Pediatric Trauma Update: 2013

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Objectives

- Review recent trends and advancements in pediatric trauma care, focusing on issues with:
  - Broad Visibility
  - Significant Clinical Impact

Objectives:

- Disclaimer: I dislike this kind of lecture:
  - Superficial discussion of large topics
  - Often leaves more questions than answers
  - Often rushed
  - Never able to cover all the topics

- BUT:
  - These are the topics on everyone’s mind.
  - There are some great developments to talk about.
  - These is what I get questioned about anyway.

Topics

- ATLS changes: 9th edition
- Influences of Military experience
- Radiation Exposure
- Traumatic Brain Injury: concussions
- Liver and Spleen injuries
ATLS CHANGES

• Airway
  - Oral airway insertion
    - Recommends against the “backward” technique
  - Cuffed tube recommendation:
    - Use for any age
    - Measure cuff pressures, goal <30
    - No nasal-tracheal intubations
    - LMA discussed as an option

• Circulation:
  - Blood volume estimates
    - 70-80 ml/kg
  - Consider transfusion after 1st saline bolus
  - Vascular Access Priority:
    - Peripheral X2
    - Interosseous (all ages)
    - Femoral
    - External Jugular
    - Cut Down

• Head Injuries
  - Strongly encourages aggressive avoidance of hypoxia and hypotension
  - Persistent emesis or Seizure: CT scan
  - “Options”
    - Hypertonic Saline
    - Mannitol
    - Anti-epileptics
    - Intracranial pressure monitoring

ATLS 9th Edition
ATLS 9th Edition

- Studies
  - Limit CT scans
    - ALARA: “as low as reasonably achievable”
    - Do not scan if planning transfer
  - FAST
    - Use as adjunct to physical exam
    - Should not be the sole diagnostic test to determine intra-abdominal injury

Massive Transfusions and Pediatrics

  - Retrospective analysis
  - Compared 1:8 transfusions to attempted 1:1 transfusion
    - Practical difficulty achieving ratio
    - Mortality dropped from 65% to 19%
  - Despite study criticism, multiple subsequent studies have been performed confirming benefits.

INFLUENCES OF MILITARY LESSONS LEARNED

- Massive Transfusion Protocols
  - 1:1:1 transfusion ratios
- Tranexamic Acid
- Tourniquet use
- Spine immobilization?
  - Vacuum boards

Massive Transfusions and Pediatrics

Pediatric experience

Nationwide Children’s, Columbus OH
- MTP policy adopted 2009
- Goal of 1:1:1 ratio
- Results: 55 pts.
  - FFP:PRBC ratio of 1:3
  - No difference in Mortality
  - Lower thrombo-embolic events

J. Hendrickson, Emory, Transfusion, June 2012
J. Groner, Nationwide Children’s, J Trauma, OCT 2012
**Tranexamic Acid (TXA)**

- Synthetic derivative of Lysine
- Similar to E-aminocaproic acid (Amicar)
  - 8 times the potency
  - Reversible blockade of a lysine binding site on the plasminogen molecule

- Result: Antifibrinolytic
  - without increased vaso-occlusive events

**CRASH II Study**

- 274 hospitals
- 40 countries
- 20,000+ patients with significant bleeding
- Randomized to TXA vs Placebo

- 15% reduction in risk of death from bleeding
- Improvement only seen if given within first 3 hours.

**TXA in Pediatrics**

- Prior uses of TXA
  - Cardiac Surgery
  - Extensive experience with E-Aminocaproic acid
  - Scoliosis
  - Craniosynostosis
  - Traumatic Hyphema
- No published data on the use of TXA specifically used for pediatric Trauma.

**TXA**

- Crash 3 Trial
  - Now accruing world wide
  - Use of TXA for traumatic Brain injury
  - NOT accruing pediatric patients

http://crash3.lshtm.ac.uk/
TXA in Pediatrics

- Royal College of Paediatrics and Child Health
  - Working group recommendations
    - In general, adverse effects of TXA are rare
    - No thromboembolic effects noted from other uses
    - Loading Dose 15 mg/kg (max 1gm) over 10 minutes
    - Maintenance infusion 2mg/kg/hr for 8 hours

- No information is available regarding intraosseus administration
- Ambulance units may follow protocols for administration of TX for patients over 12 years old.

Tourniquets in Children

- Pediatric Tourniquets in Iraq and Afghanistan
  - 88 injured children, age 4-17
  - 67 extremity injuries
  - Extremity AIS 2-4
  - Survival 93%
  - Using standard combat application tourniquet

Tourniquets: Pediatric Concerns

- Concerns:
  - Skin break down
  - Increased ischemia time
  - Morbidity from compartment syndrome
  - Increased amputation rate

  Baghdad study in 2008 showed tourniquet use is safe after assessing for nerve palsy, clot, myonecrosis, fasciotomy, and amputation due to use of the tourniquet
  - BUT Tourniquet time > 2 hours has stronger association with fasciotomy and amputation
Radiation Exposure in Children

Statistics and Data
Cumulative dose >10mSv linked to an increased cancer risk.
50 mSv is the annual OSHA limit in the US
10-20 mSv in children results in a 40% increase in the cancer rate
1 in 1000 children that undergo a CT scan will develop a fatal cancer over their lifetime.
Trauma patient mean radiation dose: 14-18 mSv

Radiation Exposure in Children

Trends:
- Pediatric specific dose adjustments
- Limit number of scans
- More reliance on:
  - History
  - Physical exam over time
  - FAST
- “No-Scan” protocols
  - PECARN study

PECARN Working Group
Aeri Pediatric Adolese Med. DEC 2011

National Cancer Institute

A. Kharbanda (Minneapolis). “Analysis of Radiation exposure …” J Trauma 2013

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New Ideas to Reduce Radiation Exposure

• Serum markers
  - S100b
  - neuron specific enolase
  - myelin basic protein
  - Glial fibrillar acidic protein.
• “Quick Scan” MRI for Head Trauma
  - Fast spin T2 weighted study
  - Alternative to isolated head CT scan?
• Clinical Prediction Tools (abdominal)

Concussions in the Media

• Military experience
  - Publicized problems
  - Protocol changes (2009-2010)
• Alan Swartz
  - 2007 New York Times Article
    - “Expert Ties Ex-Player’s Suicide to Brain Damage”
  - More than 100 articles on concussions
  - Pulitzer prize Finalist in 2011
    - “…illuminating the peril of concussions … spurring a national discussion”
Management

- What you need to know:

- Most Common Question you will be asked:
  - When can she play again??

“Zurich” Recommendations:

- 4th Consensus conference on concussion management, Zurich 2012:
  - Lab markers (s=100b): not proven
  - Recommended:
    - SCAT3 evaluation tool
    - Clinical Neuro exam for all
    - Formal Neuropsychological testing for some

Tips for Counseling Parents

- Do NOT give a specific time for a return
  - Must be symptom free first.
  - Graduated program that includes cognitive activity
  - Repetitive concussions within a short time span
    - Can cause lasting deficits.
    - Might need PERMANENT activity restrictions.
  - Need for further testing is variable
    - Follow up MRI
    - Neuropsychology testing
Liver and Spleen Injuries: Non-operative Management

**Historic Recommendations:**
- ICU for 1 day.
- Bed rest for grade+1
- Activity restrictions grade+2
- Contraindicated with neurologic injury or other associated injury
- CBC and abdominal exam every 6 hours
- NPO for 24-48 hours

**Liver and Spleen Injuries: Non-operative Management**

**EAST Guidelines 2012:**
- Unstable or peritonitis to the OR (level 1)
- Angiography is an option for transient responders
- No longer an ABSOLUTE contraindication:
  - Grade of injury
  - Neurologic status
  - Age of patient
- Monitoring, serial exams, and operating room all available
- Venous thrombo-embolism prophylaxis may be considered

**Liver and Spleen Injury**

**Questions being asked:**
- Frequency of Hemoglobin Measurements
- Frequency of abdominal exams
- Duration of monitoring
- Time to oral intake
- Duration of restricted activity
- Length of ICU stay
- When to start DVT prophylaxis

The Eastern Association for the Surgery of Trauma
www.east.org
One Example: Recent Trials

- Kansas City Studies:
  - Prospective study
  - 131 children with solid organ injury
  - Limited bed rest:
    - 1 Day: grade 1-3
    - 2 Days: Grade 4-5
  - Splenectomy: 1

Liver and Spleen Injuries: Non-operative Management

Current Clinical Trends:
- Decreasing length of stay and ICU stay
- No ICU for grade 1-3
- Begin PO when Hb is stable
- More aggressive non-operative management
  - Observation with head injuries
  - Observation with associated injuries
- Grading becoming less important
- No follow up CT scans

Summary

- Adult standards translated to children
- MTP protocols
- TXA
- Tourniquets
- Use less radiation
- Concussions: restrict activity more
- Liver / Spleen: Observe all stable kids for shorter period

Questions?