Applying the 3 P's to Pediatric Resuscitation-
Planning, Preparation and Persistence

Angie Cunningham, BSN, RN, CCRN-K, C-NPT
Transport Outreach & EMS Relations Coordinator

Children's Mercy KANSAS CITY

UMKC School of Medicine

BEST CHILDREN'S HOSPITALS USNews 2017-18

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

1

Objectives

At the conclusion of this learning session, the learner will be able to:

- Develop a management plan for commonly diagnosed traumatic injuries in children
- Analyze emerging research, developing standards and learning experiences to increase quality of pediatric resuscitation

Children's Mercy KANSAS CITY

Purpose, planning, passion, patience, practice and persistence prevent piss poor performance

Children's Mercy KANSAS CITY

Purpose

- Trauma is the leading cause of death in children age 19 and under
- Blunt trauma is the most common mechanism of injury (falls, MVC)
- 25% of all traumatic injuries occur in children
- Critically ill children have better outcomes when treated in pediatric trauma centers (Manual of Pediatric Trauma)

Children's Mercy KANSAS CITY

Dr. James Styner – 1976 crash

"When I can provide better care in the field with limited resources than my children and I received at the primary facility, there is something wrong with the system and the system has to be changed"

Children's Mercy KANSAS CITY

Committee of the Future of Emergency Care in the United States Health System 2007

- Examine the full scope of emergency care
  - 3 reports
- Emergency Care for Children: Growing Pains
  - Identified needs in pediatric trauma care
  - Noted that issues affecting the emergency care system have a greater impact on the outcomes of critically ill pediatric patients.

Children's Mercy KANSAS CITY

North Carolina study (Hunt,2006)

- 35 Emergency Departments
- Failure to stabilize seriously injured children during trauma simulations
  - Accurate estimation of patient weight- 49%
  - Treatment of severe hypoglycemia- 97%
  - Treatment of hypothermia- 97%
  - Proper administration of IV fluid boluses- 89%

Children's Mercy KANSAS CITY

CSHCN at risk for suboptimal care during emergent event- even with advanced training

•Occult medical problem

•Recognizable problem with atypical management

•Unknown baseline status with known medical condition

•Rare condition

•Technology-dependent child

•Inaccurate medication dosing/delivery

(Sacchetti, et al., 2000).

Children's Mercy KANSAS CITY

- Pediatric Medication Safety in the Emergency Department (AAP, 2018)
  - Community EDs and inpatient units
    - 28.3 million- 89% seen in non-pediatric hospitals, 4% critical or require admission (H-CUP, 2010)
    - Errors 10-31% in Pediatric dedicated ED, 39% in Community ED (AAP, 2018)
  - EMS providers
    - 10% pediatric, 1% critical
    - Errors 34.7%
  - Rural vs urban
    - 8% vs 92%

Children's Mercy KANSAS CITY

Medication errors 3 times the rate in adult patients.

Think about that…

Children's Mercy KANSAS CITY

PURPOSE.

Children's Mercy KANSAS CITY

Planning and Preparation

AAP Policy Statement: Pediatric Medication Safety in the Emergency Department recommendations:

- Up to date, readily accessible reference materials
- Use of length-based dosing tools when scale not available or use not feasible
- Weights measured and recorded only in kilograms
- Provide recommended pre-calculated doses with standard concentrations

Children's Mercy KANSAS CITY

- Root Cause of Errors in Pre-hospital Simulated Pediatric Emergency (Lammers, et al. 2012)
  - Active cognitive, procedural, affective, teamwork and latent errors
  - Knowledge and skill retention by EMS correlated by frequency of use
    - 60% error rate for Versed and 47% error rate for Valium for seizures
  - Error producing conditions
    - Equipment not carried to patient, peds bags locked, lack of familiarity with equipment
- Simulation valuable for identifying unanticipated errors and previously unrecognized, error-producing conditions

Children's Mercy KANSAS CITY

- Reducing Cognitive Load with Resuscitation Aids (Luten, et al,2002)
  - Two important practical considerations in a resuscitative process:
    - Delay in the time needed to implement a given action or prolonged implementation time
      - Prolonged and more error prone in peds resuscitation due to multiple age and size related factors which must be addressed from evaluation through completed action
    - Error in decision making as a result of, or in part from, suboptimal or inadequate critical thinking time.

Children's Mercy KANSAS CITY

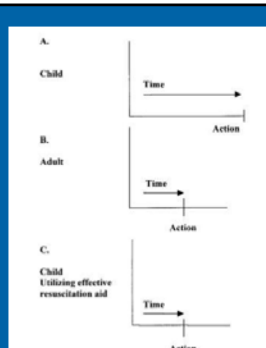


Figure 1. Graph of implementation times. Implementation time represents the time from decision to completed action. It may be prolonged in the child (**A**) as compared with the adult (**B**) because of the time needed to complete the logistical steps of resuscitative process. With rapid completion and/or elimination of logistical steps using an effective resuscitation aid, implementation time can be shortened (**C**). (This graph was created to visually demonstrate general concepts and is not based on actual clinical data.)

Children's Mercy KANSAS CITY

9

- Cognitive load is an important and critical feature of the pediatric resuscitation process.
- Cognitive load depends on the degree of uncertainty in the process.
- The degree of uncertainty determines the number of decisions that will need to be made.
- The more complex, non-automatic decisions in the process, the greater the cognitive load.

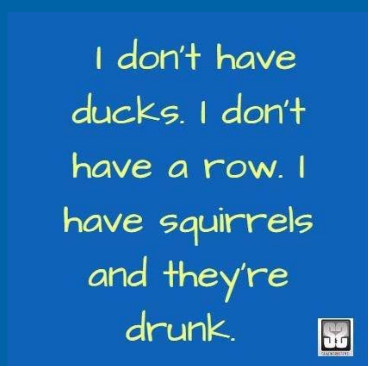
Children's Mercy KANSAS CITY

- Increased cognitive loading means increased error.
- In the setting of pediatric resuscitation, size-related variables introduce the need for non-automatic activities and decisions, thereby increasing the cognitive load. The size-related variables are unique to the resuscitation of children.
- These nonautomatic, size-related decisions can be relegated to an automatic level using resuscitation aids.

Children's Mercy KANSAS CITY

- Resuscitation aids can reduce cognitive load and therefore reduce error.
- Some resuscitation aids are better than others.
- There is a need to optimize and refine the operating characteristics of resuscitation aids.

Children's Mercy KANSAS CITY



Children's Mercy KANSAS CITY

109

Recommendations:

- Up to date, readily accessible reference materials
- Use of length-based dosing tools when scale not available or use not feasible
- Weights measured and recorded only in kilograms
- Provide recommended pre-calculated doses with standard concentrations
- Create and integrate a dedicated pediatric medication safety curriculum into training programs- for all providers

Children's Mercy KANSAS CITY

Recommendations:

- Implement and support the availability of pharmacists in the ED
- Develop tools for competency assessment
- Pediatric equipment available for patients and for
- staff to familiarize themselves with
- Routine simulation to identify obstacles for successful resuscitation

Children's Mercy
KANSAS CITY

PLAN. PREPARE.

Children's Mercy
KANSAS CITY

Patience and Persistence

What makes the pediatric patient different in trauma care?

Children's Mercy
KANSAS CITY

Children's Mercy
KANSAS CITY

Patience to watch for subtle differences and changes:

- Deceleration mechanisms can cause massive and fatal c-spine injuries
- Hypothermia develops frequently
- Different physiological response to injury
- Vast compensatory mechanisms followed by rapid deterioration
  - Smaller blood volume
  - Smaller airway
  - Less energy reserves to maintain adequate ventilation

Children's Mercy KANSAS CITY

- Different patterns of injury
  - Relatively large head, flexible bones and ligaments
- Injuries to deep soft tissues may be very significant in the absence of fractures
- Use the mechanism of injury to raise questions of internal injuries

Children's Mercy KANSAS CITY

Patience and persistence to determine injuries…

- Act younger than their age in the event of trauma and separation from parents
- Unable to localize pain until mid-school age years
- With a pre-verbal patient, clinical exam is virtually all we have to rely upon
- Evaluate response to strangers, ability to focus/track

Children's Mercy KANSAS CITY

PATIENCE. PERSISTENCE.

Children's Mercy KANSAS CITY

Airway with C-spine control

Assume cervical spine injury
- Improperly fitting collar worse than no collar!!

Children's Mercy KANSAS CITY

Airway

20% of pediatric multiple trauma patients will require urgent invasive airway management

When do you want to perform an airway intervention in a pediatric trauma patient?

Children's Mercy KANSAS CITY

Hypoxemia

- Tachypnea
- Pallor
- Nasal flaring
- Retractions
- Grunting
- Agitation

- Cyanosis
- Altered LOC
- Fatigue
- Bradypnea, apnea
- Tachycardia
- Bradycardia

Children's Mercy KANSAS CITY

Respiratory Failure

- Marked tachypnea (early)
- Bradypnea, apnea (late)
- Tachycardia (early)
- Bradycardia (late)
- Increased, decreased, or no respiratory effort
- Cyanosis
- Poor air movement
- Decreased LOC

Children's Mercy KANSAS CITY

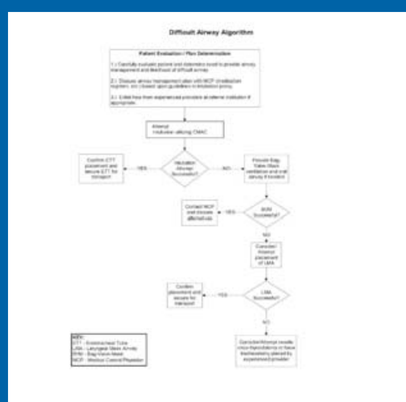
Airway Interventions

- Reposition airway
- Suction airway and belly
- High flow oxygen
- Simple Mask
  - Fits infants better upside down
- Bag/mask ventilation
  - With or without oral airway
- Intubation
- LMA
- Needle cricothyrotomy

Children's Mercy KANSAS CITY

What is your backup airway in a pediatric trauma patient?

Children's Mercy KANSAS CITY



Children's Mercy KANSAS CITY

34

LMA use in Pediatrics

- Used often in the OR as temporary airway
- Used in difficult airway protocol
- High success rate with proper training
- May be challenging to maintain placement in transport (easily replaced)

Children's Mercy KANSAS CITY

Needle Cricothyrotomy

- Surgical cricothyrotomy should not be attempted in children under 8-12 years of age
- Needle cricothyrotomy is the procedure of choice for children less than 10
- Temporary measure to oxygenate but not ventilate
- Can be used to oxygenate for up to 1 hour

Children's Mercy KANSAS CITY

Breathing

- If not intubated - assess adequacy of respirations
  - Look for signs of hypoxia/respiratory failure
- If intubated - assess ETT placement
  - EtCO2, breath sounds, chest rise
  - Place OG

Children's Mercy KANSAS CITY

Pediatric Trauma Contributing to Respiratory Distress

- Tension pneumothorax
- Open pneumothorax
- Hemothorax
- Flail chest
- Pulmonary contusions
- Diaphragmatic rupture
- Tracheobronchial injury
- Sternal fractures / Rib fractures

Children's Mercy KANSAS CITY

Circulation

- Heart rate
- Capillary refill
- Quality of pulses
- Level of consciousness
- Skin temperature
- Urine output (1-2 ml/kg/hr)
- Blood pressure
  - Up to 45% of circulating blood volume may be lost before a noticeable change in a child's blood pressure

Children's Mercy KANSAS CITY

What 3 things are the earliest indicators of changes in volume status of a pediatric patient?

Children's Mercy KANSAS CITY

- 1. Heart Rate
- 2. Capillary Refill
- 3. LOC

Children's Mercy KANSAS CITY

Circulation

- Total blood volume in a child = 80 ml/kg
- Most common cause of shock in pediatric trauma is hypovolemia
- Shock can occur with normal, increased, or decreased blood pressure

Children's Mercy KANSAS CITY

Shock – 4 types

- Hypovolemic
  - Hemorrhagic
- Distributive
  - Septic, neurogenic
- Cardiogenic
  - Myocarditis, arrhythmias, myocardial injury (trauma)
- Obstructive
  - Cardiac tamponade, tension pneumothorax

Treatment – prevention of end-organ injury and progression to cardiopulmonary failure and arrest!

Children's Mercy KANSAS CITY

What is the most effective way for a pediatric patient to increase their cardiac output?

Children's Mercy KANSAS CITY

Contractility

Newborns have limited ability to increase contractility

The ability to increase contractility goes up with age

- 30% of fetal myocardium contracts
- 60% of adult myocardium contracts

Children's Mercy KANSAS CITY

Hypotension and Shock

- Systolic blood pressure
  - Hypotension = SBP 70 + (2 x age in years)
- Compensated shock → hypotensive shock
- Hypotensive shock → cardiac arrest

Children's Mercy KANSAS CITY

Treatment of Shock

- High flow oxygen
- Vascular access (IV, IO)
- Aggressive fluid resuscitation
- Close monitoring and reassessment
- Pharmacologic support

Children's Mercy KANSAS CITY

Massive Transfusion

- 1:1:1 ratio of pRBC:FFP:PLT should be instituted in kids >30KG
- Those <30KG 30:20:20 ml/kg of pRBC:FFP:PLT
- Cryoprecipitate if continued hemorrhage after 1 round of each or fibrinogen levels < 1 - 1.5g/dl

Children's Mercy KANSAS CITY

MTP In The Literature

Chidester SJ et al.

- Prospective protocol to validate the 1:1:1 MTP
- No difference in mortality
- Those outside of the protocol had increased thromboembolic events.

Nosanov L et al.

- Retrospective review
- Did not find an increase in survival in children with higher FFP: pRBC or platelet: pRBC ratio.
- Found pediatric patients are more vulnerable to complications, such as metabolic derangements, related to blood transfusions.

Children's Mercy KANSAS CITY

Restrictive policy has also been adopted in the PICU

Hemoglobin of 7g/dL is considered a reasonable goal based on review of current literature.

Lacroix et al.

- No difference in MSOF or mortality using a restrictive approach in the PICU.

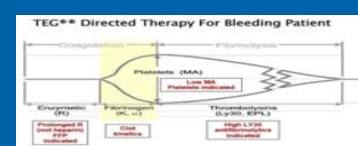
Palmieri TL et al.

- In the pediatric burn population – using a restrictive approach = no increase in mortality, length of stay or ventilator days.
- However those with a more liberal transfusion approach did have double the pulmonary complications.

Children's Mercy KANSAS CITY

Thromboelastography (TEG)

- Validated measure for fibrinolysis and assesses platelet function rather than total quantity.
- These results can be obtained much quicker than traditional coagulation studies.
- Calculates and reports the rate of clot formation, propagation and fibrinolysis in graphical form.
- Prospective data regarding the use of TEG in pediatric trauma is still lacking.



Children's Mercy KANSAS CITY

Rotational Thromboelastmetry (ROTEM)

- Modification of traditional TEG – investigates the interaction of clotting factors, their inhibitors, blood cells (PLT) during clotting and fibrinolysis
- Detects hypo and hyperfunctional stages of the clotting process
- POC testing becoming more common

Children's Mercy KANSAS CITY

- American College of Surgeons - COT recommends: Thromboeslastography should be available in Level I and II Trauma centers
- Pediatric Trauma Society – June 2017
  - Viscoelastic monitoring (VEM) during active resuscitation is infrequently used by pediatric trauma providers even when available
  - Opportunity for quality improvement in pediatric trauma treatment

Children's Mercy KANSAS CITY

TXA in Pediatric Trauma

- Tranexamic Acid (TXA)
  - Antifibrinolytic that prevents the degradation of fibrin by inhibiting plasmin and plasminogen.
  - Use in adult trauma patients = reduction in mortality with early use in both civilian and military settings.
  - Has not been widely implemented in pediatric trauma.

Children's Mercy KANSAS CITY

TXA in Pediatric Trauma

Eckert MJ et al. (2014)

- Retrospective review of all pediatric trauma admissions
- Used in approximately 10% of pediatric combat trauma patients:

Findings:

- Only independent predictors of TXA use = severe abdominal or extremity injury and base deficit of greater than 5.
- Independently associated with decreased mortality.
- No difference in thromboembolic complications or other cardiovascular events.

Children's Mercy KANSAS CITY

Pulseless Arrest

- Causes of traumatic arrest
  - Airway compromise
  - Tension pneumothorax
  - Hemorrhagic shock
  - Massive head injury

The most common immediate causes of pediatric cardiac arrest are respiratory failure and hypotension!

Children's Mercy KANSAS CITY

Pediatric Trauma Contributing to Circulatory Compromise

- Head injuries
- Facial/mandibular injuries
- Massive hemothorax
- Cardiac injury

Children's Mercy KANSAS CITY

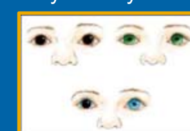
Pediatric Trauma Contributing to Circulatory Compromise

- Traumatic aortic disruption
- Abdominal injuries
  - Liver and spleen most common
- Pelvic fractures
  - Uncommon unless hit by car
  - May be accompanied by bladder rupture
- Femur fractures

Children's Mercy KANSAS CITY

Disability

- AVPU
- Pediatric GCS commonly used
  - Score of 14-15 mild brain injury
  - Score of 9-13 moderate brain injury
  - Score of < 8 severe brain injury
- Pupil reaction / Symmetry
  - Unequal
  - Sluggish



- Movement of extremities
  - Indication of spinal cord injury
  - Look for posturing

Children's Mercy KANSAS CITY

Pediatric Trauma Score

Patient Characteristics	+2	Category Value +1	-1
Weight (kg)	>20	10 to 20	<10
Airway	Normal	Maintained	Unmaintained
Systolic Blood Pressure (mm Hg)	>90	50 to 90	<50
Central Nervous System	Awake	Obtunded	Coma/ decerebrate
Open Wound	None	Minor	Major/ penetrating
Skeletal Trauma	None	Closed fractures	Open, multiple fractures

Children's Mercy KANSAS CITY

Pediatric Trauma Score

- Inverse relationship to Injury Severity Score and mortality
- PTS <8 should ALL be triaged to appropriate peds trauma center
- 25% of all peds trauma victims have PTS >8
  - Highest potential for preventable mortality, morbidity and disability
  - Requiring most aggressive monitoring and observation

Children's Mercy KANSAS CITY

70

Head Injury

- More common injury in children
- Leading cause of mortality in peds trauma
- Occurs in up to 75% of multiple trauma victims
- More cerebral edema
- Fewer intracranial hematomas

So… normal CT does not mean normal brain or patient

Children's Mercy KANSAS CITY

- Size
  - Larger head
- Blood volume
  - Proportionately larger blood volume
- Less myelinated
  - Predisposes it to shearing forces
  - DAI (Diffuse axional injury) grossly abnormal clinical findings without ICH
  - Subarachnoid space smaller, less protection due to less bouyancy
- Musculature
  - Supportive muscles such as neck, back and abdomen are underdeveloped

Children's Mercy KANSAS CITY

What now??

Assume cervical injury

- < 8 years old, high injury suspected
  - Occiput C1-C2 injuries
  - Older kids will have more variable distribution
- SCIWORA
- Mortality rate of children with spinal fractures (54.4%) is significantly higher than adults (20.5%)

Children's Mercy KANSAS CITY

Markers for Mortality

Lethal Triad

- Hypothermia
- Acidosis
- Coagulopathy

All of these are present in trauma patients with significant bleeding

Children's Mercy KANSAS CITY

Children's Mercy KANSAS CITY

81

Skull Fractures

Skull fractures:

- Linear
  - Poor indicator of intracranial injury
  - Relatively common in < 1 year old
    - Relatively modest forces (should consider NAT though)
    - Occiput fx usually child struck repeatedly against object (NAT)
  - Epidural bleed if crosses middle meningeal artery
  - Overall good prognosis

Children's Mercy KANSAS CITY

Skull Fractures

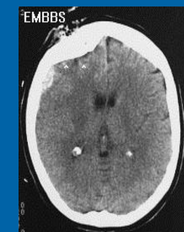
Skull fractures:

- Depressed
  - Less frequent due to more force required
  - Suspect underlying injury due to force of bone pushing inward
  - Often require surgery due to underlying injury or for cosmetic regions

Children's Mercy KANSAS CITY

Epidural Hematomas

- Uncommon < 4 years old, then steadily increases
- Usually arterial bleeding
- Minor trauma may cause
- Lucid interval with subsequent decline
  - 1-4 hours later, pt c/o headache, progressive decline in MS
- Presentation
  - Bulging fontanel, unequal pupils, anemia
- **Neurosurgical emergency**



Children's Mercy KANSAS CITY

Subdural Hematomas

- Seen most in infants and adolescents
- Commonly associated with NAT
- Venous bleeding
- More force required
- May be chronic
- May or may not require surgical intervention
- Presentation
  - Non-specific, drowsiness, lethargy, irritability, retinal hemorrhages, seizures, tense/ bulging fontanelle

Children's Mercy KANSAS CITY

Reassess and prevent

- Reassess A, B, C, D continually
- Protect the c-spine
- Secondary Brain Injury
  - Complex biochemical and cellular response to initial mechanical trauma
  - Can result in loss of tissue not initially damaged
- Physiologic effects include:
  - hypoxia, hypotension, ischemia, hypothermia

Prevent SBI by preventing/ treating above conditions

Children's Mercy KANSAS CITY

Prevent hypo-perfusion

- Increased mortality with hypotension
  - Evidence based:

    509 kids (<17yo) with severe head injury (GCS<8) noted pts with hypotension had mortality rate 66%, whereas kids without hypotension had mortality rate of only 22%
- – Normal BP: 90 + (2 x child's age)
  - Low end of normal is 70 + (2 x child's age)
- – Cerebral perfusion pressure (CPP) *CPP = MAP – ICP*
  - Child > 50 mm HG
  - Adolescent > 60-70 mm HG

Children's Mercy KANSAS CITY

Prevent hypo-perfusion

- Don't know ICP- IMPERATIVE to maintain the BP to keep CPP up
- CPP represents the pressure difference between the inflow (arterial) pressure and the outflow (venous) pressure across the cerebral vascular bed.
- Treat aggressively
  - – LR
  - – NS
- Continually reassess to avoid over or under fluid resuscitation

Children's Mercy KANSAS CITY

Head Injury Management

- Head midline & elevated 15-30 degrees
  - – Treat shock first!!
- Control seizures- more common in peds
  - – Benzodiazepines (hypotension)
  - – Long-acting anticonvulsants (Fosphenytoin)
- Mannitol 0.25-1 gm/ kg or 3% Sodium Chloride 3-6mL/kg
- Sedation AND Paralysis
  - – Assist with control of patient and ventilation
  - – Can help decrease O2 consumption and metabolism

Children's Mercy KANSAS CITY

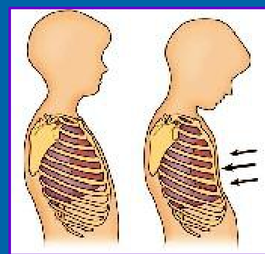
To hyperventilate or not?

- Indicators
  - – Evidence of herniation
    - Widening pulse pressure
    - Bradycardia
    - Irregular resp pattern
    - Pupil changes
  - – Moderate hyperventilation
    - Normal tidal volume (approx 10 mL/ kg)
    - 1.25-1.5 times normal rate
    - Goal PaCO2 30-35 mmHG
      - – High CO2 causes vasodilation which increases ICP BUT
      - – Dropping CO2 too low causes acidosis and vasoconstriction

Children's Mercy KANSAS CITY

Pediatric Thoracic Trauma

- Thoracic trauma is the second most deadly traumatic injury
- High incidence of pulmonary contusions and direct intrapulmonary hemorrhage
- Often with no overlying rib fractures



Children's Mercy KANSAS CITY

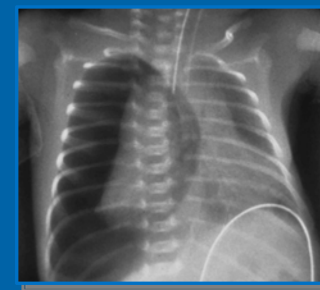
Pneumothorax: Tension

Signs / Symptoms

- Dyspnea
- ↓ Breath sounds on affected side
- PMI shift
- Hypotension
- Bradycardia (late)

MAY See:

- JVD
- Tracheal shift
- ↓ Chest wall movement



Children's Mercy KANSAS CITY

Hemothorax

- Seen less frequently than adults
- Poorly tolerated
- Treatment
  - Chest tube insertion

Children's Mercy KANSAS CITY

Pediatric Abdominal Trauma

- Incidence of abdominal injury is high due to:
  - Small pliable rib cage
  - Underdeveloped abdominal muscles
  - Lack of fat
  - Protruding abdomen
  - Proportionally larger solid organs

Children's Mercy KANSAS CITY

Abdominal Trauma

- Blunt trauma
  - 85% of peds traumatic injuries
  - MVC 50% of abdominal injuries
    - Others- pedestrian, bicycle, and sports
- Difficult to assess
  - Kids may deny pain out of fear
  - Air swallowing with crying may make abdominal exam difficult
- May be stable, then deteriorate rapidly
  - Serial evals should be conducted frequently

Children's Mercy KANSAS CITY

Abdominal Trauma

Presentation

History

External exam

"seatbelt sign"

Diagnostic Testing

CT

Ultrasound

DPL (less frequent)

Diagnosis

Serial exams

- Every 4 hour H/H for splenic & liver injury
- Most liver/ splenic injuries PICU admits at CMH

Children's Mercy KANSAS CITY

Pediatric Abdominal Trauma

- Spleen & liver injuries most common
  - Currently, nonoperative management of isolated blunt hepatic and splenic injuries is considered the standard of care for hemodynamically stable children due to:
    - Post-splenectomy sepsis
    - Complications associated with non-therapeutic laparotomies
- Surgery:
  - unstable child who doesn't respond to fluid resuscitation
  - hemorrhage
  - peritonitis

Children's Mercy KANSAS CITY

Pain Indicators

Behaviors:

- Facial grimace
- Guarding
- Lying still
- Resisting movement

Physiologic changes:

- ↑ HR
- ↑ Respiratory rate
- ↑ BP
- ↑ Perspiration

Children's Mercy KANSAS CITY

Pain Management Considerations

- Correct drug for desired effect
  - Sedation, analgesia, amnesia
- Appropriate dosing
  - Peds extremely weight dependent for dosing
- Adverse effects
  - All have them, some more fatal than others
- Monitoring
  - Must have intensive monitoring

Children's Mercy
KANSAS CITY

Pain Management

- Start with low dose and increase as needed
- Dosing for light to no sedation in one, may cause deep sedation with possible airway compromise in another
- Increased metabolic rate in children can effect how they respond
- More sensitive to vasodilatory effects

Children's Mercy
KANSAS CITY

Pain Management Pitfalls

- Kids have compensation abilities that lead to under-resuscitation which leads to rapid deterioration
- Assume every pediatric patient has multiple trauma
- Serial evaluations are crucial

Children's Mercy
KANSAS CITY

Children's Mercy
KANSAS CITY

PASSION.

Children's Mercy
KANSAS CITY

References

- Mikrogianakis A, Valani R, Cheng A. *Manual of Pediatric Trauma*. 1st ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2008.
- American Heart Association. *Pediatric Advanced Life Support* student manual; 2005.
- Air & Surface Transport Nurses Association. *Transport Nurse Advanced Trauma Course* student manual. 5th ed. 2010.
- Moloney-Harmon PA, Czerwinski SJ. *Nursing Care of the Pediatric Trauma Patient.* St. Louis, MO: Saunders; 2003.
- Air & Surface Transport Nurses Association. *Air & Surface Patient Transport Principles & Practice.* 3rd ed. St. Louis, MO: Mosby; 2003.
- Walls RM, Murphy MF. *Manual of Emergency Airway Management.* 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2004.
- American Academy of Pediatrics. Management of Pediatric Trauma. *PEDIATRICS.* 2008/Volume 121: 849-854.
- Hannon, T., (2010). Trauma Blood Management: Avoiding the Collateral Damage of Trauma Resuscitation Protocols. *ASH Education Program Book, vol. 2010 no. 1*. Retrieved from http://asheducationbook.hematologylibrary.org/content/2010/1/463.full
- Styner, J.K., (2006). The Birth of Advanced Trauma Life Support. *Journal of Trauma Nursing. Vol. 13 no 2.*
- Juang, D. (2011, June). *What's New in Peds Trauma.* Pediatric Trauma Education, Children's Mercy Hospital and Clinics, Kansas City, MO.

Children's Mercy
KANSAS CITY

References

- SafeKids. *World Report on Child Injury Prevention*. Retrieved April 15, 2009 from http://www.safekids.org. 2009.
- Woodward GA, Insoft RM, Pearson-Shaver AL. The State of Pediatric Interfacility Transport: Consensus of the Second National Pediatric and Neonatal Interfacility Transport Medicine Leadership Conference. *Pediatric Emergency Care*. 2002/Vol 18: 38-43.
- Committee on the Future of Emergency Care in the United States Health System. *Emergency Care For Children - Growing Pains*. 1st ed. Washington,DC: The National Academies Press: 2007.
- Sacchetti, Al, Sacchetti, C., Carraccio, C., & Gerardo, M. (2000). The potential for errors in children with special health care needs. *Academic Emergency Medicine, 7,* 1330-1333.
- Luten, R., Wears, R., Broselow, J., et al. (2002) Managing the Unique Size-related Issues of Pediatric Resuscitation: Reducing Cognitive Load with Resuscitation Aids. *Academic Emergecy Medicine, Vol 9: 8, 840-847.*
- Hunt, E. A., Hohenhaus, S. M., Luo, X., & Frush, K. S. (2006). Simulation of pediatric trauma stabilization in 35 North Carolina emergency departments: Identification of targets for performance improvement. *Pediatrics*, *117*(3), 641-648. DOI: 10.1542/peds.2004-2702
- Lammers, R, Byrwa, M, Fales, W. Root causes of errors in a simulated prehospital pediatric emergency. Acad Emerg Med. 2012;19(1):37-47.

Children's Mercy
KANSAS CITY