

**Maine EMS Trauma Advisory Committee**  
**Consensus Statement and Clinical Advice for Trauma Management**  
**CARE CONSIDERATIONS IN PEDIATRIC TRAUMA**

## **PART I: Key Concepts**

A. Injury continues to be the most common cause of death and disability in childhood (2). The definition of the Pediatric Patient for purposes of this guideline shall be defined as any person whose age is less than 18 years.

B. There are anatomic and physiologic differences between children and adults that impact the diagnosis and management of the pediatric trauma patient. "Children are not little adults".

C. Children with multisystem injuries can deteriorate rapidly and develop serious complications. Therefore, such patients should be transferred early to a facility capable of managing a child with multisystem injuries (2).

D. The smaller body mass of children and blunt energy force impacts results in a greater force per unit body area that can result in the high frequency of multiple organ injuries seen in the pediatric population (2).

**PLEASE REMEMBER:**

Transfers or consultations related to major (life- or limb-threatening) injuries – *regardless of age, comorbidities, or intended destination* – should be directed to the attending trauma surgeon at your regional trauma center. The trauma surgeon will recommend or facilitate subsequent actions or consultations as needed.

## **PART II: Annotations and Rationale**

A. *The value of an early trauma center consultation cannot be overstated.*

As in all cases of major injury, emphasis must be placed on stabilization of the ABC's and rapid conveyance to a trauma center.

Children who die within the first year of life from an injury usually do so as the result of child abuse (2). If you suspect an injury is the result of abuse or neglect based on history and physical findings, it is your responsibility as a mandated reporter to report the case per your facilities and State guidelines. The Maine Child Abuse Hotline number is 1-800- 452-1999; The State of Maine's child abuse hotline is staffed 24 hours a day. Mandated reporters can also view Maine state reporting information at:

[http://www.maine.gov/dhhs/mandated\\_reporters.shtml](http://www.maine.gov/dhhs/mandated_reporters.shtml).

B. The first priority is the child's airway; the inability to establish and/or maintain a patent airway with lack of oxygenation and ventilation is the most common cause of cardiac arrest in the child (2).

The child who requires endotracheal intubation should receive pre-oxygenation. The administration of Atropine 1-2 minutes before intubating children less than age 5 may minimize vagal stimulation during laryngoscopy. The dose of Atropine is 0.02 mg/kg with a minimal dose of 0.1mg and a maximal initial dose of 1.0 mg given at least 1 to 2 minutes before intubation (2).

All Medication and Fluid orders should be ordered and based on Kilogram weight or estimated Pediatric Emergency Tape weight (i.e. Broselow) for all Pediatric Patients less than or equal to 12 years of age.

Tachycardia, mental status change, respiratory compromise, absence of peripheral pulses, delayed capillary refill, skin pallor, and hypothermia are all possible early signs of shock that must be immediately recognized (1).

In Pediatric Patients less than or equal to 12 years of age, initial fluid resuscitation of 20 ml/kg of a warm crystalloid solution should be given rapidly in a bolus fashion when shock is suspected. It may be necessary to repeat this bolus up to two more times (2). Consider the administration of warmed blood (PRBC) after the third crystalloid bolus at the volume of 10ml/kg if shock persists or if the child's condition deteriorates.

Intravenous access is a preferred route for fluid resuscitation; however, consideration intraosseous access in cases of lack of access after 3 attempts or with a child in extremis should be assessed.

Hypothermia can develop quickly and may lead to prolonged coagulation times, adversely affect CNS function, and lead to conditions refractory to treatment. Keep them warm!

Blood glucose measurement should be assessed in young injured children due to caloric expenditure and typically low glucose reserves.

C. Pediatric patients requiring mechanical ventilation for  $\geq 24$  hours or invasive monitoring that are  $< 40$  kg weight should be considered for transport to a Pediatric ICU.

Gastric tube decompression may be considered to improve the effectiveness of ventilation (lowering diaphragm via gastric decompression) and decreasing potential vagal response.

D. A child's skeleton is incompletely calcified and is more pliable than an adult; internal organ damage can often occur without overlying bony fracture. The identification of rib fractures in a child suggests the transfer of a massive amount of energy, and multiple, serious organ injuries should be suspected. (2)

Head Injuries, either alone or in association with multiple system injuries, are the most severe and cause the most deaths and account for most disability in children (1). Early consultations for the management of these injuries are highly recommended to prevent secondary brain injury-hypoxia and hypotension needs to be aggressively treated.

Spinal cord injuries are uncommon in the pediatric population but cervical spine injury must be presumed until proven otherwise.

### Part III: References

1. Alterman, D.M., Daley, B.J., Kennedy, A.P., Ramanathan, R., and Lee, S. (2010). Considerations in Pediatric Trauma. Retrieved on March 24, 2011 from <http://emedicine.medscape.com/article/435031-overview>
2. American College of Surgeons Committee on Trauma (2004). Advanced Trauma Life Support for Doctors Student Course Manual, 7<sup>th</sup> Edition.
4. Pediatric Vital Signs. Retrieved on 4/1/2011 from [www.umass.edu/.../Comfort%20Care%20Appendix%20M%20Bib.htm](http://www.umass.edu/.../Comfort%20Care%20Appendix%20M%20Bib.htm)
5. Pediatric Glasgow Coma Scale. Retrieved on 4/1/2011 from <http://www.merckmanuals.com/professional/sec21/ch310/ch310a.html>

#### Additional Reading:

Hulka, F., Mullins, R., Mann, C., Hedges, J.R., Rowland, D., Worrall, W.H., Sandoval, R.D., Zechnich, A., and Trunkey, D.D. (1997). Influence of a Statewide Trauma System on Pediatric Hospitalization and Outcome. *The Journal of Trauma: Injury, Infection, and Critical Care*; Vol 42, No3.

## HELPFUL REFERENCE CHARTS

### Weight & Vital Signs by Age Group (4)

Age	Weight, kg (lb)	Respirations	Pulse	Systolic Blood Pressure
Newborn	3-4 kg (6-9 lbs)	30-50	120-160	60-80
6 mo - 1 yr	8-10 kg (16-22 lbs)	30-40	120-140	70-80
2 - 4 yr	12-16 kg (24-34 lbs)	20-30	100-110	80-95
5 - 8 yr	18-26 kg (36-55 lbs)	14-20	90-100	90-100
8 - 12 yr	26-50 kg (55-110 lbs)	12-20	80-100	100-110
> 12 yr	> 50 kg (110 lbs)	12-20	60-90	100-120

#### Urinary Output by age:

Age in years	Expected Urinary Output
0-1	2ml/kg/hr
1-3	1.5ml/kg/hr
3-12	1ml/kg/hr
>12	0.5 ml/kg/hr

### Pediatric Equipment (2)

Age and weight	Airway and Breathing							Circulation	Supplemental Equipment		
	O2 Mask	Oral Airway	Bag-Valve	Laryngo-scope	ET tube	Stylet	Suction	IV Catheter	NG tube	Chest tube	Urinary Catheter
Premie 3kg	Premie, Newborn	Infant	Infant	0 Straight	2.5-3.0	6 Fr	6-8 Fr	22 ga	12 Fr	10-14 Fr	5 Fr feeding
0-6 mos 3.5kg	Newborn	Infant	Infant	1 Straight	3.0-3.5	6 Fr	8 Fr	22 ga	12 Fr	12-18 Fr	5-8 Fr feeding
6-12 mos 7kg	Pediatric	Small	Pediatric	1 Straight	3.5-4.0	6 Fr	8-10 Fr	22 ga	12 Fr	14-20 Fr	8 Fr
1-3 yr 10-12 kg	Pediatric	Small	Pediatric	1 Straight	4.0-4.5	6 Fr	10 Fr	20-22 ga	12 Fr	14-24 Fr	10 Fr
4-7 yr 16-18kg	Pediatric	Medium	Pediatric	2 straight or curved	5.0-5.5	14 Fr	14 Fr	20 ga	12 Fr	20-32 Fr	10-12 Fr
8-10 yr 24-30 kg	Adult	Medium, Large	Pediatric, adult	2-3 straight or curved	5.5-6.5	14 Fr	14 Fr	18-20 ga	12 Fr	28-38 Fr	12 Fr

## Modified Glasgow Coma Scale for Infants and Children (5)

Area Assessed	Infants	Children	Score*
Eye opening	Open spontaneously	Open spontaneously	4
	Open in response to verbal stimuli	Open in response to verbal stimuli	3
	Open in response to pain only	Open in response to pain only	2
	No response	No response	1
Verbal response	Coos and babbles	Oriented, appropriate	5
	Irritable cries	Confused	4
	Cries in response to pain	Inappropriate words	3
	Moans in response to pain	Incomprehensible words or nonspecific sounds	2
	No response	No response	1
Motor response†	Moves spontaneously and purposefully	Obeys commands	6
	Withdraws to touch	Localizes painful stimulus	5
	Withdraws in response to pain	Withdraws in response to pain	4
	Responds to pain with decorticate posturing (abnormal flexion)	Responds to pain with decorticate posturing (abnormal flexion)	3
	Responds to pain with decerebrate posturing (abnormal extension)	Responds to pain with decerebrate posturing (abnormal extension)	2
	No response	No response	1

\*Score  $\leq$  12 suggests a severe head injury. Score  $<$  8 suggests need for intubation and ventilation. Score  $\leq$  6 suggests need for intracranial pressure monitoring.

†If the patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. This section should be carefully evaluated.

Adapted from Davis RJ et al: Head and spinal cord injury. In *Textbook of Pediatric Intensive Care*, edited by MC Rogers. Baltimore, Williams & Wilkins, 1987; James H, Anas N, Perkin RM: *Brain Injuries in Infants and Children*. New York, Grune & Stratton, 1985; and Morray JP et al: Coma scale for use in brain-injured children. *Critical Care Medicine* 12:1018, 1984.