Prehospital Management of Pediatric Traumatic Brain Injury

Gregory Faris, MD

INDIANA UNIVERSITY

School of Medicine
Department of Emergency Medicine

Objectives

- Examine the history and significance of pediatric traumatic brain injury
- Discuss the importance of hypoxia in resuscitation of pediatric traumatic brain injury
- Discuss the importance of hypotension in resuscitation of pediatric traumatic brain injury

My two goals

Hypoxia

Hypotension

A little background

- Pediatric head trauma is common

630,000

Faul, M. 2010

A little background

- Pediatric head trauma is common

630,000

60,000

Faul, M. 2010

A little background

- Pediatric head trauma is common
- Pediatric head trauma is deadly

6,000

Faul, M. 2010

A little background

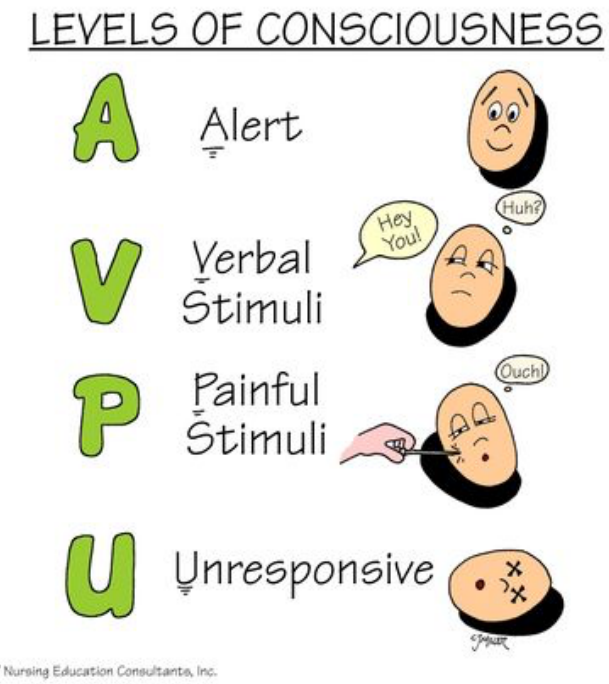
- Pediatric head trauma is common
- Pediatric head trauma is deadly
- Interventions can save lives

Faul, M. 2010

Define severity

- GCS

- AVPU



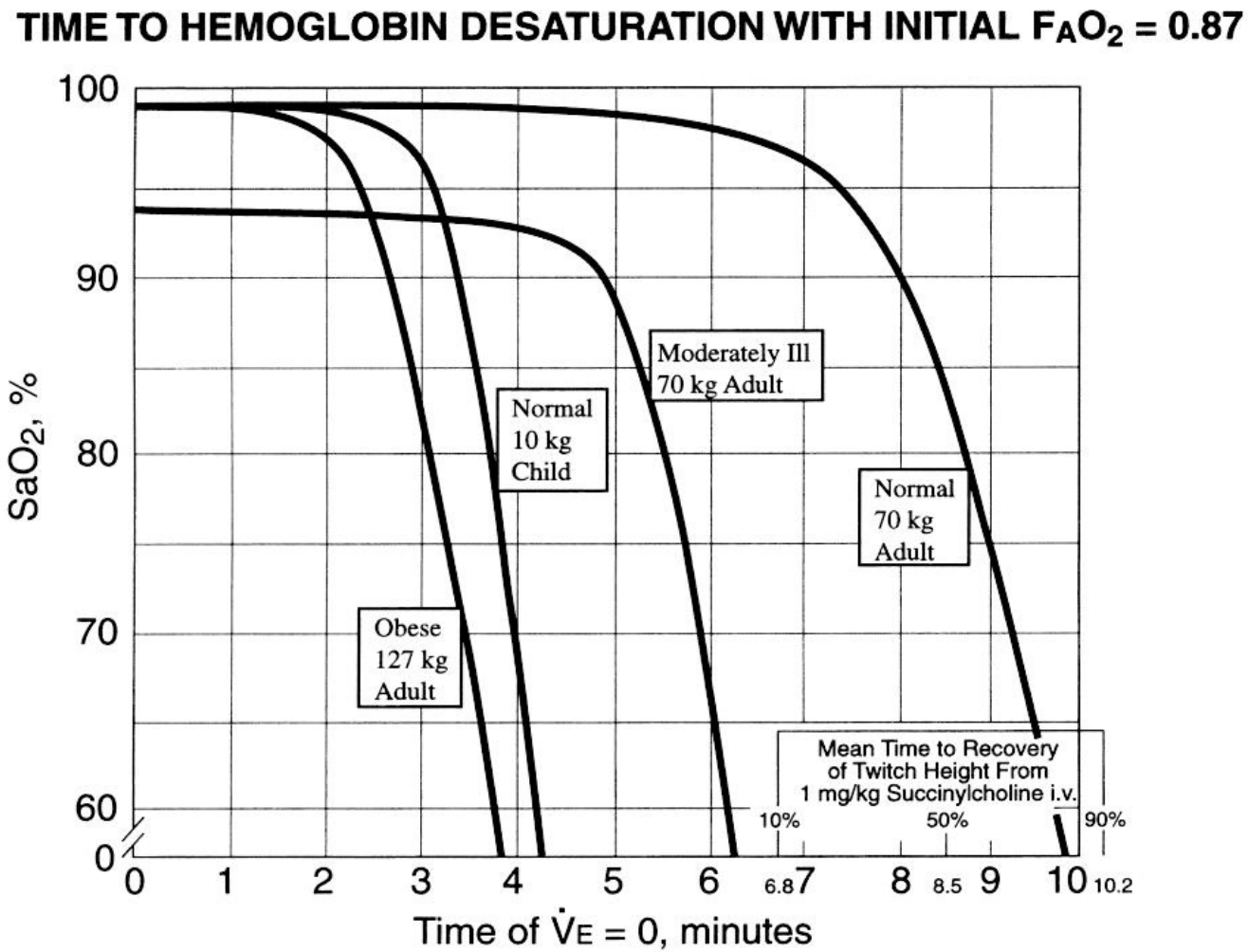
Something better?

- Simplified Motor Score
  - Obeys commands
  - Localizes to pain
  - Withdrawals to pain or less response

Gill M 2005

Hypoxia

Hypoxia in Pediatric



http://crashingpatient.com/resuscitation/airway/airway.htm/

Crit Care Med. 2014 October ; 42(10): 2258–2266. doi:10.1097/CCM.0000000000000507.

Acute Care Clinical Indicators Associated with Discharge Outcomes in Children with Severe Traumatic Brain Injury

Monica S. Vavilala, MD[1], Mary A. Kernic, PhD, MPH[2], Jin Wang, PhD[3], Nithya Kannan, MD[4], Richard B. Mink, MD, MACM[5], Mark S. Wainwright, MD, PhD[6], Jonathan I. Groner, MD[7], Michael J. Bell, MD[8], Christopher C. Giza, MD[9], Douglas F. Zatzick, MD[10], Richard G. Ellenbogen, MD[11], Linda Ng Boyle, PhD[12], Pamela H. Mitchell, PhD[13], Frederick P. Rivara, MD, MPH[14], and **the PEGASUS (Pediatric Guideline Adherence and Outcomes) Study**

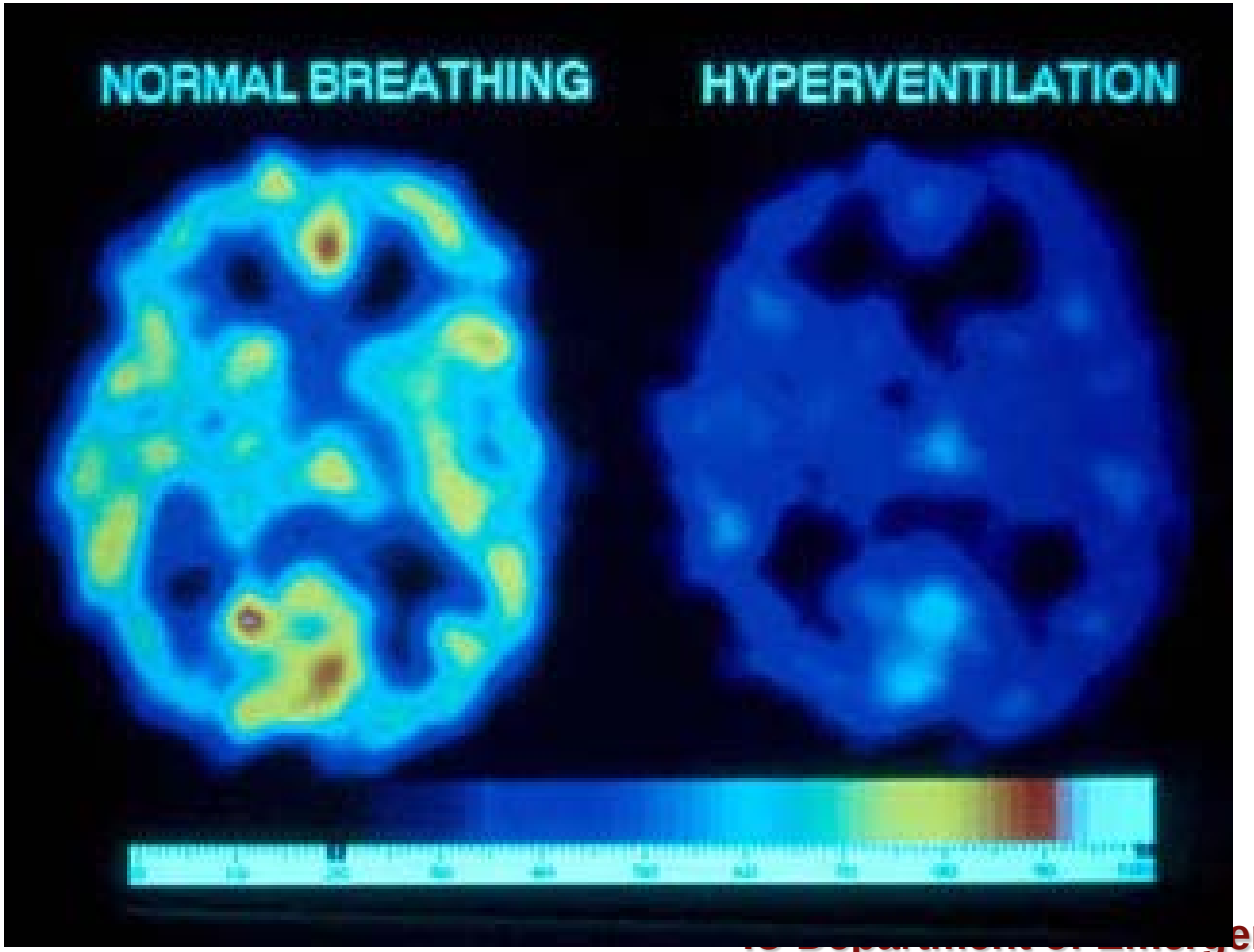
Vavilala et al, 2014

Airway interventions

Airway interventions

Airway interventions

Ventilation issue



http://www.normalbreathing.com/e/headache-after-exercise.php

Hypotension

Neonate <60 mmHg

Infant <70 mmHg

Child <70 + 2x(age)

Child >10yrs <90 mmHg

Hypotension ≠ Hypoxia

Hypotension

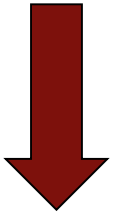
6 hours

Hypotension

6 hours

Hypotension

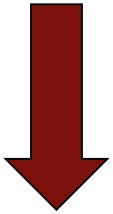
6 hours



Mortality

Hypotension

6 hours



Mortality

Improved neurologic outcomes

Hypotension interventions

https://aimsmedical.com.au/SODIUM-CHLORIDE-BXAHB7127

Combined effects

EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

The Effect of Combined Out-of-Hospital Hypotension and Hypoxia on Mortality in Major Traumatic Brain Injury

Daniel W. Spaite, MD*; Chengcheng Hu, PhD; Bentley J. Bobrow, MD; Vatsal Chikani, MPH; Bruce Barnhart, RN, CEP; Joshua B. Gaither, MD; Kurt R. Denninghoff, MD; P. David Adelson, MD; Samuel M. Keim, MD, MS; Chad Viscusi, MD; Terry Mullins, MBA; Duane Sherrill, PhD

*Corresponding Author. E-mail: dan@aemrc.arizona.edu.

Thank you

Gregory Faris
gfaris@iu.edu

References

- 1. Adelson PD, Bratton SL, Carney NA, et al. Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents. Chapter 3. Prehospital airway management. *Pediatr Crit Care Med.* 2003;4(3 Suppl):S9-11.
- 2. Adelson PD, Bratton SL, Carney NA, et al. Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents. Chapter 4. Resuscitation of blood pressure and oxygenation and prehospital brain-specific therapies for the severe pediatric traumatic brain injury patient. *Pediatr Crit Care Med.* 2003;4(3 Suppl):S12-18.
- 3. Gill M, Windemuth R, Steele R, Green SM. A comparison of the Glasgow Coma Scale score to simplified alternative scores for the prediction of traumatic brain injury outcomes. *Ann Emerg Med.* 2005;45(1):37-42.
- 4. Hill CS, McLean AL, Wilson MH. Epidemiology of Pediatric Traumatic Brain Injury in a Dense Urban Area Served by a Helicopter Trauma Service. *Pediatr Emerg Care.* 2016.
- 5. Kannan N, Wang J, Mink RB, et al. Timely Hemodynamic Resuscitation and Outcomes in Severe Pediatric Traumatic Brain Injury: Preliminary Findings. *Pediatr Emerg Care.* 2016.
- 6. Kernic MA, Rivara FP, Zatzick DF, et al. Triage of children with moderate and severe traumatic brain injury to trauma centers. *J Neurotrauma.* 2013;30(13):1129-1136.
- 7. Nesiama JA, Pirallo RG, Lerner EB, Hennes H. Does a prehospital Glasgow Coma Scale score predict pediatric outcomes? *Pediatr Emerg Care.* 2012;28(10):1027-1032.
- 8. Samant UBt, Mack CD, Koepsell T, Rivara FP, Vavilala MS. Time of hypotension and discharge outcome in children with severe traumatic brain injury. *J Neurotrauma.* 2008;25(5):495-502.
- 9. Spaite DW, Bobrow BJ, Stolz U, et al. Evaluation of the impact of implementing the emergency medical services traumatic brain injury guidelines in Arizona: the Excellence in Prehospital Injury Care (EPIC) study methodology. *Acad Emerg Med.* 2014;21(7):818-830.

References

- 10. Spaite DW, Hu C, Bobrow BJ, et al. The Effect of Combined Out-of-Hospital Hypotension and Hypoxia on Mortality in Major Traumatic Brain Injury. *Ann Emerg Med.* 2017;69(1):62-72.
- 11. Thompson DO, Hurtado TR, Liao MM, Byyny RL, Gravitz C, Haukoos JS. Validation of the Simplified Motor Score in the out-of-hospital setting for the prediction of outcomes after traumatic brain injury. *Ann Emerg Med.* 2011;58(5):417-425.
- 12. Vavilala MS, Kernic MA, Wang J, et al. Acute care clinical indicators associated with discharge outcomes in children with severe traumatic brain injury. *Crit Care Med.* 2014;42(10):2258-2266.
- 13. Warner KJ, Cuschieri J, Copass MK, Jurkovich GJ, Bulger EM. The impact of prehospital ventilation on outcome after severe traumatic brain injury. *J Trauma.* 2007;62(6):1330-1336; discussion 1336-1338.
- 14. Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton SL. Early resuscitation of children with moderate-to-severe traumatic brain injury. *Pediatrics.* 2009;124(1):56-64.