

AUGUST 22, 2024

Overstaying Your Welcome: Extended Management of the Trauma Patient

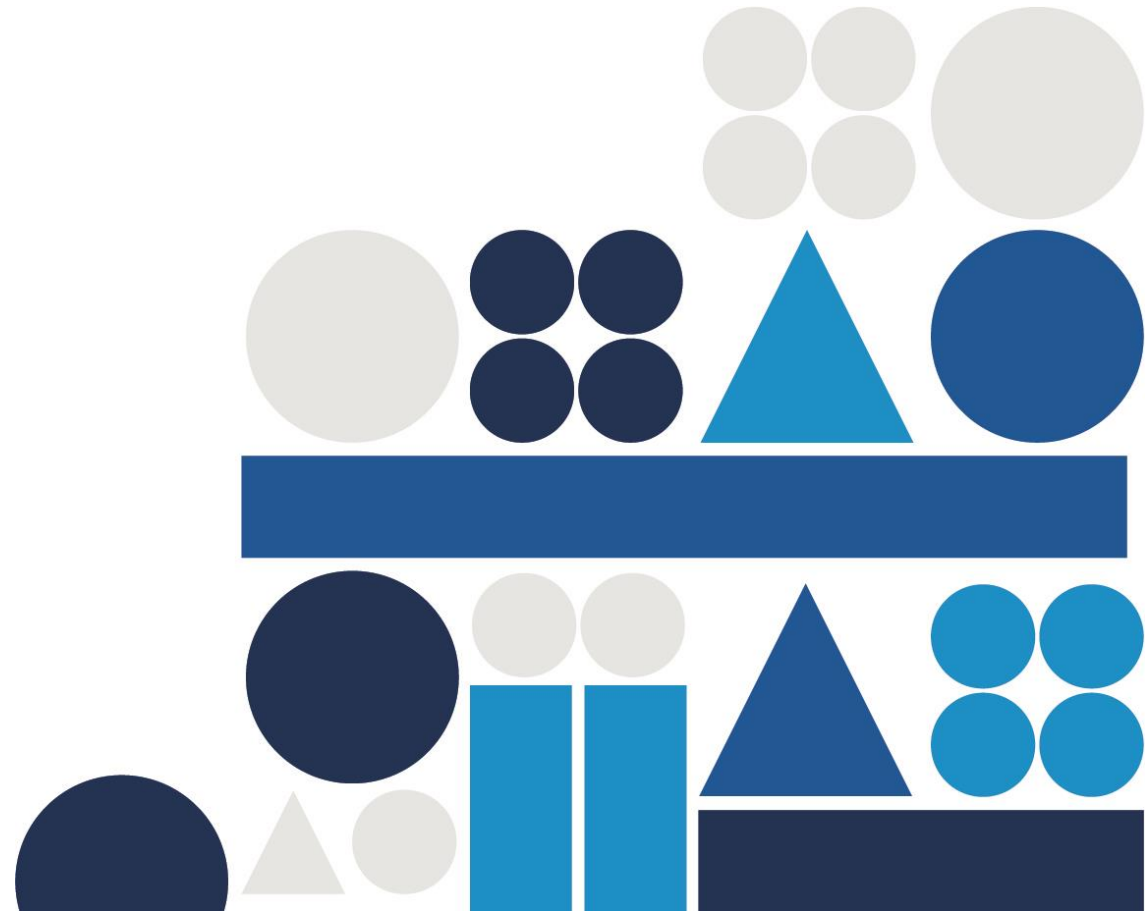
John Wiersch, MD

Pediatric Surgeon

Children's Hospital Colorado



Affiliated with
School of Medicine
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS



Congratulations! I look forward to overstaying my welcome in one of your extraneous bedrooms.



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Aviation Weather Overview

INFO

METARS

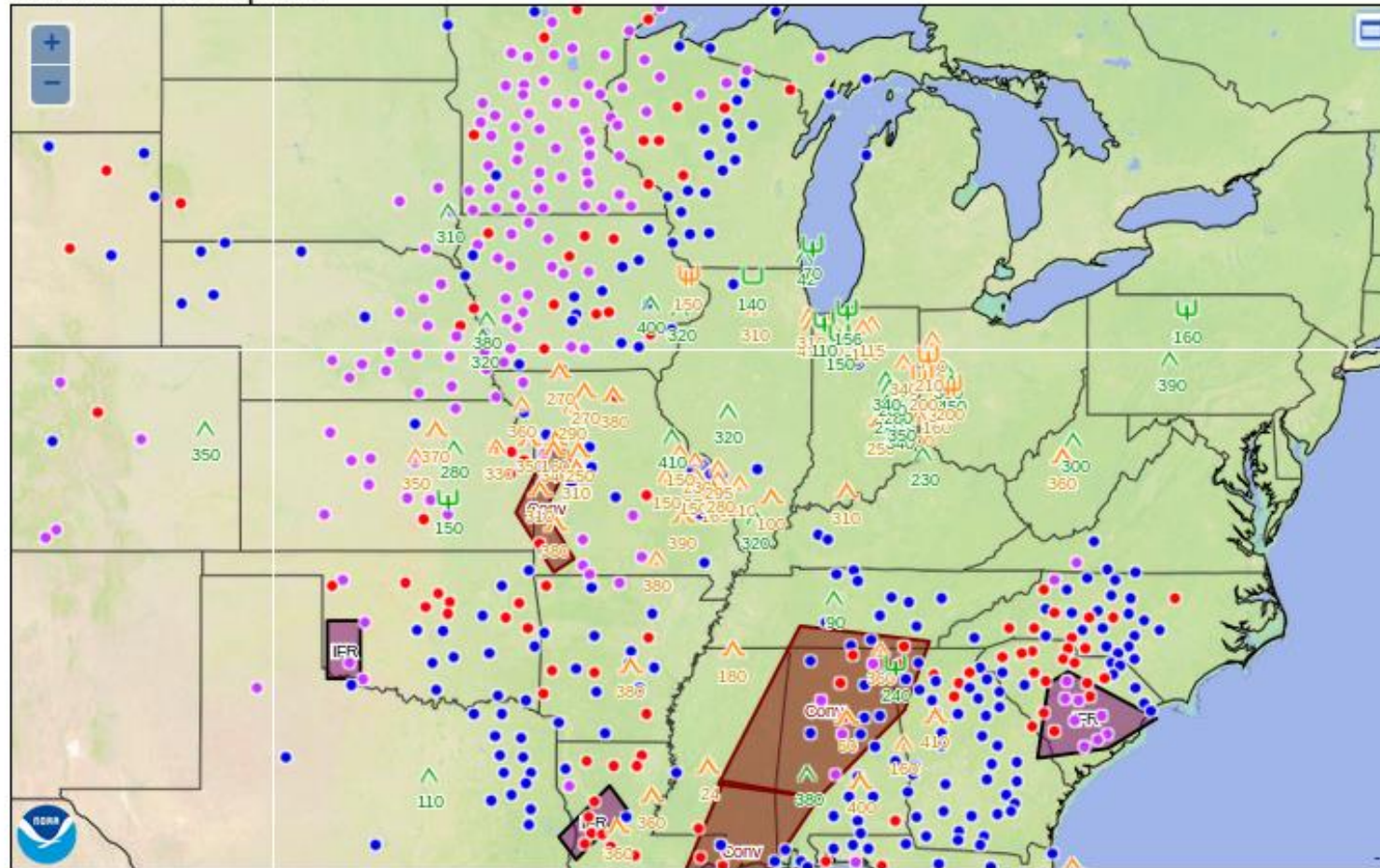
TAFs

AIR/PIREPs

SIGMETs

G-AIRMETS

Valid at 1155 UTC 3 Apr 2017



- Sat
- VisFog
- Radar
- METAR
- FltCat
- SIGMET
- CWA
- G-AIRMET
- PIREP-Ice
- PIREP-Turb
- Highways
- Jetroutes
- FIRs
- Hover

SIGMET ■ ■ CWA G-AIRMET ■ ■ ■ ■ ■ ■ ■

Flt Cat: ● MVFR ● IFR ● LIFR PIREP Turb: ▲ LGT ▲ MOD ▲ SEV PIREP Ice: ☞ LGT ☞ MOD ☞ SEV

Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details



Objectives

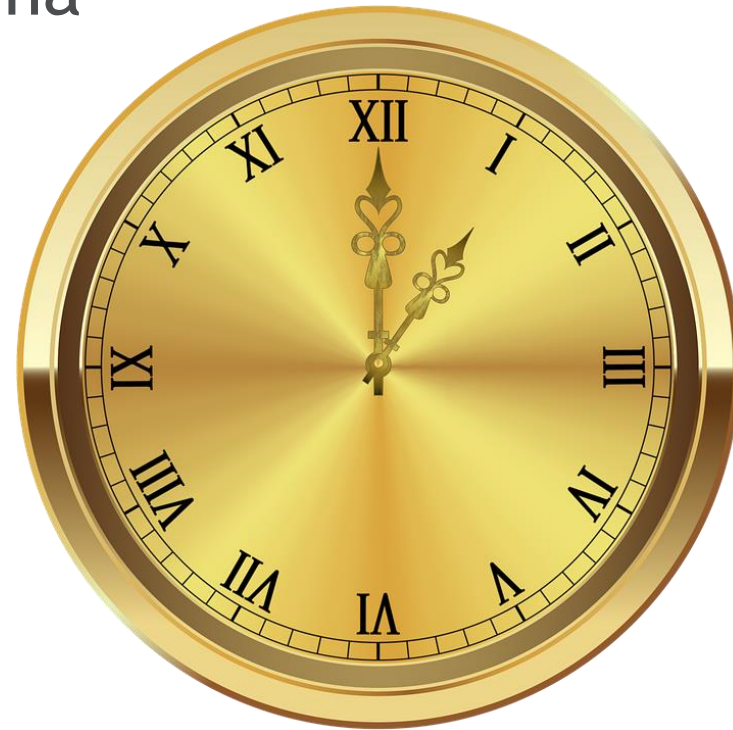
- 1 Discuss the literature on hospital transfer times
- 2 Review ATLS primary & secondary assessments
- 3 Discuss extended management options for various injuries

What is the Golden Hour?



The “Golden Hour”

- The first hour after a traumatic injury where you have the time-limited opportunity to prevent irreversible injury and death in severe trauma



The Reality

- Even under the best circumstances, most patients do not arrive at a trauma center within 1 hour... or 2 hours... or sometimes 4 or more hours...
- Outcomes do not always depend on rapidity of transport

Analysis of Compliance and Outcomes in a Trauma System With a 2-Hour Transfer Rule

Marie L. Crandall, MD, MPH; Thomas J. Esposito, MD, MPH; R. Lawrence Reed, MD;
Richard L. Gamelli, MD; Frederick A. Luchette, MD

Arch Surg. 2010;145(12):1171-1175

- Review of trauma patients in Chicago at a single trauma center
- Only 20% of patients arrived a trauma center within 2 hours of injury - the most severely injured patients
- Early arrival patients: higher ISS, more likely to have same day surgery, more likely to have surgery during admission, increased severity of head/ortho injuries compared to late group
- Median transport time 2 hrs 20 mins
- Amongst delayed group: Group mortality equivalent to total mortality rate, no clear adverse effect on outcomes

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- Takeaways:
 - The golden 2 (?) hours may not be as critical for all but the most severely injured patients
 - The most severely injured patients move the fastest
 - The less injured patients don't seem to have significantly adverse outcomes from delay in transfer

Prolonged Emergency Department Stay at Referring Facilities: A Poor Trauma Performance Improvement Tool

Pascal Udekwa, MBBS, MBA/MHA^{1,4}, Brian Simonson, BS, NRP^{2,4}, Anquonette Stiles, DC, MPH^{1,4}, Sarah McIntyre, MSN^{1,4}, Kimberly Tann, BS^{1,4}, and Sharon Schiro, PhD^{3,4}

The American Surgeon
2022, Vol. 88(4) 728–733

- Review of trauma patients to address an ED LOS >4 hrs at referring facilities before trauma center transfer
- Performed at UNC / Wake Forest
- Pediatric patients excluded due to differing baseline vital signs by age

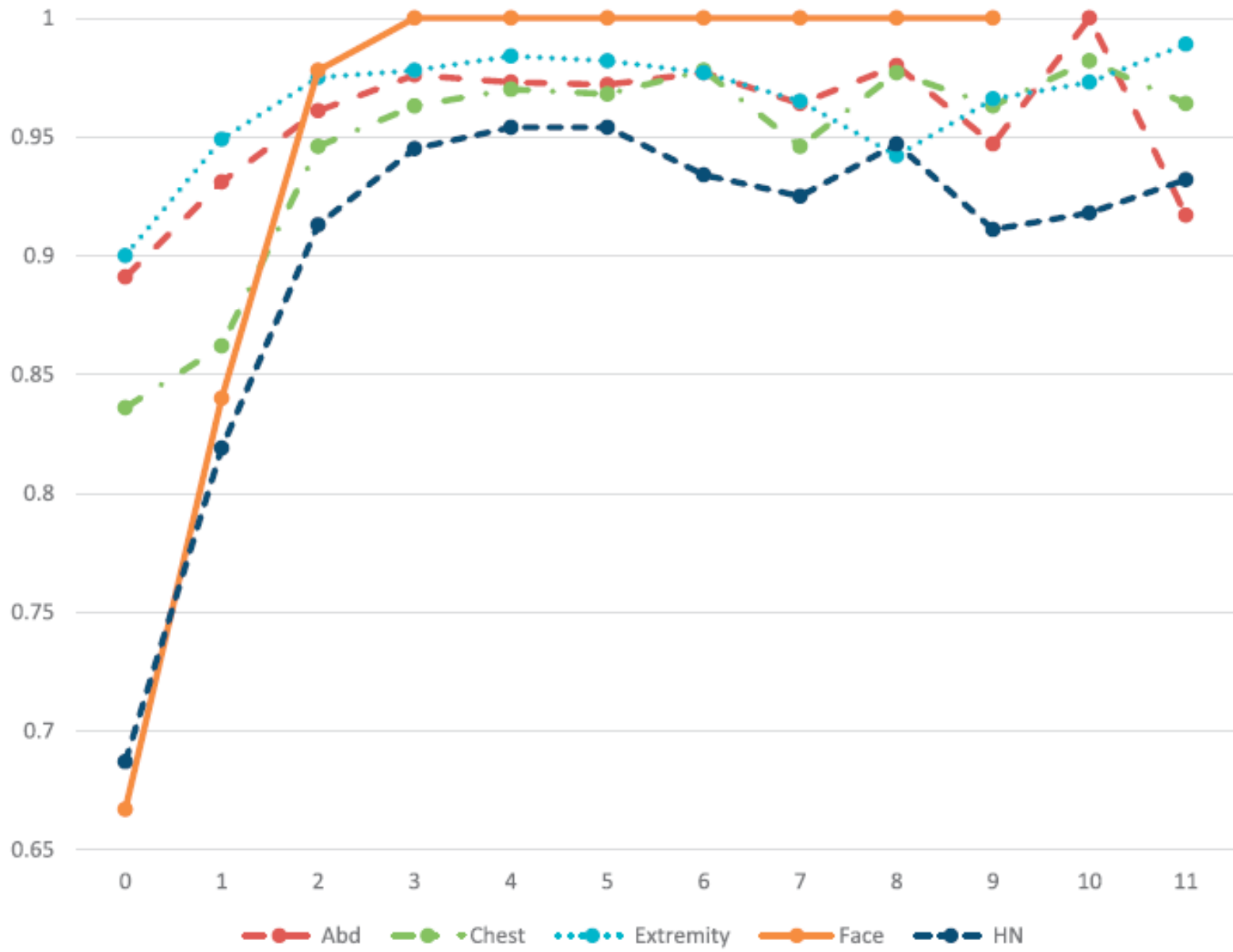


Figure I. Survival vs RF LOS by AIS. y-axis = (proportion of patients surviving transferred within each time period). x-axis = {n} to {n.9} hours at referring facility

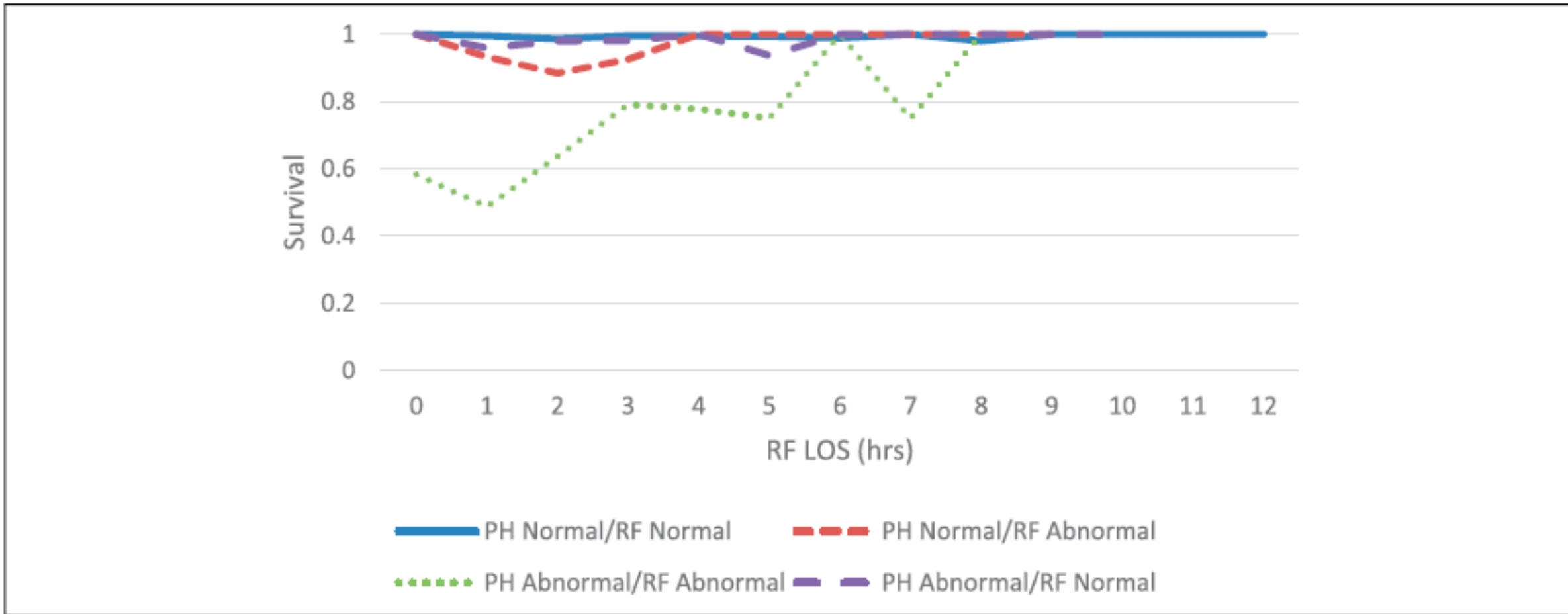


Figure 2. GCS-M Survival v RF LOS.

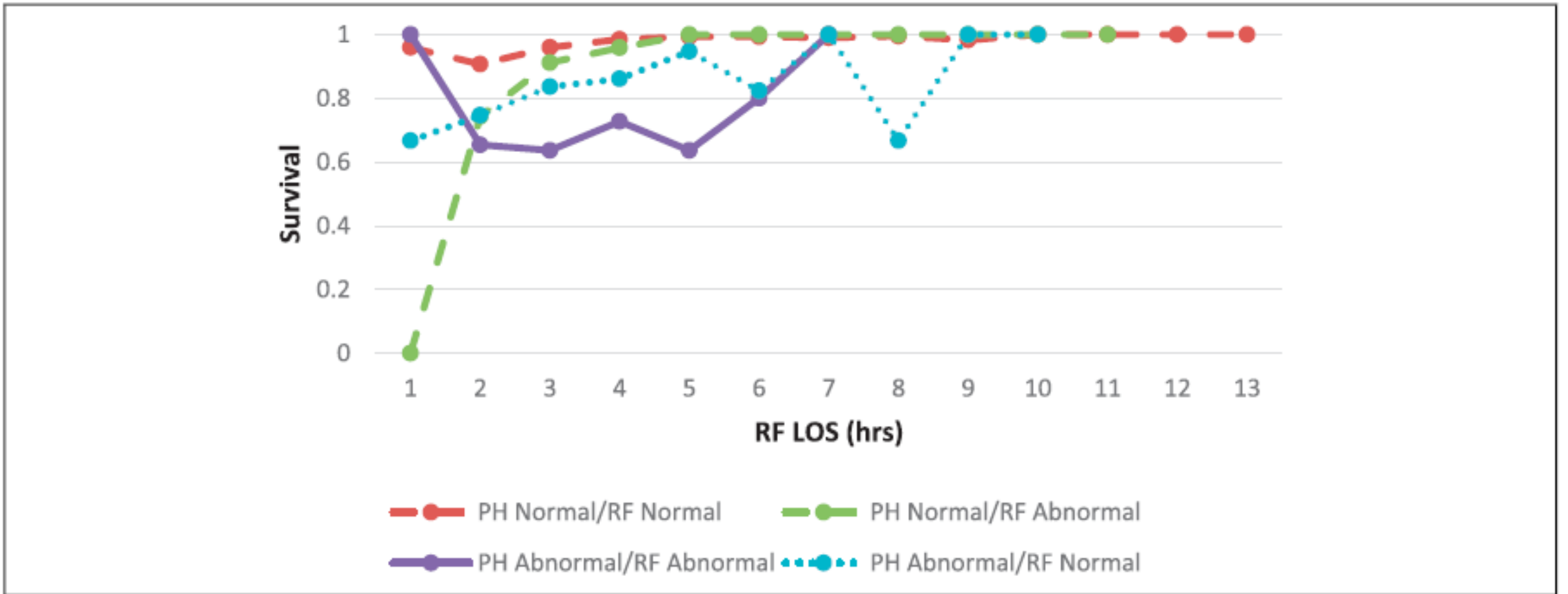


Figure 3. SBP Survival by RF LOS.

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- Takeaways:
 - Early deaths after traumatic injury tended to occur within the first two hours
 - Patients with severe injuries to the face, head, and neck died most often in the first two hours of stay at the presenting facility
 - Findings suggest that minimizing LOS for patients presenting with low systolic blood pressure might have the most benefit
 - No particular area of bodily injury was associated with increased mortality with increasing LOS at the referring facility

Outcomes of trauma patients: Direct transport versus transfer after stabilisation at another hospital

Injury, Int. J. Care Injured 43 (2012) 1575–1579

Kuang-Yu Hsiao^{a,b}, Leng-Chieh Lin^{a,b}, Meng-Hua Chou^a, Cheng-Chueh Chen^c, Hwa-Chan Lee^d,
Ning-Ping Foo^{e,f,g}, Chi-Jei Shiao^h, I-Chuan Chen^{a,b}, Cheng-Ting Hsiao^{a,i}, Kai-Hua Chen^{i,j,*}

- Review of trauma patients who were stabilized at a local hospital before interfacility transfer in comparison to those transferred direct to trauma centers from scene of injury
- Trauma system in Taiwan
- Interval to 1st hospital arrival: 27 mins overall, 28 mins direct from scene, 25 minutes scene to transferring hospital
 - Significantly better transport time for transfers to local facility
- Interval from 1st hospital arrival to trauma center arrival: 138 mins

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- ISS
 - Direct to trauma ctr: 27.7, Transfer from local hospital: 25.6
- Mortality
 - Direct to trauma ctr: 14.1%, Transfer from local hospital: 14.7%
- Other factors without significant differences:
 - % of hypotensive patients
 - Total GCS score
 - Values for Hgb & platelet count

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- Takeaways:
 - Treatment rendered during the prehospital and 1st hospital phase can be effective at reducing overall mortality

ATLS Primary & Secondary Survey



ATLS Assessment

- Primary survey
- Secondary survey
- Adjuncts

Primary Survey

- A - Airway
 - B - Breathing
 - C - Circulation
 - D - Disability
 - E - Exposures
-
- Identify and treat immediate threats to life

Secondary Survey

- Head to toe thorough examination
- Labs
- X-rays
- FAST
- CT
- Transfer call

Managing Your Prolonged Guest



Priorities - Pilots

- Aviate
- Navigate
- Communicate

Priorities – Healthcare Providers

- Treat the patient
- Assess where you are and make a plan
- Call for help

Head Injuries

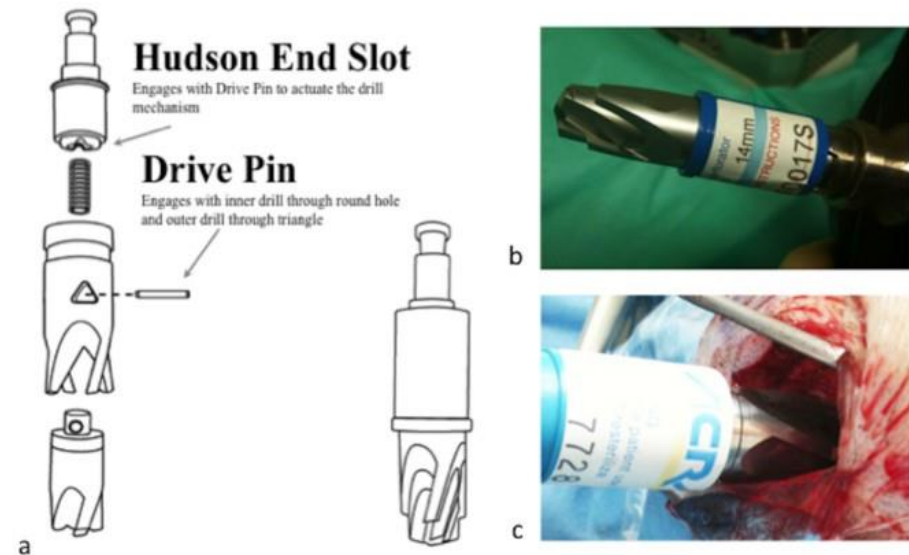
- Primary survey!
 - Manage the airway in severe TBI
 - Obtain good vascular access
- Image the problem - share with your friends!
- Support the patient

Head Injuries

- Supportive treatments for intracranial hypertension
 - Adequate sedation +/- paralysis
 - Airway management - Avoid hypoxemia
 - Normocapnia (CO₂ levels) - avoid hyperventilation!
 - Elevate HOB 30 degrees
 - Avoid hyperthermia
 - Normoglycemia
 - Normotension
 - Correct coagulopathies

Head Injuries

- Treatments for intracranial hypertension
 - Hypertonic saline (3% NS @ 5 mL/kg boluses)
 - Mannitol with caution & outside advisement
 - Burr hole?
 - <https://www.acepnow.com/article/perform-emergency-burr-hole-procedure/>



Chest Injuries

- What's in there?
 - Heart
 - Lungs
 - Big blood vessels
- Cardiac injury (blunt)
 - Most common sign is dysrhythmia (tachycardia)
 - Supportive care
 - Treatment of major arrhythmias, monitoring of the rest
 - No need to follow troponins

Chest Injuries

- Pneumothorax/Hemothorax
 - Small - consider observation, repeat CXR if respiratory status worsens
 - Moderate/Large - chest tube drainage
- Pulmonary contusions
 - Support respirations using non-invasive methods if able
 - If ventilated, small tidal volumes (6 cc/kg)
 - Avoid fluid overload

Chest Injuries

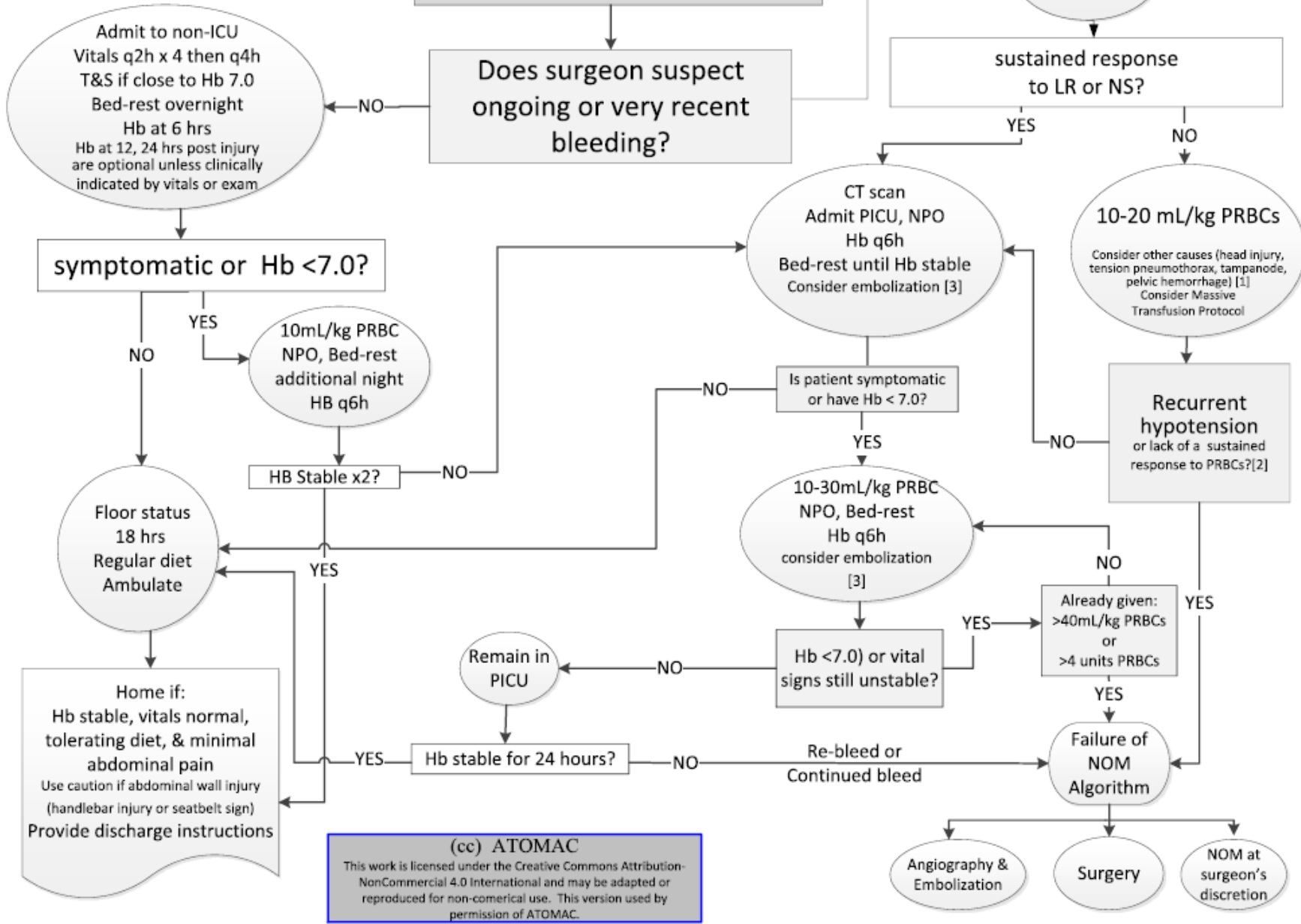
- Aortic disruption
 - Good news is the patient arrived alive!
 - Avoid hypertension
 - Treat discomfort and anxiety
 - Inform receiving center



Abdominal Injuries – Solid Organs

- Liver/Spleen ATOMAC Guidelines for Non-Operative Management
- The grand majority of pediatric patients do not require intervention for spleen/liver injuries even at higher grades
- DON'T angioembolize the blush! Follow the protocol!

ATOMAC
Blunt Pediatric Liver/Spleen Injury
Guideline v11.0



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spleen injury in
e using GRADE
Care Surg. 2015;

Abdominal Injuries – Solid Organs

- While not clearly defined, transfusion thresholds of 40 mL/kg are suggested by some studies to be the limit at which intervention is suggested
- Most common intervention is angioembolization
- Correct coagulopathy if present
- Allow the stable kids to eat!

TABLE 2. Comparison of Clinical Variables Between Low- and High-Grade Spleen Injuries

Variable	Low Grade (I–III) (n = 70)	High Grade (IV and V) (n = 23)	<i>p</i>
Median age, y	11.9 (7.5–14.8)	12.3 (8.4–14.8)	0.8
Injury Severity Score	9.5 (5–17)	21 (16–26)	0.00
Median LOS without TBI	1.0 (0.4–2.9)	1.6 (0.6–3.7)	0.3
Median LOS with TBI	0.8 (0.3–3.1)	1.0 (0.4–5.1)	0.1
ICU admission	18% (13)	43% (10)	0.1
Transfusion requirement	4% (3)	30% (7)	0.00

TBI, traumatic brain injury.

TABLE 3. Comparison of Clinical Variables Between Low- and High-Grade Liver Injuries

Variable	Low Grade (I–III) (n = 70)	High Grade (IV and V) (n = 36)	<i>p</i>
Median age, y	9.5 (5.0–15.3)	8.8 (4.5–12.5)	0.38
Injury Severity Score	10.5 (5–17)	17 (16–29)	0.0002
Median LOS without TBI	1.0 (0.3–2.8)	1.9 (1.0–6.6)	0.06
Median LOS with TBI	0.8 (0.7–3.8)	1.2 (1.6–7.1)	0.1
ICU stay	11.4% (8)	44% (16)	0.00
Transfusion requirement	17.1% (12)	61% (22)	0.00

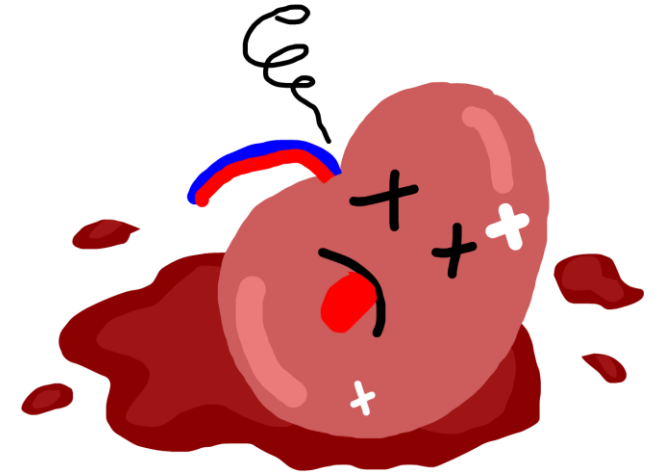
TBI, traumatic brain injury.

Abdominal Injuries – Solid Organs

- Only 3 patients with grade 5 liver injuries required surgery (1.5%)
- Only 3 patients with grade 4 spleen injuries required angioembolization (1.5%)

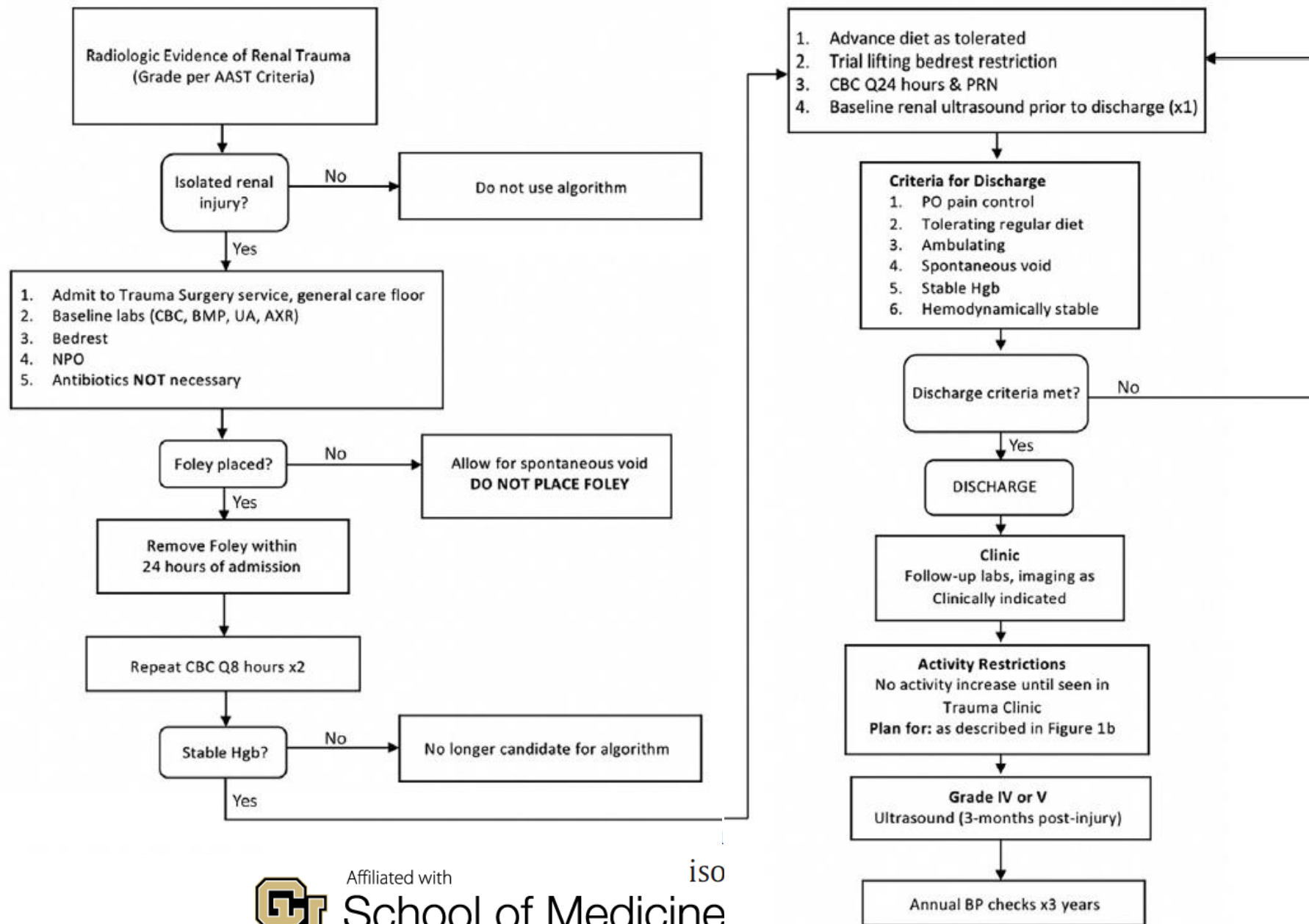
Abdominal Injuries – Solid Organs

- Kidney injuries
- Similar to spleen/liver injuries, kidney injuries are also managed non-operatively
- EAST/PTS collaboration on non-operative treatment recommendation
- Below study, only one patient (2%) failed non-operative management and this patient presented in a delayed fashion after initial hospital discharge



Implementation of a clinical guideline for nonoperative management of isolated blunt renal injury in children

Surgery Open Science 5 (2021) 19–24



ative management of

Abdominal Injuries – Hollow Viscous Injury

- Presenting signs:
 - Peritonitis
 - Free air on imaging
 - Signs of developing sepsis
- Supportive care:
 - Fluid resuscitation, ensure adequate IV access
 - Antibiotics
 - Vasopressors if needed
 - Communication with a surgeon

**Whenever you encounter
massive bleeding, the first
thing to remember is: it's not
your blood.**

Raphael Adar, MD, FACS

Bleeding

Hemorrhage Classification



Bleeding

- STOP THE BLEED!
 - Direct pressure
 - Packing
 - Tourniquets
 - Pelvic binder
- Small vessel bleeding can be significant if left uncorrected for long periods of time - check bulky dressings!
- Don't forget appropriate use of bedside exploration and ligation

Bleeding

- Some named vessels (i.e. radial artery) can be ligated!
- Pressure held in the right place for a long enough time can allow holes in even large vessels to clot
 - Large cannula sites for aortic endografts and ECMO cannulas can be closed in this manner even after anticoagulation

Calling for Help

OneCall

Connection is about to get easier

720-777-3999

- Admissions/Transfers
- Phone consultation with a surgeon
- Telephoto image sharing



What We Can Do to Help

- Clinical decision making
- Algorithm selection
- Procedural guidance
- Consultation with local surgeons

Some Problems Require an Urgent Intervention

- Perforated intestines
- Bleeding from inaccessible vessels
- Intracranial bleeding causing mass effect
- Fractures associated with vascular injury

Get Creative

- Assess all potential local or regional resources
- Determine who in your own institution might have clinical skills that can be of value in your situation
- Consider ground transport to nearby facilities that can offer needed services prior to definitive transport
- Don't negate the value of a “partial fix” to a problem

Objectives

- 1 Discuss the literature on hospital transfer times
- 2 Review ATLS primary & secondary assessments
- 3 Discuss extended management options for various injuries

Remember...

- Blue skies have their drawbacks, too...
- Studies showing increasing frequency and severity of trauma associated with clear skies, higher temperatures:

Effect of weather and time on trauma events determined using emergency medical service registry data

Injury, Int. J. Care Injured 46 (2015) 1814–1820

Seasonal, Weather, and Temporal Factors in the Prediction of Admission to a Pediatric Trauma Center

World J Surg (2019) 43:2211–2217

The association of weather, temperature, and holidays on pediatric maxillofacial trauma *Laryngoscope Investigative Otolaryngology*. 2020;5:846–852.

A young boy with blonde hair and blue eyes is shown from the chest up. He has a significant sunburn on his face, neck, and shoulders. He is wearing blue swimming goggles on his head. The background is a beach with the ocean and a cloudy sky.

Questions?