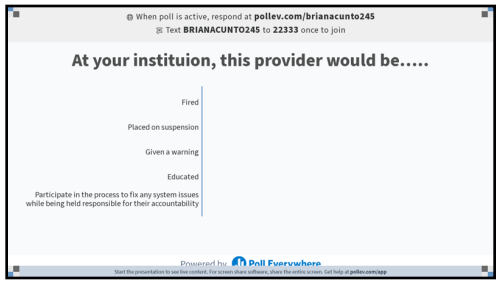
When poll is active, respond at pollev.com/brianacunto245
Text BRIANACUNTO245 to 22333 once to join
At your instituion, this provider would be.....
Fired
Placed on suspension
Given a warning
Educated
Participate in the process to fix any system issues while being held responsible for their accountability
Powered by Poll Everywhere

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15

In the Aftermath of the Error, What Dr. Goodguy Did Well

- Disclosed the error to the patient and his family
- Mitigated the immediate danger to the patient due to the ongoing medical condition that was present.

16

In the Aftermath of the Error, What Dr. Goodguy Did Not Do Well

- Did not follow institutional policies around serious occurrence
- Did not fill out an incident form
  - Legal and Risk Management were not aware
  - Insurers were not aware
  - Mandatory reporting to Federal, State, Local and accrediting agencies could not occur

17

Identifying Sentinel Events

Sentinel events are a subcategory of adverse events. A *sentinel event* is a patient safety event (not primarily related to the natural course of a patient's illness or underlying condition) that reaches a patient and results in death, severe harm (regardless of duration of harm), or permanent harm (regardless of severity of harm).

- Suicide of any patient receiving care, treatment, and services in a staffed around-the-clock care setting or within 72 hours of discharge, including from the health care organization's emergency department (ED)
- Surgery or other ***invasive procedure*** performed at the wrong site, on the wrong patient, or that is the wrong (unintended) procedure for a patient regardless of the type of procedure or the magnitude of the outcome
- Any elopement (that is, unauthorized departure) of a patient from a staffed around-the-clock care setting (including the ED), leading to death, permanent harm, or severe harm to the patient

https://www.jointcommission.org/resources/sentinel-event/sentinel-event-policy-and-procedures

18

- Fall in a staffed-around-the-clock care setting or fall in a care setting not staffed around the clock during a time when staff are present resulting in any of the following:
  - Any fracture
  - Surgery, casting, or traction
  - Required consult/management or comfort care for a neurological (for example, skull fracture, subdural or intracranial hemorrhage) or internal (for example, rib fracture, small liver laceration) injury
  - A patient with coagulopathy who receives blood products as a result of the fall
  - Death or permanent harm as a result of injuries sustained from the fall (not from physiologic events causing the fall)

https://www.jointcommission.org/resources/sentinel-event/sentinel-event-policy-and-procedures

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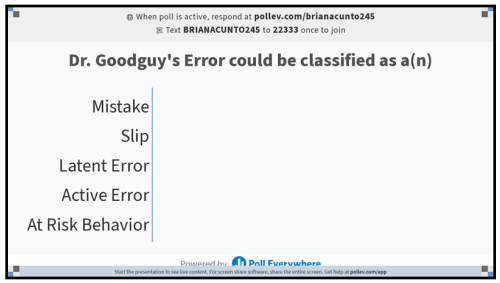

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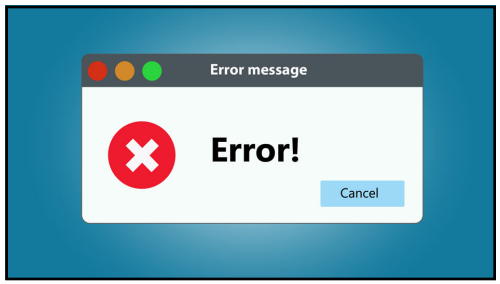

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MISTAKES

- You don't know the right thing to do because you haven't been taught
- Incorrect choices
- Lack of experience, training, or negligence

https://www.ismp.org/resources/differences-between-human-error-risk-behavior-and-reckless-behavior-are-key-just-culture
MedIQ. Culture of Safety Module 3: Error Causation and Response

23

SLIPS

- You know the right thing to do, but unintentionally don't do it.
- Failures of schematic behaviors
- Lapses in concentration
- Occur in the face of competing sensory or emotional distractions, fatigue, or stress
  - Training/Education will NOT decrease slips
  - Add extra step to process to prevent SLIPS

https://www.ismp.org/resources/differences-between-human-error-risk-behavior-and-reckless-behavior-are-key-just-culture
MedIQ. Culture of Safety Module 3: Error Causation and Response

24

ACTIVE ERRORS

- Occur at the point of contact between a human and some aspect of a larger system.
- They are readily apparent
- Typically involve someone at the frontline
  - Push wrong button
  - Ignore warning light

https://psnet.ahrq.gov/primer/root-cause-analysis
MedIQ. Culture of Safety Module 3: Error Causation and Response

25

LATENT ERRORS

- Less apparent failures of organization or design that allows harm to patients.
  - Organization uses different types of infusion pumps

https://psnet.ahrq.gov/primer/root-cause-analysis
MedIQ. Culture of Safety Module 3: Error Causation and Response

26

AT RISK BEHAVIORS

- Behavioral choice that increases risk where risk is not recognizes or is mistakenly believed to be justified.

https://www.ismp.org/resources/differences-between-human-error-risk-behavior-and-reckless-behavior-are-key-just-culture
MedIQ. Culture of Safety Module 3: Error Causation and Response

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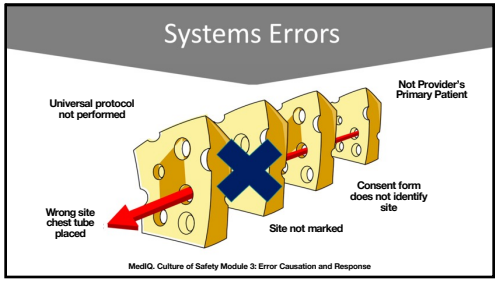

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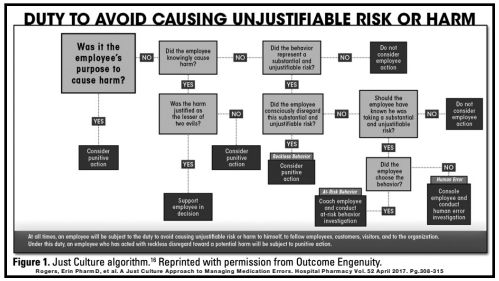

Figure 1. Just Culture algorithm.[18] Reprinted with permission from Outcome Engenuity.
Rogers, Erin PharmD, et al. A Just Culture Approach to Managing Medication Errors. Hospital Pharmacy Vol. 52 April 2017. Pg.308-315

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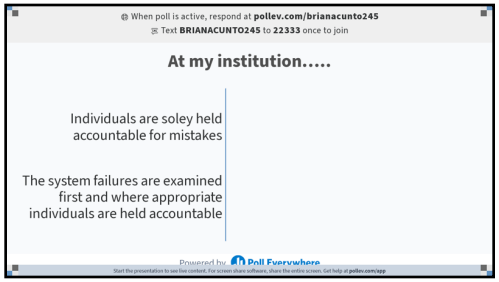

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You Made A Mistake: Checklist

- Mitigate any further harm
- Follow your institutions policies and procedures for serious occurrence
- Reporting
- Notify patient
- Apology ?

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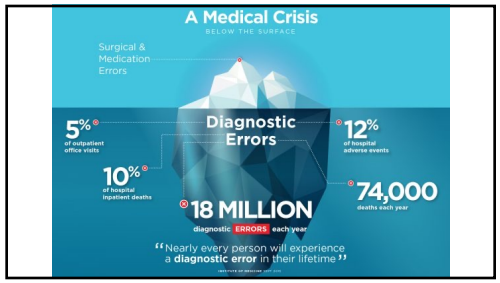
A Medical Crisis
BELOW THE SURFACE
Surgical & Medication Errors
Diagnostic Errors
5% of outpatient office visits
10% of hospital inpatient deaths
12% of hospital adverse events
74,000 deaths each year
18 MILLION diagnostic ERRORS each year
"Nearly every person will experience a diagnostic error in their lifetime"

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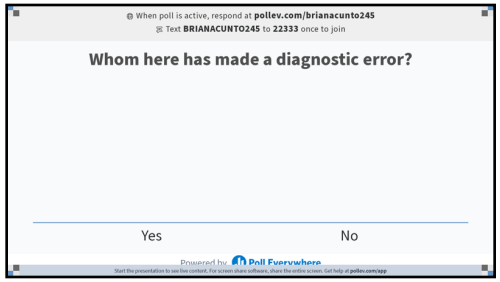

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Comparative Effectiveness Review
Number 258

Diagnostic Errors in the Emergency Department: A Systematic Review

Prepared for:
Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
5600 Fishers Lane
Rockville, MD 20857
www.ahrq.gov

38

Conclusions. Although estimated ED error rates are low (and comparable to those found in other clinical settings), the number of patients potentially impacted is large. Not all diagnostic errors or harms are preventable, but wide variability in diagnostic error rates across diseases, symptoms, and hospitals suggests improvement is possible. With 130 million U.S. ED visits, estimated rates for diagnostic error (5.7%), misdiagnosis-related harms (2.0%), and serious misdiagnosis-related harms (0.3%) could translate to more than 7 million errors, 2.5 million harms, and 350,000 patients suffering potentially preventable permanent disability or death. Over two-thirds of serious harms are attributable to just 15 diseases and linked to cognitive errors, particularly in cases with "atypical" manifestations. Scalable solutions to enhance bedside diagnostic processes are needed, and these should target the most commonly misdiagnosed clinical presentations of key diseases causing serious harms. New studies should confirm overall rates are representative of current U.S.-based ED practice and focus on identified evidence gaps (errors among common diseases with lower-severity harms, pediatric ED errors and harms, dynamic systems factors such as overcrowding, and false positives). Policy changes to consider based on this review include: (1) standardizing measurement and research results reporting to maximize comparability of measures of diagnostic error and misdiagnosis-related harms; (2) creating a National Diagnostic Performance Dashboard to track performance; and (3) using multiple policy levers (e.g., research funding, public accountability, payment reforms) to facilitate the rapid development and deployment of solutions to address this critically important patient safety concern.

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December 15, 2022

ACEP, EM Organizations Issue Letter Regarding AHRQ Report on Diagnostic Errors in the ED

The American College of Emergency Physicians and nine other emergency medicine organizations issued a letter expressing their deep concern about a recently released report titled "Diagnostic Errors in the Emergency Department: A Systematic Review," which was conducted as part of AHRQ's Effective Health Care Program.

40

The letter states in part,

> "...while it is clear that EM, just as all specialties, can improve, we have reviewed the materials available to us and identified multiple findings that are misleading, incorrectly interpreted, and, in several cases, incorrect. The initial request ... was to investigate opportunities to improve care in the ED. We see little in this report to identify such opportunities. Instead, we see a diagnostic error rate (derived from non-applicable European sources with training very different than that of the U.S.) and an analysis of malpractice data interpreted to be cognitive error.
>
> "The repercussions of this faulty report cannot be overstated, as it will irresponsibly and falsely alarm the public and potentially lead them to delay or even forego treatment for time sensitive emergencies, while also undermining the relationship between patient and emergency physician. The intended effect of improving patient care and increasing patient safety may, in fact, paradoxically result in greater harm."

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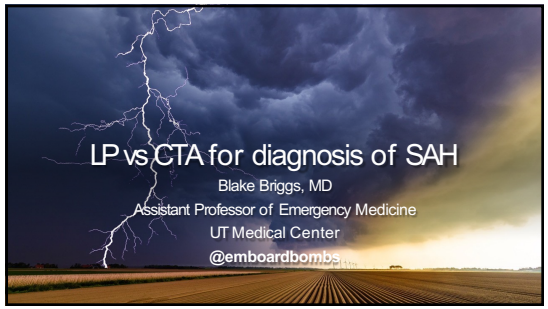

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Disclosures

- No funding to disclose
- I own a medical education podcast platform, EM Board Bombs, LLC

Board Bombs

3

10%

Headaches are 2% of all ED visits.
Of these, 1-3% turn out to be a SAH.

Shea AM, Reed SD, Curtis LH, et al. Characteristics of nontraumatic subarachnoid hemorrhage in the United States in 2003. Neurosurgery 2007; 61:1131.

4

Background

- Aneurysmal vs non-aneurysmal

Sudden, severe headache = 97% of cases.

Unilateral headache = 30% of patients.

Nausea and vomiting = 77% of patients.

Loss of consciousness = about 50% of patients.

Seizures = ~10% of patients. Arguably the most concerning symptom if present early on.

Sudden death = ~10-15% of patients. These rarely reach the hospital.

5

Ottawa Subarachnoid Hemorrhage Rule

MUST have the following to undergo this assessment:

- neurologically intact patients
- ≥15 years old
- nontraumatic headaches that reach max intensity within one hour

6

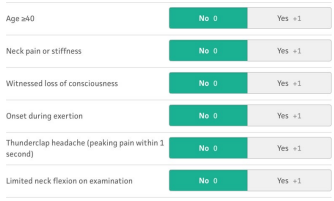
Ottawa Subarachnoid Hemorrhage Rule

Do NOT use in the following:

- New neurologic deficits
- Prior aneurysm
- Prior SAH
- Known brain tumors
- Chronic recurrent headaches (≥3 headaches of same character for >6 months)

7

Ottawa Subarachnoid Hemorrhage Rule



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Summary of Ottawa SAH Decision Rule Study Results

Study	Patients	Prevalence of SAH	Missed SAH	Sensitivity (95% CI)	Specificity (95% CI)
JAMA 2013	2131	6.2%	0	100% (97.2 - 100.0%)	15.3% (13.8 - 16.9%)
AJEM 2014	4154	2.0%	0	100% (62.9% - 100.0%)	7.6% (5.4% - 10.6%)
BMJ 2016	1561	17.7%	0	100% (98.6% - 100%)	8.8% (7.2% - 10.7%)
CMAJ 2017	853	5.8%	0	100% (94.6% - 100%)	13.6% (13.1 - 15.8%)

How it holds up

- 100% sensitive, but very limited use
- 8-15% specificity

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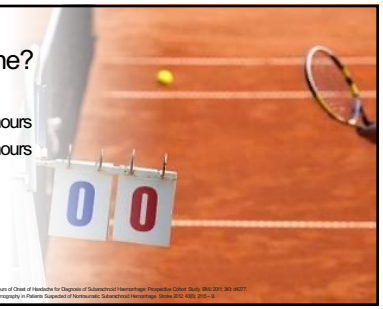
CT head alone?

- 92% if <24 hours
- 100% if <6 hours



Perry JJ et al. Sensitivity of Computed Tomography Performed Within Six Hours of Onset of Headache for Diagnosis of Subarachnoid Hemorrhage: Prospective Cohort Study. BMJ 2011; 343: d4277.
Backes D et al. Time-Dependent Test Characteristics of Head Computed Tomography in Patients Suspected of Nontraumatic Subarachnoid Hemorrhage. Stroke 2012; 43(9): 2500—6.

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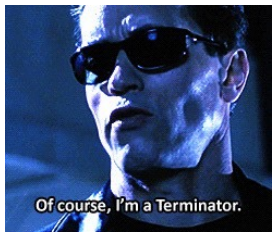
Critical Caveats

- 1) reviewed by "expert" radiologist
- 2) no significant anemia (Hgb <10)
- 3) CT scanner is a modern model
- 4) "typical" presentation



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Lumbar puncture

<2000 RBCs/microL in addition to no xanthochromia excludes SAH with a sensitivity of 100%

© Marcin Konsek/Solent News

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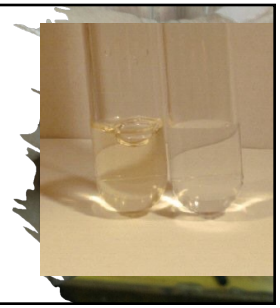
Xanthochromia



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Drawbacks

- Poor specificity
- Time-consuming
- False positive results

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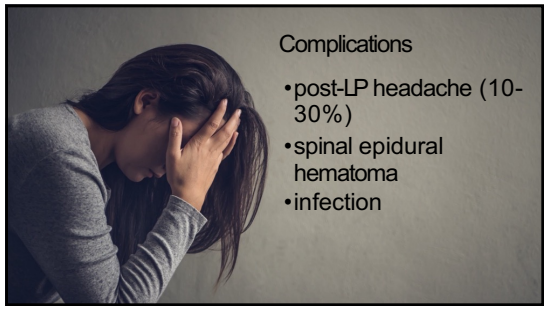
Complications
•post-LP headache (10-30%)
•spinal epidural hematoma
•infection

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Difficult to do

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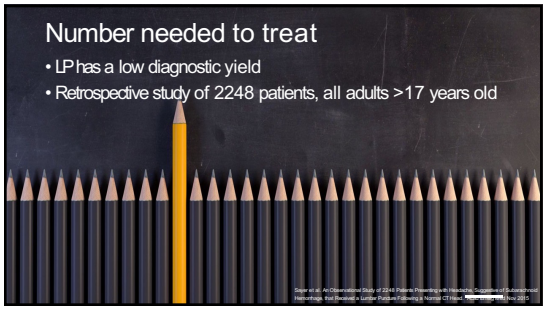
Number needed to treat
• LP has a low diagnostic yield
• Retrospective study of 2248 patients, all adults >17 years old

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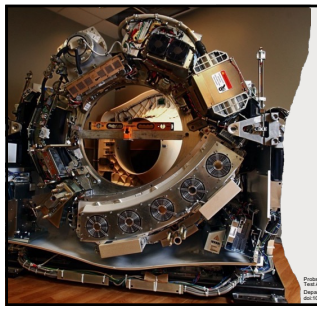

CTA

>98% accurate for SAH

Probst MA, Hoffman JR. Computed Tomography Angiography of the Head Is a Reasonable Next Test After a Negative Noncontrast Head Computed Tomography Result in the Emergency Department Evaluation of Subarachnoid Hemorrhage. *Ann Emerg Med*. 2016;67(6):773-774. doi:10.1016/j.annemergmed.2014.03.009

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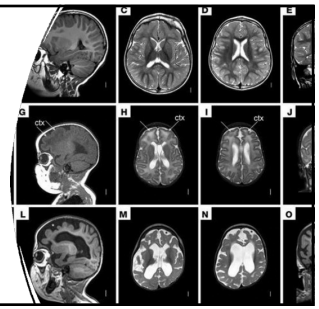
Drawbacks of CTA

Incidentalomas



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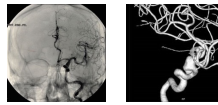
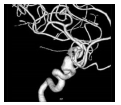
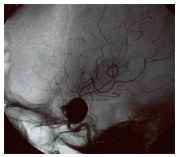
Incidentalomas

- "Normal" aneurysms?
- Most are in anterior circulation
- 20-30% have multiple.







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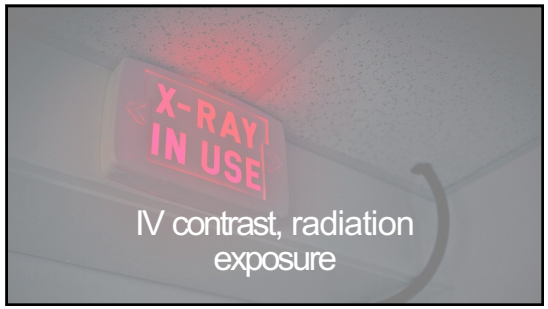

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LP
- Poor specificity
- Painful
- Time-consuming/difficult to do
- Complications/harm to patient

CTA
- Incidental findings
- IV contrast, radiation exposure
- More expensive?

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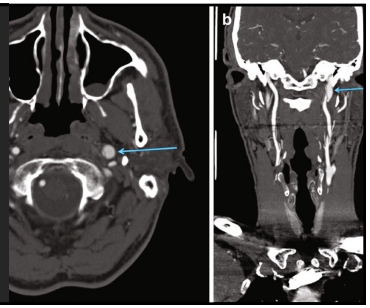
Other considerations



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Concern for SAH

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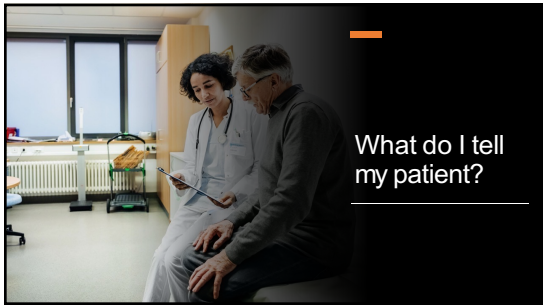

What do I tell my patient?

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Conclusions

- The Ottawa SAH Rule is 100% sensitive at ruling out patients who need a SAH workup, *but* the criteria are very strict.
- CT head has ~100% sensitivity for ruling out SAH < 6 hours.
- Lumbar punctures are not benign procedures, and the NNT is very high in most cases.
- CTA is very good and likely equivalent to LP for ruling out subarachnoid hemorrhage.

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