GROW-WI
GATHERING THE RURAL OB WORKFORCE IN WI

Project ECHO®

Gathering the **R**ural **O**B **W**orkforce in **WI**
GROW-WI ECHO Program

How to Join:
https://iecho.org/public/program/PRGM17425658124325CC96FHKX3

For attendance purposes, please text the code KADHAF to 608-260-7097.

Session Date: March 24, 2026
Facilitator: Rachel Hartline, MD

	Topic	**Presenter**
Educational Presentation	Rural EMS OB Preparedness	James Small Rural EMS Outreach Program Manager Wisconsin Office of Rural Health Madison, WI
Case Presentation	Case: Maternal Hemorrhage Management: Transfusion Decisions and Air Transport Challenges	Craig Tschautscher, MD, MS, DRTM UW Department of Emergency Medicine, Division of Prehospital Medicine Madison, WI

Agenda:

7:30 – 7:35 AM – Welcome and Introductions

-Text-in your attendance, even if you do not plan to claim Continuing Education credits.

7:35 – 8:00 AM – Educational Presentation and Q&A

8:00 – 8:30 AM – Case Presentation & Discussion

Continuing Education Credits:

To claim CE credit, **you must complete the evaluation form after each session**.
ICEP will email you a link to the evaluation form after texting in for attendance.

Interprofessional
Continuing Education Partnership
UNIVERSITY OF WISCONSIN-MADISON

GROW-WI ECHO (Gathering the Rural OB Workforce in WI)
2025-2026
Rural EMS OB Preparedness
March 24, 2026
James Small; Craig Tschautscher, MD, MS, DRTM
Provided by the University of Wisconsin–Madison Interprofessional Continuing Education Partnership (ICEP)

Intended Audience:
MD/DO, RN, APRN, Physician Assistants, Certified Nurse Midwives, Students

Objectives:
1. Describe how declining rural obstetric access increases EMS involvement in labor, delivery, and high-risk perinatal transports.
2. Explain how EMS system reliability challenges—staffing gaps, mutual aid dependence, and long response times—affect the management of obstetric emergencies.
3. Analyze the operational and clinical risks created by rural geography, weather, and long transport distances during obstetric responses.
4. Identify practical strategies EMS agencies and clinicians can use to strengthen readiness for low-frequency, high-risk obstetric events.

Policy on Disclosure
It is the policy of the University of Wisconsin–Madison Interprofessional Continuing Education Partnership (ICEP) to identify, mitigate and disclose all relevant financial relationships with ineligible companies* held by the speakers/presenters, authors, planners, and other persons who may influence the content of this accredited continuing education (CE). In addition, speakers, presenters, and authors must disclose any planned discussion of unlabeled/unapproved uses of drugs or devices during their presentation. For this accredited continuing education activity, all relevant financial relationships have been mitigated and detailed disclosures are listed below.
** **Ineligible companies** are those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients. The ACCME does not consider providers of clinical service directly to patients to be ineligible companies.*

Name	Role	Financial Relationship Disclosures	Discussion of unlabeled/unapproved uses of drugs/devices in presentation	COI completion date
James Small	Presenter	No relevant financial relationships with ineligible companies to disclose.	No	1/16/2026
Craig Tschautscher, MD, MS, DRTM	Presenter	No relevant financial relationships with ineligible companies to disclose.	No	1/20/2026
Jillian Landeck, MD	RSS Chair	No relevant financial relationships with ineligible companies to disclose.	NA	12/2/2025
Jenny White	RSS Coordinator	No relevant financial relationships with ineligible companies to disclose.	NA	12/1/2025
Katherine Breitenmoser, CPM, LM	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/2/2025
Bonnie Brown, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/4/2025
Jensena Carlson, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/10/2025
Lee Dresang, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/1/2025
Rachel Hartline, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/10/2025
Caitlin Hill, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/12/2025
Ryan Luellwitz, DO	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/12/2025
Allegra Ponshock, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/1/2025
Ryan Spencer, MD	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/4/2025
Cindy Stippich, CNM	Planner	No relevant financial relationships with ineligible companies to disclose.	NA	12/8/2025

Accreditation Statement

In support of improving patient care, the University of Wisconsin–Madison ICEP is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC) to provide continuing education for the healthcare team.

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The University of Wisconsin-Madison ICEP designates this live activity for a maximum of 1.0 *AMA PRA Category 1 Credit(s)*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

The University of Wisconsin–Madison ICEP designates this live activity for a maximum of 1.0 ANCC contact hour(s).

The University of Wisconsin–Madison ICEP, as a member of the University Professional & Continuing Education Association (UPCEA), authorizes this program for 0.1 CEUs or 1.0 hour.

Welcome!

We will get started shortly.

Feel free to share your name, specialty/role, and practice location in the chat.

For attendance purposes please text the code **KADHAF** to 608-260-7097.

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American Nurses Credentialing Center (ANCC)

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Continuing Education Units

The University of Wisconsin–Madison ICEP, as a member of the University Professional & Continuing Education Association (UPCEA), authorizes this program for 0.1 continuing education units (CEUs) or 1 hour.

Disclosures

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- The planning committee has no conflicts of interest to disclose.

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Attendance

- For attendance purposes please text the code **KADHAF** to 608-260-7097
- Please text for attendance, **even if you are *not* claiming** continuing education credit.

Continuing Ed Credit

To receive continuing education credit:

1. Log your attendance (as above)
   - **Create an ICEP account if you don't already have one.**

2. Fill out the session evaluation form to receive credit – **REQUIRED for credit.**
   - A link to the evaluation will be sent after you text the code.

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Update on Midwife CEUs

For **Certified Professional Midwife** Continuing Education Credit:

- We are unable to meet MEAC Continuing Education credit requirements.
- The GROW-WI ECHO sessions may be used to meet the NARM Continuing Education Category 2 CEUs.

For **Certified Nurse Midwife** Continuing Education Credit:

- The ACNM Continuing Education Committee accepts AMA PRA Category 1 Continuing Education Credit.
- The GROW-WI ECHO sessions are approved for this.

For **Everyone:**

- To receive any Continuing Education credits, participants must:
  - Create a free ICEP account.
  - Text the attendance code at the time of the session.
  - **Fill out the evaluation** at the end of the session.

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Planning Team

Katherine Breitenmoser, CPM, LM – Windy Hill Midwifery, LLC, Merrill, WI

Bonnie Brown, MD – UW DFMCH

Jensena Carlson, MD – UW DFMCH

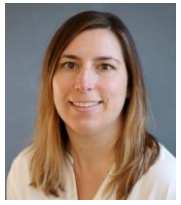
Lee Dresang, MD – UW DFMCH

Rachel Hartline, MD* – Upland Hills Health, Dodgeville, WI

Caitlin Hill, MD – Emplify Health, La Crosse, WI

Jillian Landeck, MD* – UW DFMCH

Ryan Luellwitz, MD – UW OB GYN



Allegra Ponshock, MD* – Mile Bluff Med Ctr, Mauston, WI

Ryan Spencer, MD – UW OB GYN

Cindy Stippich, CNM – Prairie Ridge Health, Columbus, WI

Jenny White* – UW DFMCH

* Core Facilitation Team

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Friendly Reminders

- Video appreciated
- Use chat function to ask questions or raise hand if able
- Mute microphone when not speaking
- Maintain confidentiality, no PHI
- Didactic will be recorded
- Mission is to empower those working in rural settings
- Our diversity of perspectives, specialties, practice scopes are our strength
- **"Coming together is a beginning. Keeping together is progress. Working together is success." -** Henry Ford

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Announcements

- **Next Session:** April 28rd

- **TOLAC/VBAC in Rural Settings - Navigating Policy Creation**

Allegra Ponshock, MD, FAAFP, DABFM – FM OB
Mile Bluff Medical Center, Mauston, WI

Rachel Hartline, MD, FM OB
Upland Hills Health, Dodgeville, WI

- TOLAC Case

Stefanie Sippl, MD, FMOB

Upland Hills Health, Mineral Point, WI

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Interested in sharing a case?

Email jennifer.white@fammed.wisc.edu

- Slide template shared, 10 min for details of case
- Priority to cases from rural and resource-limited settings
- No PHI
- Include on CV as a state presentation

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Rural EMS OB Preparedness

Operational realities, system strain, and what it means for prehospital care

James Small
Wisconsin Office of Rural Health
small5@wisc.edu
March 24, 2026

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Disclosures

- No Disclosures

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Objectives

- **Describe how declining rural obstetric access increases EMS involvement in labor, delivery, and high-risk perinatal transports.**
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- **Analyze the operational and clinical risks created by rural geography, weather, and long transport distances during obstetric responses.**
- **Identify practical strategies EMS agencies and clinicians can use to strengthen readiness for low-frequency, high-risk obstetric events.**

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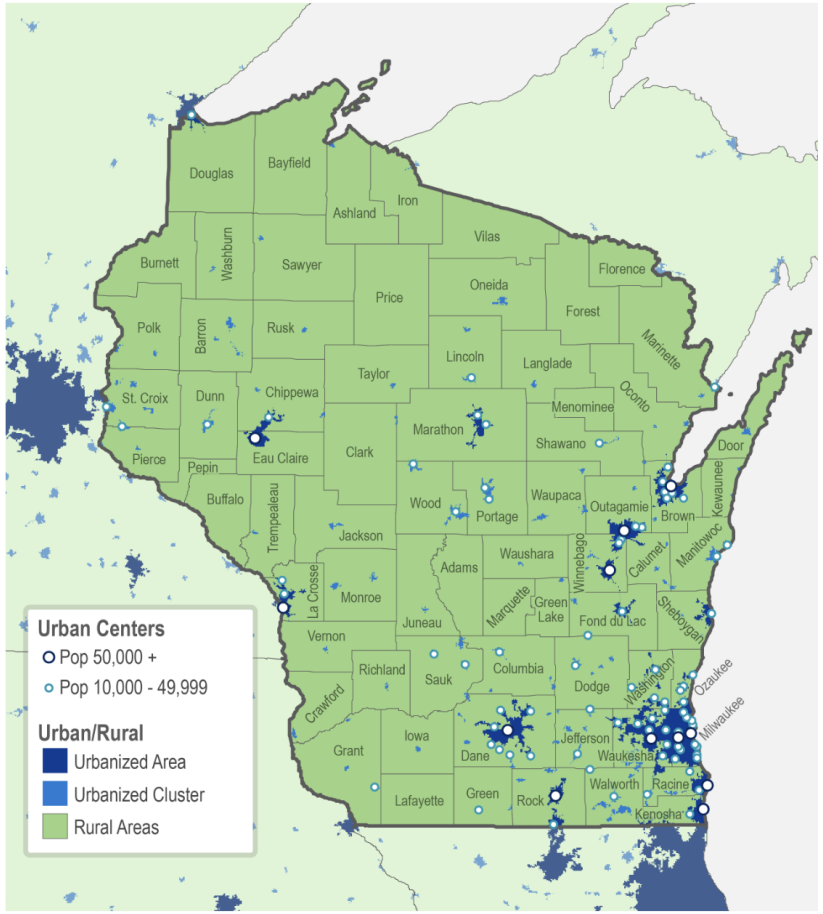
Wisconsin

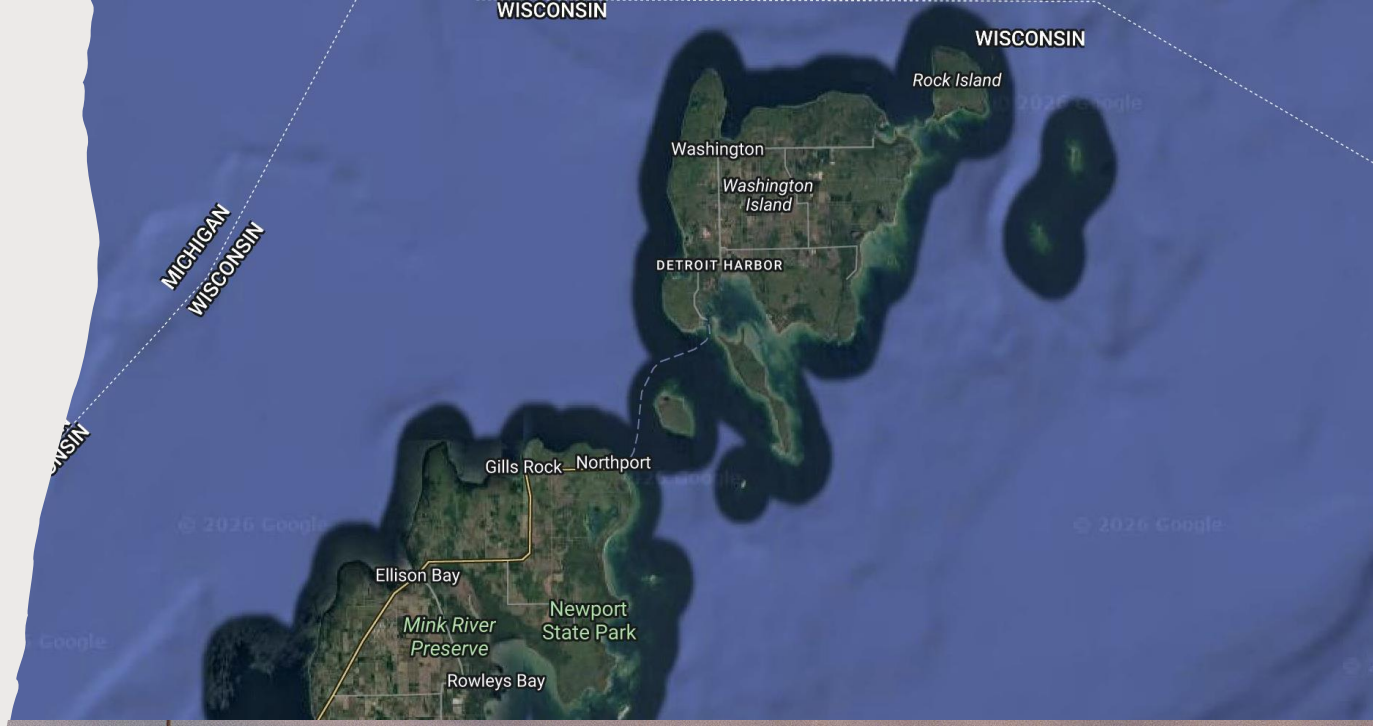


- 5.9 Million population
  - 30 % Rural
- 72 Counties
- 1,850 local governments
  - 1265 Townships
  - 585 City and Villages
  - 11 Tribal Governments

97% of Land Area is Rural

Christmas Eve 1983

- Washington Island
- Unexpected Labor
- No Medical Providers on Island
- Volunteer Rescue Squad Response
- Heavy Ice Conditions on Lake Michigan-2 hour crossing
- Unable to dock due to Ice conditions
- Door County Ambulance response
- 1st baby born in Door County Ambulance



Relevance to Today

- Geography unchanged
- Weather Conditions unchanged
- Travel Distances unchanged
- ***Hospital OB Access Declining***
- ***EMS Reliability under Significant Strain***

The Rural OB Landscape

Only **57%** of rural hospitals still deliver babies

8 OB units closed in the last 5 years

14% decrease in rural births → lower volume → more closures

Closures driven by **provider coverage**, **low volume**, **reimbursement**

Wisconsin Office of Rural Health. (2024). *Obstetric delivery services and workforce in rural Wisconsin hospitals*.

OB Closures Impact on EMS

- Longer transports
- More interfacility transfers
- Higher likelihood of field delivery
- More high-risk patients far from specialty care

EMS Reliability: A system under strain

- **41%** of EMS agencies had staffing gaps
- **78%** provided mutual aid due to another agency's staffing failure
- **41%** rely on **6 or fewer** people for 80% of staffing
- Rural + volunteer agencies at highest risk

Wisconsin Office of Rural Health. (2023). *The reliability of Wisconsin's 911 ambulance response*.

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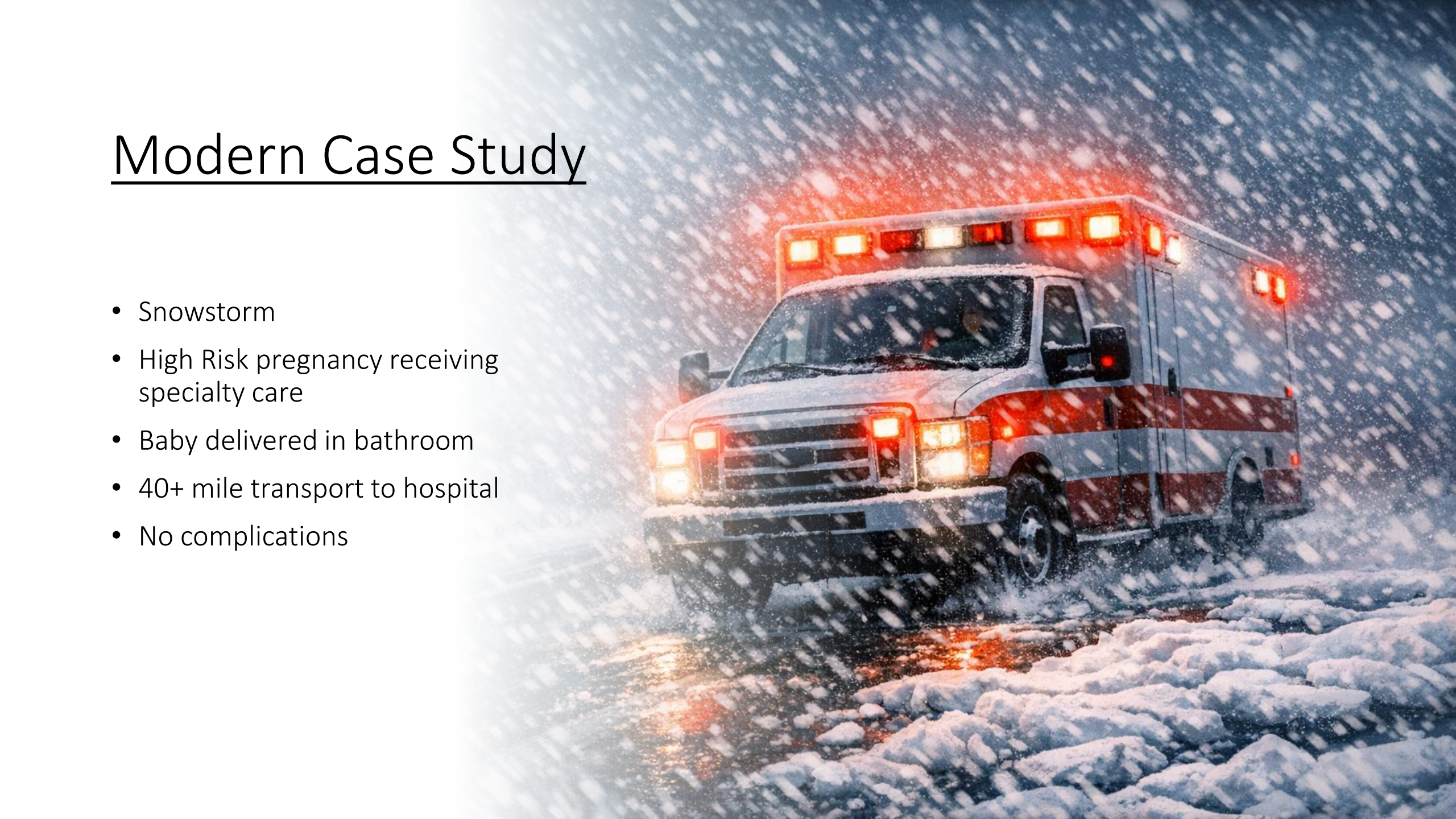
Modern Case Study

- Snowstorm
- High Risk pregnancy receiving specialty care
- Baby delivered in bathroom
- 40+ mile transport to hospital
- No complications



Common Themes

High Risk Patients may live far from specialty care

Weather and Geography create delays

EMS may be the only clinician available

Long transport times may increase risk

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Clinical Scenarios for EMS

- Precipitous Delivery
- Breech
- Shoulder Dystocia
- Hemorrhage
- Preeclampsia/eclampsia
- Neonatal resuscitation

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EMS Training Challenges

- Long travel distances to training
- Class cancellations
- Volunteers unavailable during daytime
- Aging workforce
- Low-frequency, high-risk skill decay

Wisconsin Office of Rural Health. (2023). *The reliability of Wisconsin's 911 ambulance response*.

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Hospitals Can Help EMS

- Clear, shared OB emergency protocols
- Early consultation during transport
- Support for simulation and joint training
- Recognition of EMS as a clinical partner
- Advocacy for sustainable EMS funding

EMS Agencies need:

- Regular OB simulation
- Protocol updates for high-risk OB
- Pre-plans for long-distance transports
- Regional coordination with hospitals
- After-action reviews for OB calls

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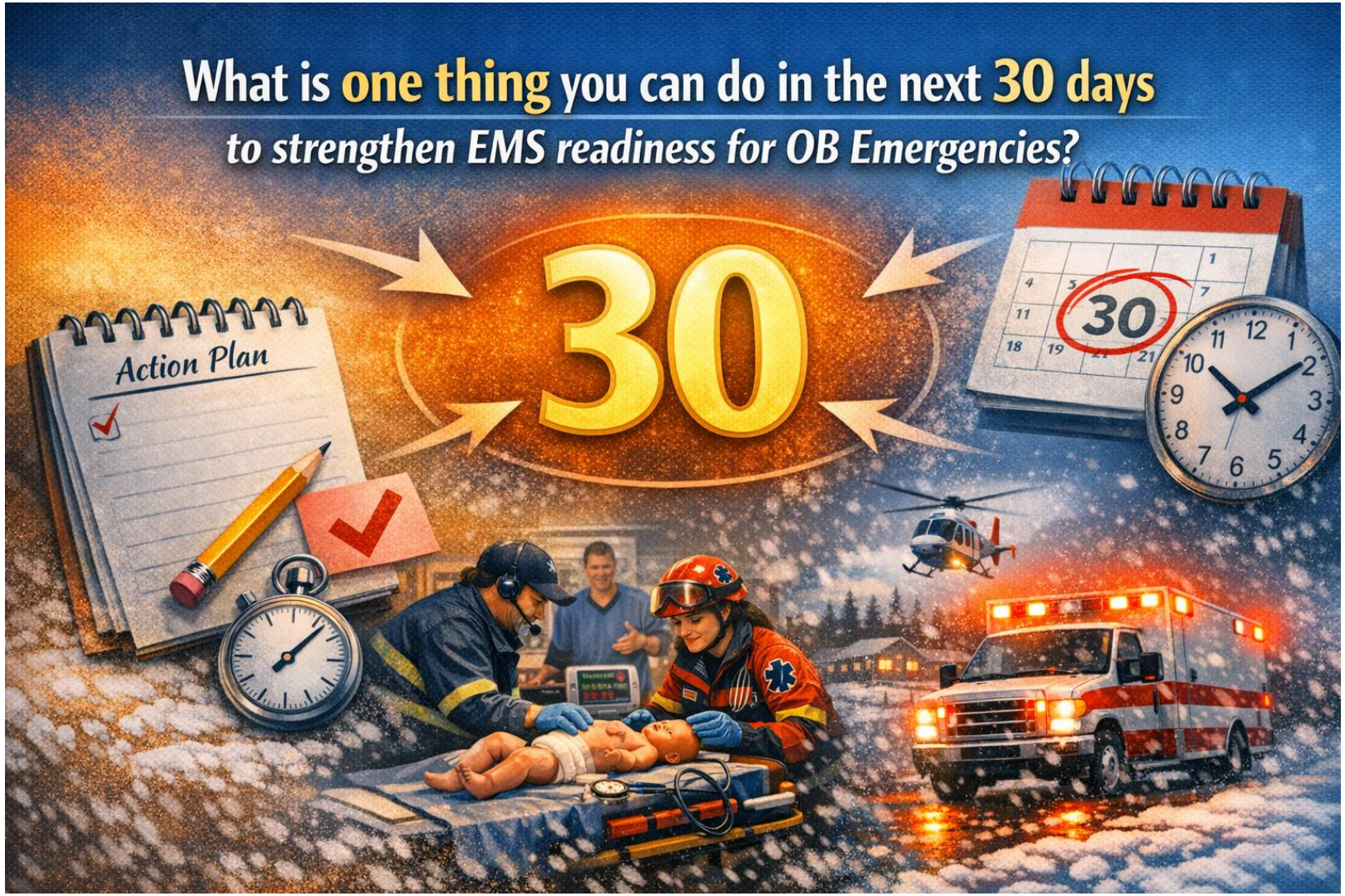

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References

Wisconsin Office of Rural Health. (2023). *The reliability of Wisconsin's 911 ambulance response*. University of Wisconsin–Madison.

Wisconsin Office of Rural Health. (2024). *Obstetric delivery services and workforce in rural Wisconsin hospitals 2024*. University of Wisconsin–Madison.

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CRITICAL CARE TRANSPORT & RESUSCITATION IN POSTPARTUM HEMORRHAGE

Craig Tschautscher MD, MS, DRTM (RCSEd)
Flight Physician
Assistant Professor of Emergency Medicine
University of Wisconsin School of Medicine and Public Health

OBJECTIVES

- Brief summary on Med Flight
- Fundamentals of postpartum hemorrhage
- Damage control resuscitation
- Rural case management

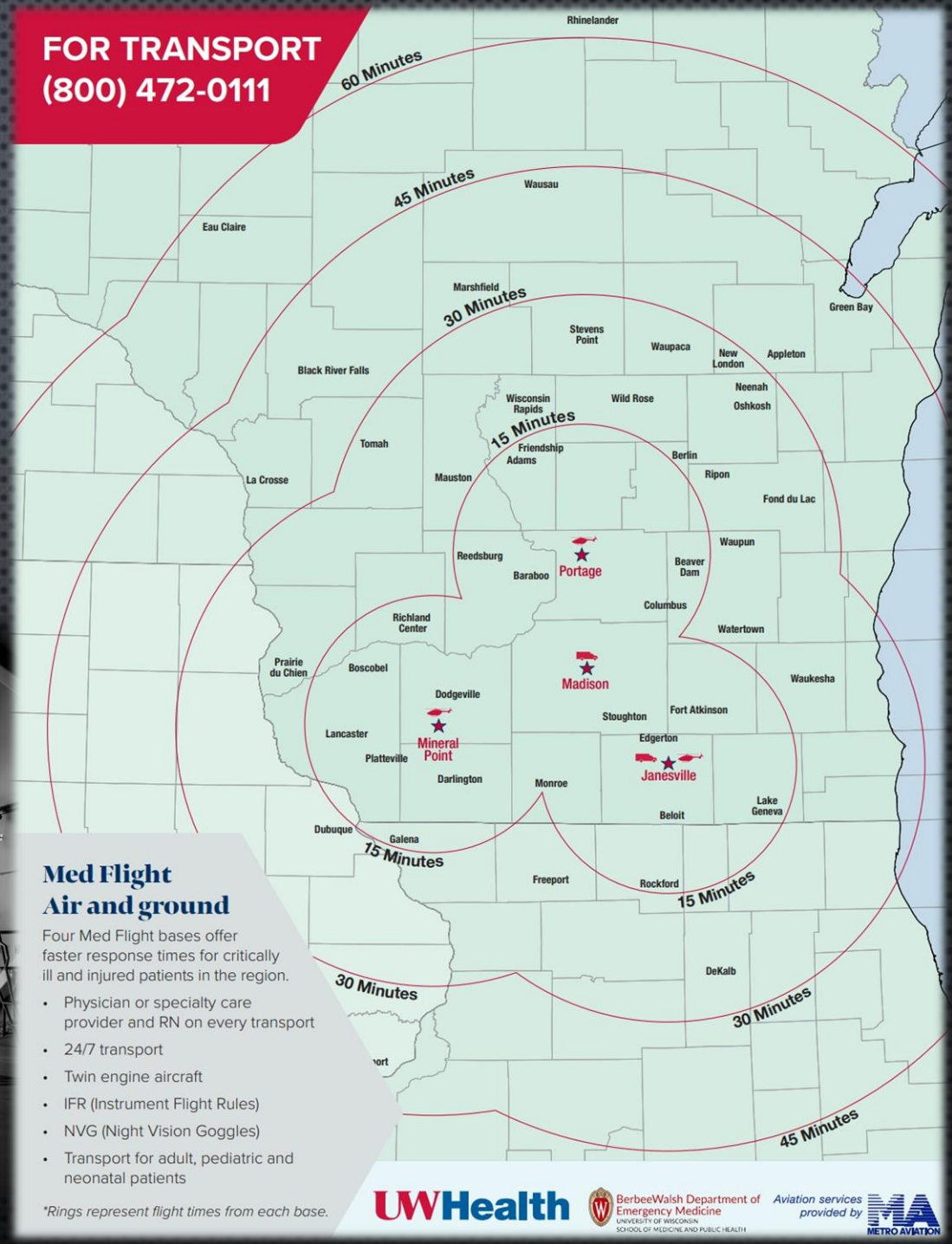
DISCLOSURES

I HAVE NONE

MED FLIGHT

- 3 Aircraft
  - Physician, Nurse, Pilot
- 2 Critical Care Ambulances
  - Nurse, RT, EMT-B

FOR TRANSPORT
(800) 472-0111



Med Flight
Air and ground

Four Med Flight bases offer faster response times for critically ill and injured patients in the region.

- Physician or specialty care provider and RN on every transport
- 24/7 transport
- Twin engine aircraft
- IFR (Instrument Flight Rules)
- NVG (Night Vision Goggles)
- Transport for adult, pediatric and neonatal patients

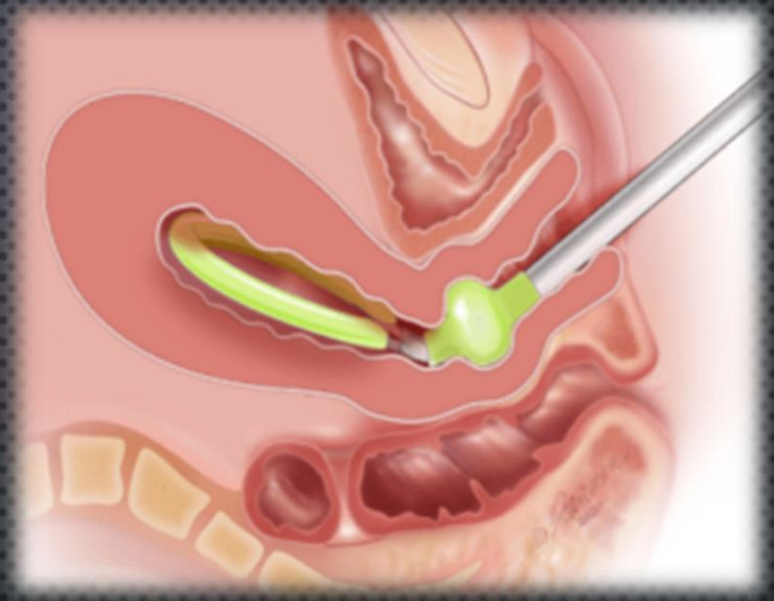
**Rings represent flight times from each base.*

UWHealth
BerbeeWalsh Department of Emergency Medicine
University of Wisconsin School of Medicine and Public Health
Aviation services provided by MA Metro Aviation

Patient History

- 27 year old female
- G1P1 (Counting this delivery)
- Vacuum Assisted Vaginal delivery at 40 weeks
  - Concerning fetal heart tones
  - 1 L blood loss during delivery
  - Methylergonovine and oxytocin given
  - 2 L IVF
- Sudden Hypotension
  - Concern for Local Anesthetic Systemic Toxicity (LAST)
  - Given Lipid Emulsion

Patient History



- Developed postpartum Hemorrhage
- Massive Transfusion Protocol initiated
  - Carboprost tromethamine – 250 mcg x2
  - Methylergonovine – 0.2 mg x3
  - Oxytocin – 10 U
  - TXA - 1 gram x2
  - Component therapy - 13 RBCs, 2 Cryo, 5 FFP, 1 Platelet
- vacuum-induced, postpartum hemorrhage control device x2 placement
  - 4 L of blood loss
- IR embolization
  - Component therapy - 9 RBCs, 5 FFP, 1 Cryo
- While in MICU further vaginal hemorrhage

PATIENT HISTORY

- Developed further vaginal hemorrhage
- Taken to the OR estimated 22000 cc of blood loss
- Complete hysterectomy, bilateral salpingectomy
- Component therapy resuscitation in OR
  - 24 units packed red blood cells
  - 18 units fresh frozen plasma
  - 11 units cryoprecipitate
  - 11 units platelets

POSTPARTUM HEMORRHAGE

- Hemorrhage greater than expected - results in signs & symptoms of hypovolemia
  - >500 ml within 24 hours
  - Severe >1000 ML within 24 hours
- Impacts 3% of deliveries in the United States
- Significant cause of maternal morbidity and mortality accounting for 11.4% of maternal deaths in the United States
- National Partnership for Maternal Safety recommended
  - Birthing facilities partner with local transfusion services rapid availability of blood products
  - published hospital protocols in place for blood component therapy as a critical aspect of postpartum hemorrhage management

POSTPARTUM HEMORRHAGE

- Common causes
  - Atony
    - Uterotonic
    - Intrauterine Devices
    - Embolization
    - Surgical
  - Trauma
    - Topical hemostasis
    - Surgery
  - Retained placental tissue
    - Removal
  - Coagulopathy
    - Transfusion

DAMAGE CONTROL RESUSCITATION IS ASSOCIATED WITH A REDUCTION IN RESUSCITATION VOLUMES AND IMPROVEMENT IN SURVIVAL IN 390 DAMAGE CONTROL LAPAROTOMY PATIENTS

Bryan A Cotton, MD, MPH,[1] Neeti Reddy, BS,[1] Quinton M Hatch, MD,[1] Eric LeFebvre, BS,[1] Charles E Wade, PhD,[1] Rosemary A Kozar, MD, PhD,[2] Brijesh S Gill, MD,[2] Rondel Albarado, MD,[2] Michelle K McNutt, MD,[2] and John B Holcomb, MD[1,2]

DAMAGE CONTROL RESUSCITATION

Damage-control resuscitation in obstetrics

Javier A. Carvajal, Isabella Ramos, Juan P. Kusanovic & María F. Escobar

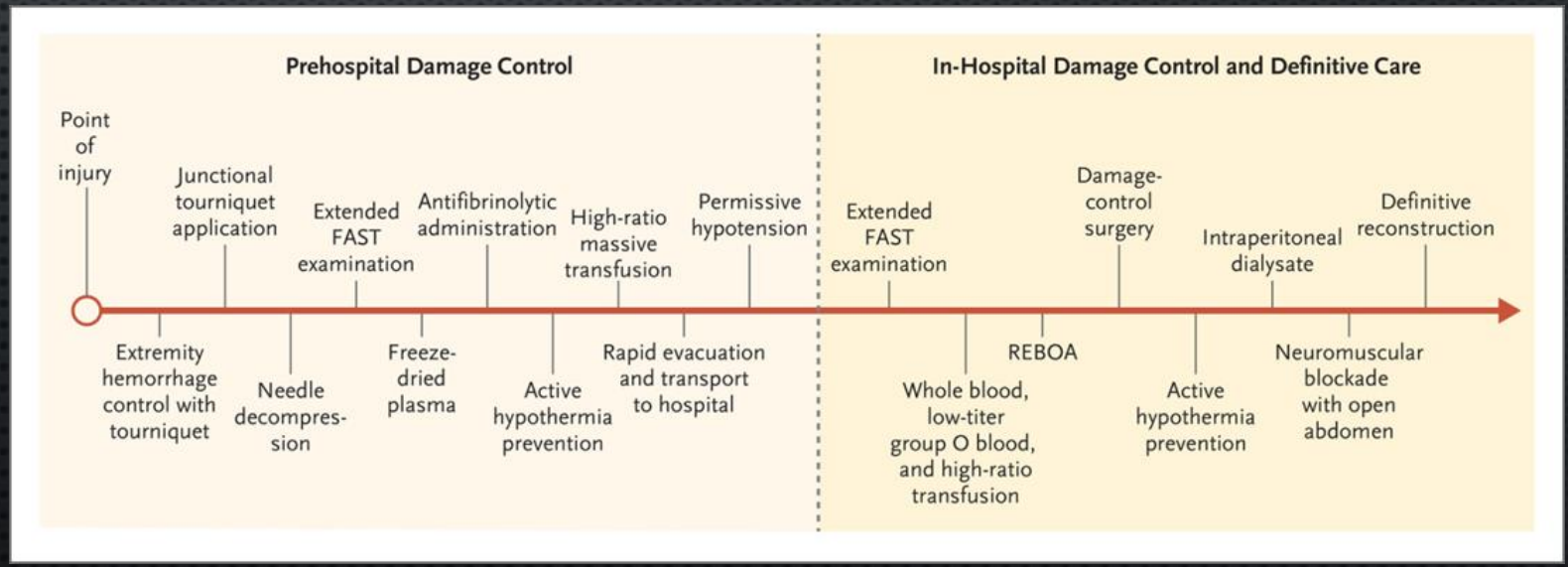
Pages 785-798 | Received 29 Sep 2019, Accepted 13 Feb 2020, Published online: 26 Feb 2020

Damage Control Surgery in Obstetrics and Gynecology: Abdomino-Pelvic Packing in Multimodal Hemorrhage Management

Stoyan Kostov [1,2,†], Yavor Kornovski [2], Angel Yordanov [3], Stanislav Slavchev [2], Yonka Ivanova [2], Ibrahim Alkatout [4], Rafał Watrowski [5,6,*,†]

DCR

- Approach to care that begins with first contact and onward
  - Pre-hospital
  - ED
  - OR
  - ICU
- Survival over morbidity



ADVANTAGES

- **Maintains normothermia**
- **Minimize coagulopathy**
- **Reduced usage of blood products**
- **Goal of decreased**
  - Acute Lung Injury (ALI)
  - Acute Respiratory Distress Syndrome (ARDS)
  - Multiple Organ Dysfunction Syndrome, Multi-Organ Failure (MODS/MOF)
- **Increased survival**

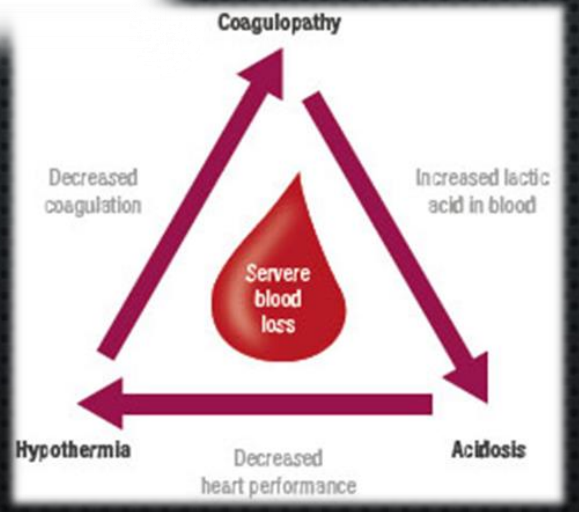
BACKGROUND

"IMPERFECT DECISIONS, BASED ON INCOMPLETE AND EVOLVING INFORMATION"

- CHALLENGING TO CONDUCT QUALITY RESEARCH
- WITHIN THE LAST 20 YEARS
  - LARGE ADVANCES
- SIGNIFICANT IMPROVEMENT IN SURVIVABILITY

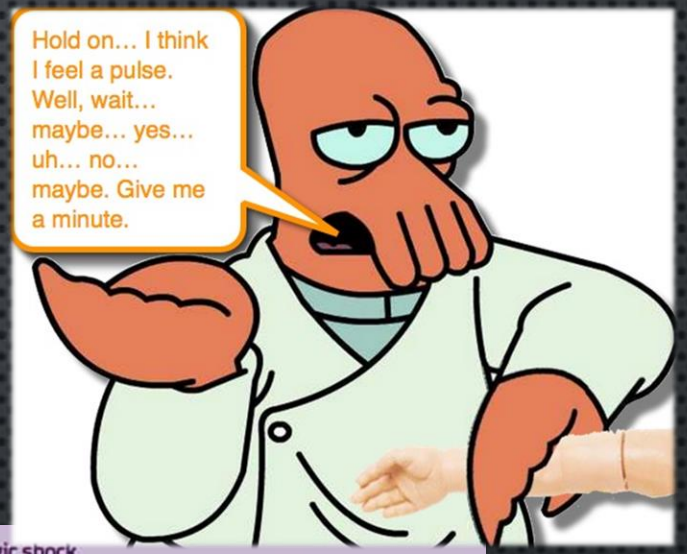
INITIAL PHASES

- MAINTAIN CIRCULATING VOLUME
- CONTROL HEMORRHAGE
- CORRECT THE 'LETHAL TRIAD' - DIAMOND
  - COAGULOPATHY
  - ACIDOSIS
  - HYPOTHERMIA
  - CALCIUM
- PREVENT "BLOOD FAILURE"



HEMORRHAGE ASSESSMENT

- **PULSE PALPATION (ROUGH ESTIMATE)**
  - **ONLY THE CAROTID PULSE IS PALPABLE, SYSTOLIC BLOOD PRESSURE**
    - (SBP) IS 60-70 MMHG
  - **CAROTID AND FEMORAL PULSES ARE PALPABLE**
    - SBP IS 70-80 MMHG
  - **RADIAL PULSE IS ALSO PALPABLE**
    - SBP IS >80 MMHG

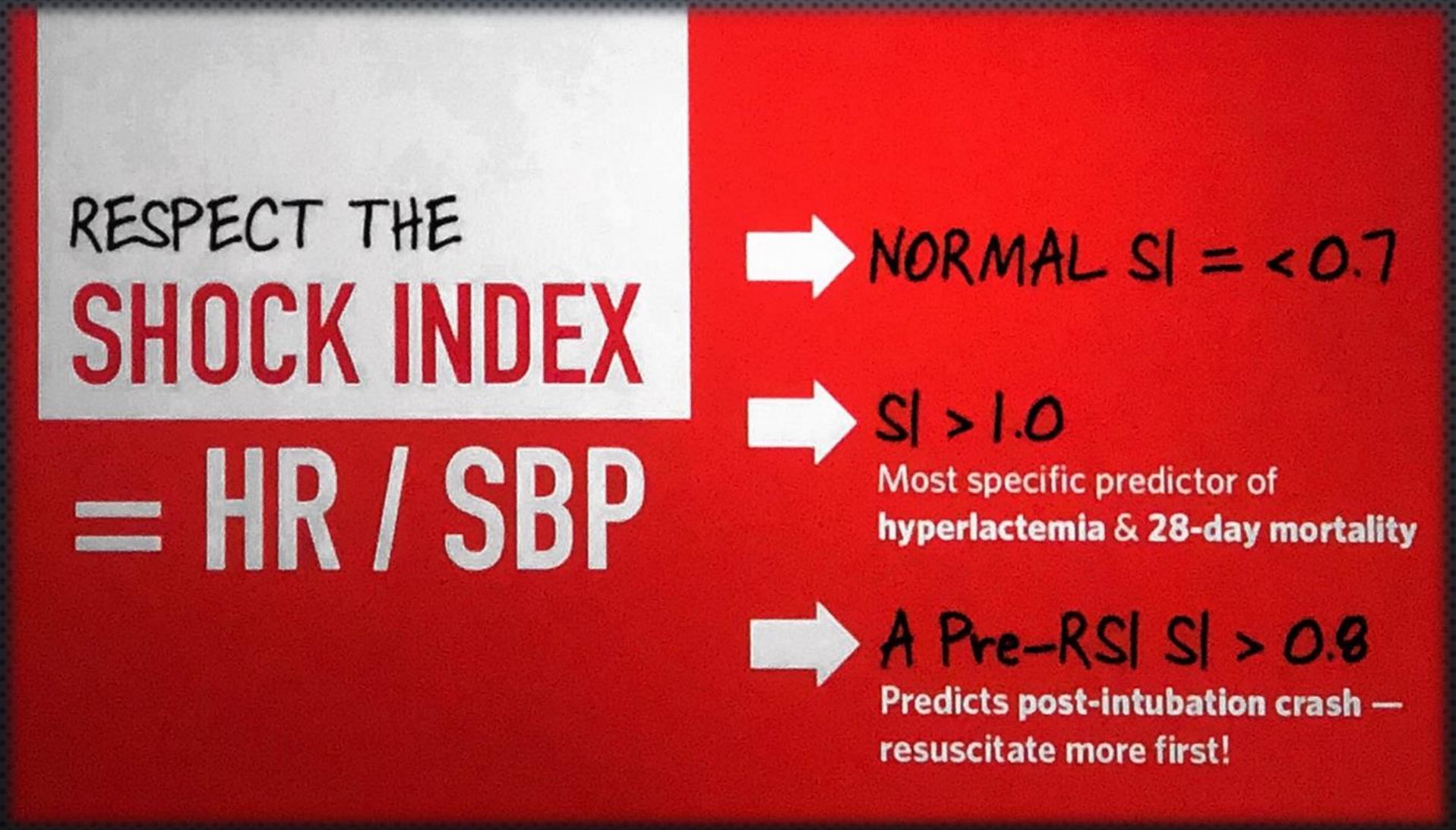


	Class of haemorrhagic shock			
	I	II	III	IV
Blood loss (mL)	Up to 750	750–1500	1500–2000	> 2000
Blood loss (% blood volume)	Up to 15	15–30	30–40	> 40
Pulse rate (per minute)	< 100	100–120	120–140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	> 35
Urine output (mL/hour)	> 30	20–30	5–15	Negligible
Central nervous system/ mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

HEMORRHAGE ASSESSMENT

- Classic categories should be used cautiously
  - Compensation differs
  - Age
  - Comorbidities
  - Medications

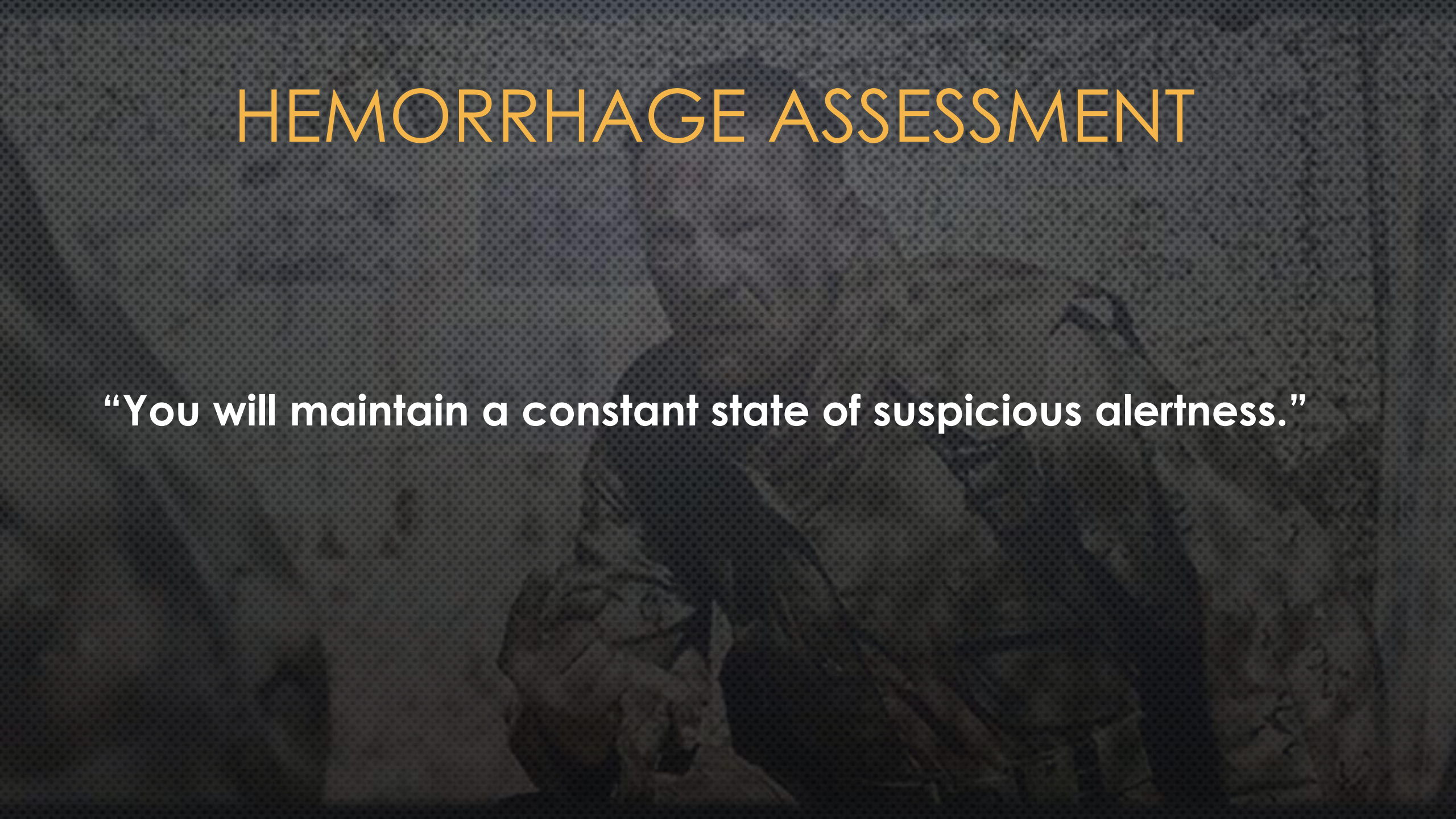
HEMORRHAGE ASSESSMENT



HEMORRHAGE ASSESSMENT

- Need for DCR
  - SBP <100 mmHg
  - HR > 100 bpm
  - HCT < 32
  - pH < 7.25
- In Postpartum hemorrhage
  - fibrinogen level less than 200 mg/dL
  - 17% went on to have >2500cc of hemorrhage

HEMORRHAGE ASSESSMENT



“You will maintain a constant state of suspicious alertness.”

ANTI-FIBRINOLYTIC THERAPY

- MALIGNANT HYPERFIBRINOLYSIS
  - ASPECT OF COAGULOPATHY IN TRAUMA
- TRANEXAMIC ACID IDENTIFIED AS BENEFICIAL IN TRAUMA PATIENTS
  - ADMINISTERED WITHIN 3 HOURS OF INJURY
  - 1 GRAM BOLUS OVER 10 MINUTES
  - 1 GRAM INFUSION OVER 8 HOURS
  - COMPONENT OF MASS TRANSFUSION PROTOCOLS
- DETRIMENTAL AFTER 3 HOURS

Military Application of Tranexamic Acid in Trauma Emergency Resuscitation (MATTERs) Study.

Morrison JJ[1], Dubose JJ, Rasmussen TE, Midwinter MJ.

The CRASH-2 trial: a randomised controlled trial and economic evaluation of the effects of tranexamic acid on death, vascular occlusive events and transfusion requirement in bleeding trauma patients.

Roberts I[1], Shakur H, Coats T, Hunt B, Balogun E, Barnetson L, Cook L, Kawahara T, Perel P, Prieto-Merino D, Ramos M, Cairns J, Guerriero C.

Effects of tranexamic acid on death, disability, vascular occlusive events and other morbidities in patients with acute traumatic brain injury (CRASH-3): a randomised, placebo-controlled trial

CRASH-3 trial collaborators

ANTI-FIBRINOLYTIC THERAPY

Tranexamic acid for postpartum bleeding: a systematic review and individual patient data meta-analysis of randomised controlled trials

Katharine Ker [1], Loïc Sentilhes [2], Haleema Shakur-Still [3], Hugo Madar [2], Catherine Deneux-Tharaux [4], George Saade [5], Luis D Pacheco [6], François-Xavier Ageron [7], Raoul Mansukhani [3], Eni Balogun [3], Amy Brenner [3], Danielle Prowse [3], Monica Arribas [3], Homa Ahmadzia [8], Rizwana Chaudhri [9], Oladapo Olayemi [10], Ian Roberts [3]; Anti-fibrinolytics Trialists Collaborators Obstetric Group

- TXA for Postpartum Hemorrhage
  - 54,404 women from five trials
    - 178 (0·65%) of 27300 women in TXA group
    - 230 (0·85%) of 27 093 women in the placebo group
      - (pooled odds ratio [OR] 0·77 [95% CI 0·63-0·93]; p=0·008)
  - no evidence TXA effect varied
    - underlying risk of life-threatening bleeding,
    - type of birth,
    - presence of moderate or severe anemia
    - timing of administration.
  - No significant difference was identified between groups with regard to thromboembolic events:
    - 50 (0·2%) of 26571 women in TXA group had fatal or non-fatal thromboembolic events
    - 52 (0·2%) of 26373 women in the placebo group
      - (pooled OR 0·96 [0·65-1·41]; p=0·82)

PERMISSIVE HYPOTENSION

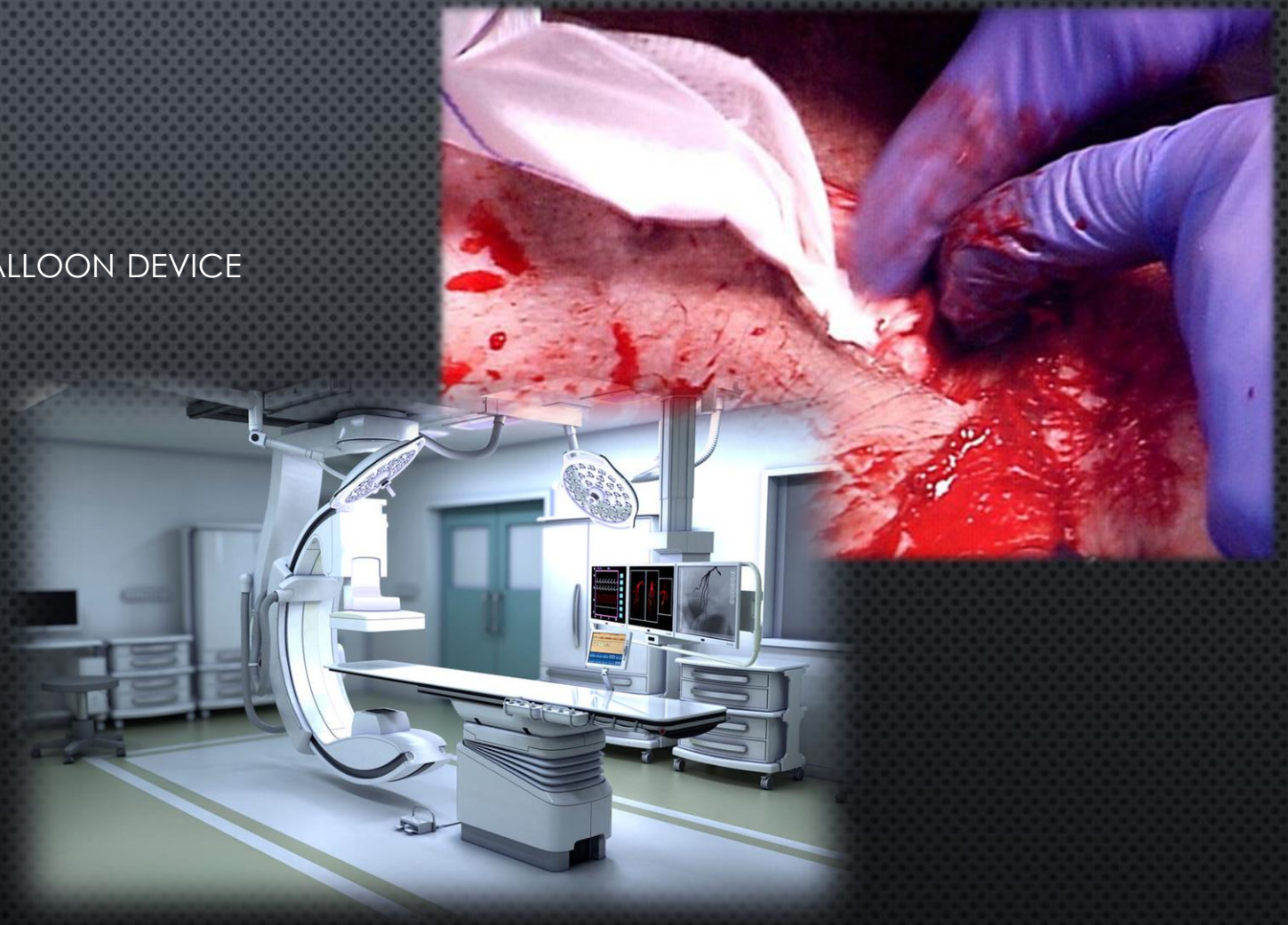
- Perfusion > than blood pressure
  - Target a MAP >65 mmHg
  - Clear mental status
  - Good radial pulse
  - Good pulse oximetry waveform.
- Recent meta-analysis 30 studies
  - Reduction in mortality in hypotensive resuscitation group
  - RR 0.50; 95% confidence interval [CI]: 0.40–0.61

SALT WATER

- Dogma of 2L of crystalloid should be abandoned
- Avoid excessive fluid administration
  - Hemodilution
  - Fluid overload
  - Clot disruption

HEMORRHAGE CONTROL

- Invasive measures
  - Sutures
  - Tamponade - packing or vacuum/balloon device
  - Ligate vessels
  - Cautery
  - Interventional radiology
  - Damage control surgery
- Correct coagulopathy



HEMOSTATIC RESUSCITATION

- CONTROL HEMORRHAGE
- MAINTAIN CIRCULATING VOLUME
- CORRECT THE 'LETHAL DIAMOND'
- DIAMOND OF DEATH
  - COAGULOPATHY
  - ACIDOSIS
  - HYPOTHERMIA
  - HYPOCALCEMIA

LETHAL DIAMOND

- Correct Hypothermia
  - Decreases platelet responsiveness
  - Increases platelet sequestration within liver and spleen
  - Reduces function of Factors XI and XII
  - Alters Fibrinolysis

LETHAL DIAMOND

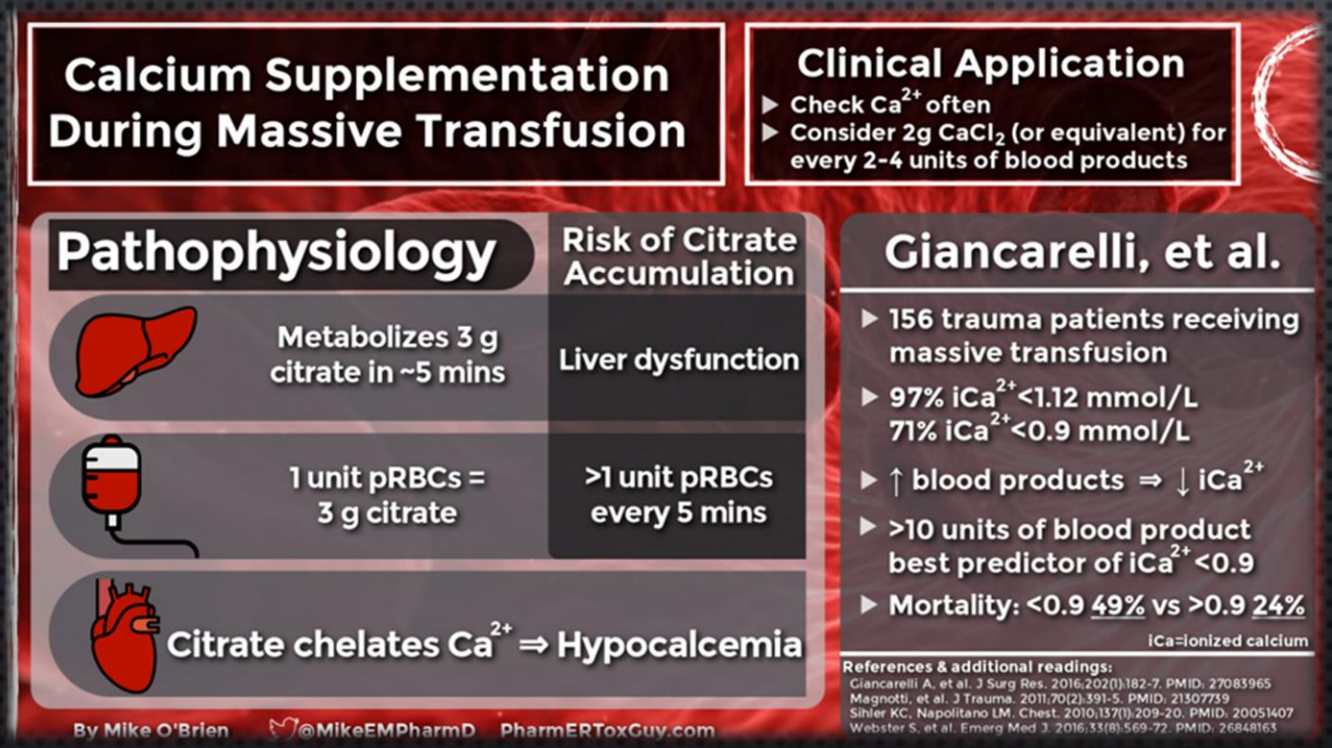
- Correct Acidosis
  - pH large effect on activity of Factors V, VIIa, and X
  - Inhibits thrombin generation
  - Cardiovascular effects with pH <7.2
  - Decreased contractility = decreased cardiac output
    - Vasodilatation → Hypotension
    - Bradycardia
    - Increased dysrhythmia

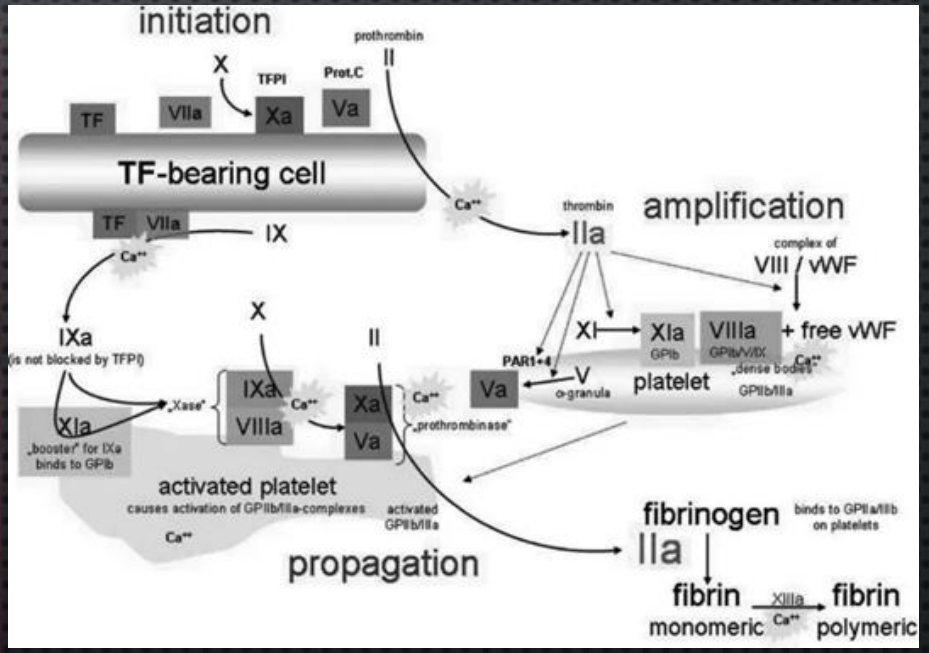
LETHAL DIAMOND

- Treat coagulopathy early and aggressively
  - Develops early after insult
  - Higher FFP and platelet to PRBC ratios
    - Less evidence for platelets
  - Cryoprecipitate increases factors at a low volume
    - MATTERS2 study
  - rFVIIa used, but anecdotally (outside of known hemophiliac)

LETHAL DIAMOND

- **HYPOCALCEMIA**
  - CALCIUM IS AN INDEPENDENT PART OF THE DEATH SPIRAL, BUT IT IS ALSO INTERTWINED WITH THE OTHER THREE FACTORS





HEMOSTATIC RESUSCITATION

- Reduce use of crystalloids
  - Complications of over resuscitation
    - Edema → compartment syndrome and ALI
      - Lower volumes = lower edema
  - May increase hemorrhage with clot disruption
  - Worsens
    - Anemia
      - No oxygen carrying capacity
    - Thrombocytopenia
    - Coagulopathy via dilution
    - Anaerobic metabolism
- Possible role for hypertonic saline
  - Restores microvascular flow
  - Decreased edema
  - Attenuates inflammatory response
  - Requires hemostasis

HEMOSTATIC RESUSCITATION

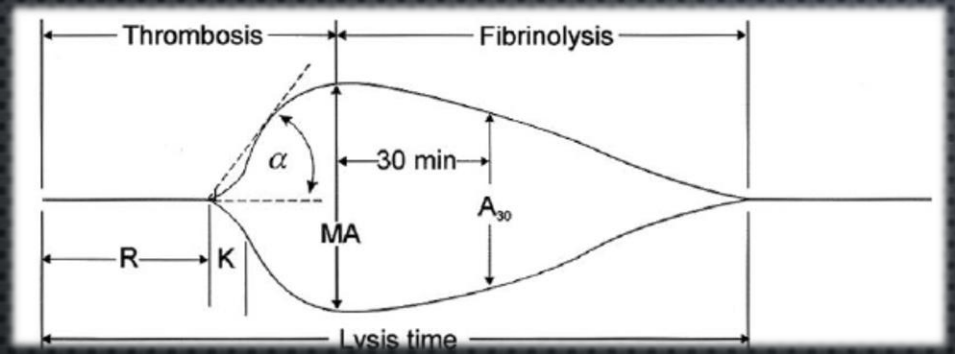
- EARLY TRANSFUSION OF BLOOD PRODUCTS
- HIGH-RATIO MASS TRANSFUSION
  - ANTICIPATED OR IDENTIFIED HEMORRHAGIC SHOCK
- WHOLE BLOOD (WB) IS OPTIMAL
  - LOW TITER GROUP O BLOOD
- IF NO WB MIMIC
  - 1 FFP : 1 PRBC : 1 PLATELETS
  - WARMED TO BODY TEMPERATURE
  - RATE PROPORTIONAL TO DEGREE OF SHOCK
    - UP TO 500 CC/MIN
  - CONTINUAL REASSESSMENT, AND COAGULATION TESTING TO GUIDE THERAPY

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

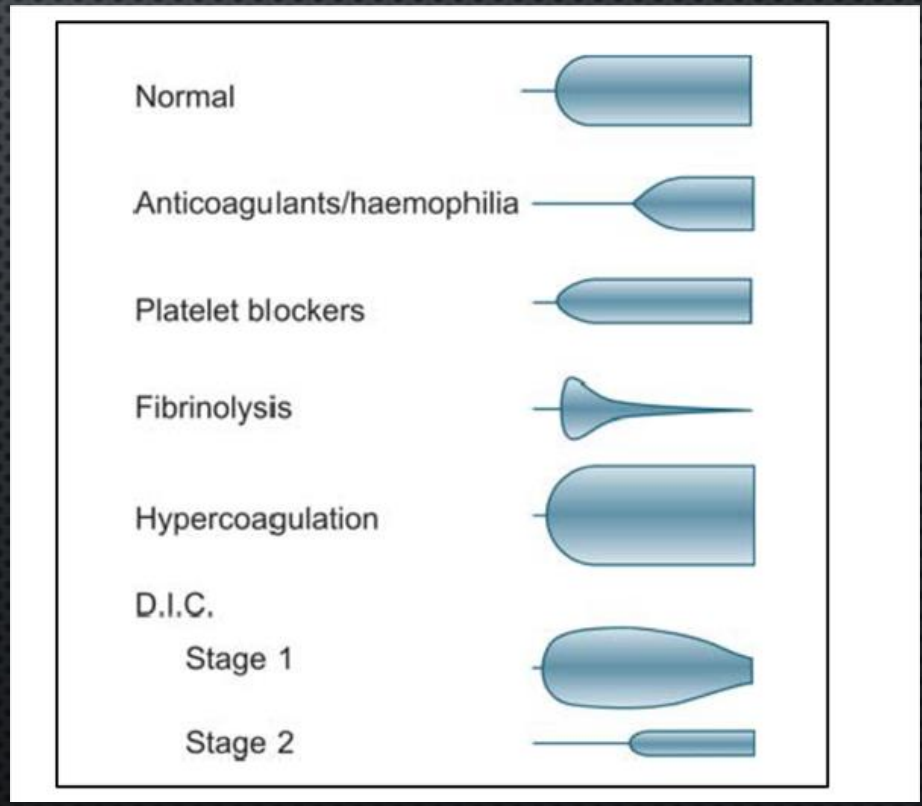
John B. Holcomb, MD[1]; Barbara C. Tilley, PhD[2]; Sarah Baraniuk, PhD[2]; et al

VISCOELASTIC TESTING

- 3 PHASES, INITIATION, AMPLIFICATION, AND PROPAGATION



R – Reaction time, form fibrin clot
K – Kinetics, time to form "stronger clot"
A – Angle between R and K, speed of fibrin build up
MA – Maximum Amplitude, ultimate strength of clot
platelet(80%)/fibrin(20%)
LYA30 – Lysis in 30 min, amount of clot degradation



Risks of blood product in females

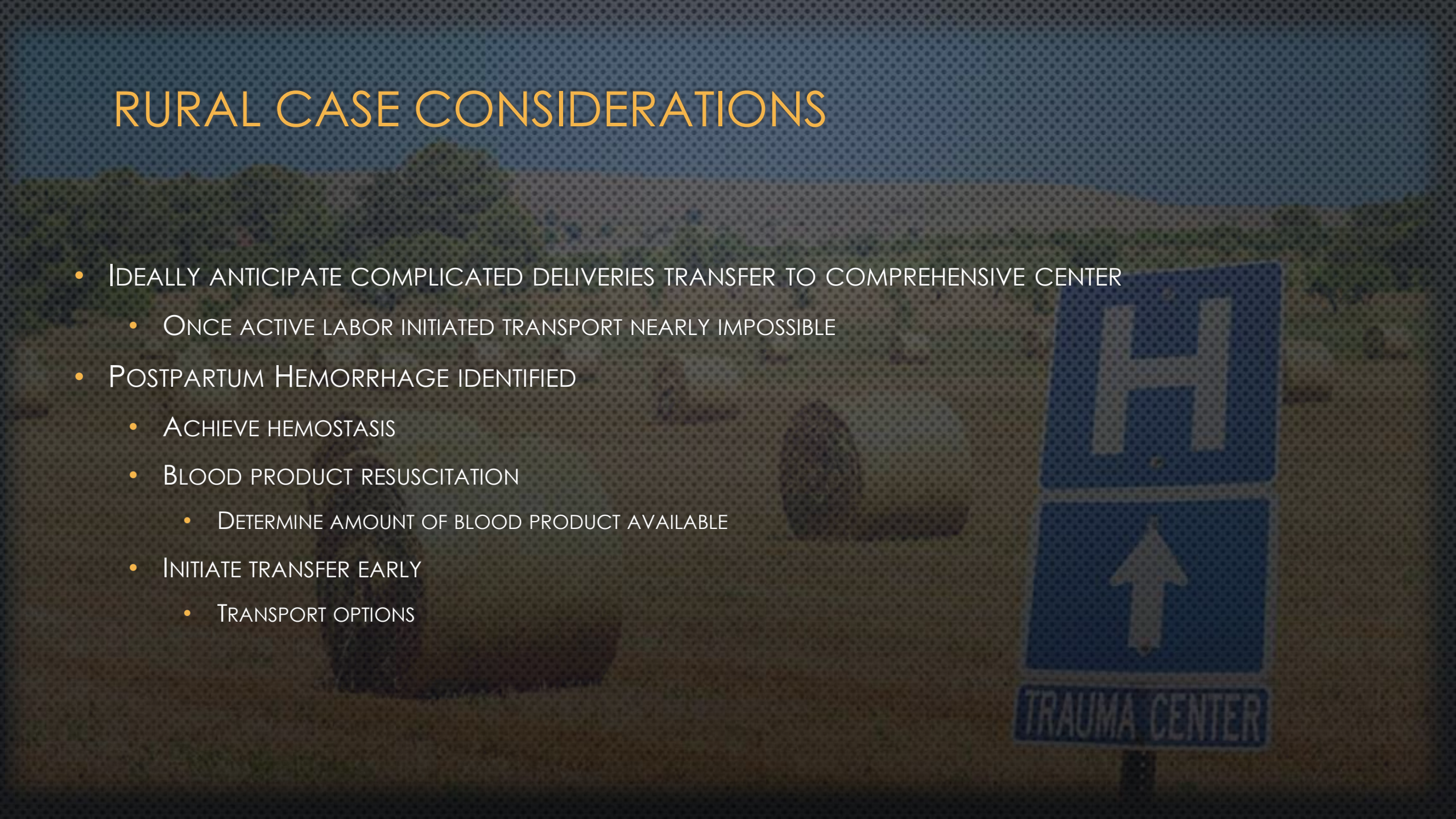
- Females of childbearing age to LTO+ WB. In particular is the risk of maternal RhD alloimmunization.
- RhD alloimmunization
  - Woman with RhD-negative (Rh-) blood
  - Exposed RhDpositive (Rh+) blood cells
  - Formation of antibodies against RhD.
- Exposure risk Rh+ blood cells
  - Fetal-maternal hemorrhage
  - Blood product administration, including LTO+ WB
- Recent studies of hospitalized patients observed that the alloimmunization rate of exposed individuals is between 11.5% and 30.4%
- RhD alloimmunization has been successfully prevented with the administration of Rho(D) immuneglobulin, (RhIg).

RHD ALLOIMMUNIZATION

- Standard pre-natal or post-natal dose of RhIG
  - single 300 microgram (ug) vial IV or IM, depending on the manufacturer.
- Dose prevents alloimmunization
  - exposure to 15mL of Rh+ PRBCs or 30 mLs of Rh+ whole blood
- RhIG administration may be considered
  - Received less than 20% of their total blood volume (TBV) during transfusion of LTO+ WB.
  - Favorable clinical characteristics, RhIG is dosed at 18-20 ug per mL of transfused red cells to prevent isoimmunization.
- If volume of transfusion exceeds 20% TBV RhIG administration not pursued
  - considerable risk of inducing splenic sequestration and extravascular hemolysis.
  - Larger volume transfusion events > 20% TBV, red blood cell exchange may be considered to remove antigenic stimulus.
  - Recommended for follow-up testing at three, six and twelve months to determine if alloimmunization occurred

RURAL CASE CONSIDERATIONS

- Ideally anticipate complicated deliveries transfer to comprehensive center
  - Once active labor initiated transport nearly impossible
- Postpartum Hemorrhage identified
  - Achieve hemostasis
  - Blood product resuscitation
    - Determine amount of blood product available
  - Initiate transfer early
    - Transport options



CASE CONCLUSION

- Med Flight called for transport
  - Ongoing cryo and platelet transfusion
  - Developing signs of Transfusion Associated Circulatory Overload (TACO)
    - Signs of developing edema
    - Lasix infusion
    - Challenging ventilation requiring increased PEEP, decreased respiratory rate and decreased inspiratory time
  - Calcium and Magnesium infusion
  - Sedation on propofol and fentanyl

  - Discharge on hospital day 6

SUMMARY

- Critical Care Transport Med Flight
- Postpartum hemorrhage
  - Hemostasis
- Damage control resuscitation
  - Stabilize for definitive control
  - Guided resuscitation
- Rural case management
  - Transfer early

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QUESTIONS?