Pediatric Tactical Emergency Casualty Care (TECC) Guidelines

Developed by: The Committee for Tactical Emergency Casualty Care

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Disclaimer:

These are guidelines only intended primarily for the high-threat environment where traditional resources may not be available, and there are competing safety, operational, and patient care priorities. They do not supersede or substitute for departmental/agency operational protocols being delivered by qualified providers under the guidance of direct or indirect medical oversight.

Why did C-TECC develop these guidelines?

Children under 18 years old comprise about 25% of the population and are at a disproportionate disadvantage when they become injured in the prehospital environment. This is especially true when their injuries involve hemorrhage, hypothermia, head injury, and severe emotional trauma. Tactical responders need to recognize and mitigate these conditions proactively to optimize patient outcomes. These guidelines are complementary to the general *C-TECC Guidelines* and the principles of pediatric resuscitation. They are intended to be used as a tool for departments and agencies to prepare to respond to the needs for patients of all ages in the unique environments.

Defining the pediatric patient:

There is no consensus and a high degree of variability on the definition of a pediatric patient across healthcare systems around the world. For operational simplicity for the purposes of these guidelines, *a pediatric patient is one who by observation does not appear to have reached puberty*.

Organization of these guidelines:

These pediatric guidelines follow the same conceptual format as the *C-TECC Guidelines*, which emphasize three phases of the tactical/operational environment, each which requires a unique approach towards patient care:

1. Direct Threat

2. Indirect Threat

3. Evacuation

Section I: Direct Threat Care

Goal

- Accomplish the mission objectives while mitigating the risk to the injured, to responders, and to the public

Key Principles:

- Threats and hazards in this environment are dynamic and require ongoing assessment and mitigation
- Minimal patient care interventions are warranted in this phase. CPR and other advanced interventions should not be performed in the Direct Threat environment.
- Accessing and removing the injured from the threat should be a priority
- Mitigate the psychosocial impact to the pediatric victim by using simple, calm language (e.g., "I'm a police officer and I'm going to help you").

Guidelines:

1. **Execute a rescue plan to reduce the risk to the injured from ongoing direct threat by using one or more of these strategies**:
    a. Direct the pediatric patient to self-extricate to a safer position using simple, age-appropriate commands. Use simple phrases that are understandable by a child and which are actionable (e.g., "look at my face and crawl to me right now")
    b. Mitigate the risk to the patient and providers
    c. Direct another person to assist with extricating the pediatric patient to a safer position
    d. Physically remove the patient
    e. Consider a rescue plan for a patient that is unable to be extricated by other means (e.g., unresponsive, inaccessible, or otherwise unable to move)
2. **Stop life threatening external hemorrhage**
    a. Apply immediate, purposeful, focused manual pressure to the bleeding source
    b. Apply junctional pressure if needed to supplement
    c. Apply a tourniquet to the patient with uncontrolled severe extremity bleeding or an amputation
        i. Apply the tourniquet as high (proximal) on the limb as possible
        ii. Apply to bare skin if possible
        iii. Apply a second tourniquet to an extremity that continues to bleed if necessary

1. Apply proximal to the existing tourniquet if able
2. Apply to bare skin if possible

iv. Some tourniquets may not function as intended on small limbs- know your equipment limitations

d. Continue to apply manual pressure to the source or to a junctional location as needed

3. **Support the airway**
   a. Place, or direct the patient to be placed, into the best position to protect the airway (e.g., recovery position or sitting up)
   b. Consider rapid, high-yield airway interventions if needed
      i. Manual positioning
      ii. Placement of an airway adjunct

Section II: Indirect Threat Care

Goals:

- Leverage this phase of *relative* safety to rapidly stabilize additional time-sensitive life-threatening injuries to the patient to permit safe extraction to more definitive treatment and evacuation
- The threat remains at this point and as such, so does the need for heightened awareness to the safety and security of the responders and the patients

Key Principles:

- Conduct a rapid patient assessment and initiate life-saving interventions
- Do not delay patient extraction for non-life-saving interventions
- Consider establishing a casualty (patient) collection point(s)
- Do not unnecessarily delay the movement of the patient towards definitive care
- Prepare for patient evacuation
- Be prepared to document any care rendered
- Anticipate for the possibility of extended/prolonged care under the phase of Indirect Threat

Guidelines:

1. **Assess patient using the Pediatric Assessment Triangle (Appendix 1) to identify major deficits**
    a. General appearance
    b. Work of Breathing
    c. Circulation to Skin
2. **Expose, assess and control ongoing severe bleeding**
    a. Apply aggressive direct manual pressure to the source of the bleeding immediately
    b. Apply a tourniquet if necessary
    c. Utilize trauma dressings to control bleeding at the source
        i. Hemostatic trauma dressings are appropriate to use in pediatric patients if available
        ii. Apply using deep wound packing technique
        iii. Apply a pressure dressing over the packed wound
    d. Re-assess any tourniquets that were already applied to the patient
        i. Assess for distal pulses on extremities with tourniquets applied and tighten device if present
        ii. Expose skin and apply a tourniquet 2-3 inches above wound for severe extremity bleeding if not already done (see Section I)

e. Expose and clearly mark tourniquet site with the time of application if possible
f. For prolonged care under Indirect Threat, consider a tourniquet conversion
    i. If the delay to definitive care will be longer than 2 hours and
        1. The patient is not in hemorrhagic shock
        2. The bleeding wound can be visualized and accessed
        3. The tourniquet is not controlling bleeding from a partial or complete amputation
        4. The patient has not already had a tourniquet downgrade attempted
    ii. Apply a new tourniquet proximal to the existing device and be prepared to tighten if necessary
    iii. Expose and pack the previously bleeding wound site
        1. Use a hemostatic trauma dressing if available
    iv. Apply a pressure dressing to the wound site
    v. Slowly remove the first tourniquet and continuously assess for bleeding
        1. If bleeding recurs, tighten the new tourniquet until hemostasis is obtained
g. Consider the use of tranexamic acid (TXA) in patients with suspected or actual massive hemorrhage
    i. TXA use should only be undertaken in a pediatric trauma system-of-care setting where pre-event coordination with local medical infrastructure has taken place
    ii. Suggested dose: 15 mg/kg loading dose followed by 2 mg/kg/hour for 8 hours
    iii. Only initiate if less than 3 hours from time of injury, but ideally within the first 30 minutes from time of injury
    iv. Consider administering TXA after resuscitation with whole blood has occurred

3. Support airway and breathing

a. Assess patient for adequacy of airway and respiratory effort
    i. Look, listen, and feel
    ii. Consider pulse oximetry if available with a goal of over 94% on room air
b. If necessary, intervene to open and maintain a patent airway. Consider these interventions:
    i. Manually position airway
        1. Head-tilt/chin-lift, or
        2. Manual jaw thrust (open mouth first)
    ii. Suction airway (avoid putting fingers in mouth, and use caution for vaso-vagal response from aggressively suctioning hypopharynx)

iii. Allow patient to assume most comfortable position, which may be lateral recumbent or sitting up. For recumbent infants and younger children, elevate the shoulders with gentle support (e.g., folded towel) to optimize airway positioning
iv. Maintain a high index of suspicion for potential airway worsening in a patient with inhalational burns or other injuries

c. Support ventilations as needed
   i. basic airway adjunct (NP or OP airway) and effective bag-valve-mask ventilation are the initial intervention
   ii. If unable to ventilate, consider more advanced airway support
      1. Extraglottic (supraglottic) airway
      2. If a surgical airway is indicated, needle cricothyroidotomy is recommended over surgical approach for pediatric patients
      3. Intubation if unable to manage airway with extraglottic airway
   iii. Consider administering oxygen
   iv. Avoid hyperventilation with assisted ventilations
d. Consider the need to prevent or treat a tension pneumothorax in patients with unstable or deteriorating respiratory effort
   i. Apply a seal to any open chest, back, or neck wounds
      1. Ideally this is a vented commercial chest seal
      2. Monitor patient for possible development of tension pneumothorax, especially if a non-vented chest seal is applied
   ii. Perform needle decompression on the side of the injury
      1. Infants and small children require a smaller needle than adults for decompression. Consider a 5cm 14g or 16g needle[i].
      2. Landmarks for insertion are the same as for adults
         a. 2nd intercostal space at the mid-clavicular line
         b. 4-5th intercostal space at the mid-axillary line
      3. Consider bilateral needle decompression in the peri-cardiac arrest and traumatic arrest patient

4. Assess circulatory status

a. For a patient in suspected shock
   i. Ensure that external hemorrhage is being aggressively controlled
   ii. Obtain IV/IO access promptly
   iii. Warm fluids are preferred
   iv. Consider blood products for a patient in suspected hemorrhagic shock:
      1. Transfuse with low-titer O-negative whole blood (LTOWB) 10 mL/kg in children one year or older

2. Transfuse a 1:1 ratio of packed red blood cells (PRBC) and plasma at 10 mL/kg each

v. If blood not available, or suspected shock of non-hemorrhagic etiology, consider a bolus of 20 mL/kg normal saline or lactated Ringer's solution

vi. Consider repeat bolus up to a maximum of 60 mL/kg if still demonstrating signs/symptoms of shock

vii. Continually assess patient and slow the rate of IV fluid administration if patient improves or recovers to minimal blood pressure range for age or recovers a strong peripheral pulse

1. Systolic BP goal: 60 mmHg <1 month of age, 70 mmHg + [2 x age in years] in children 1 month to 10 years of age, 90 mmHg in children 10 years of age or older

b. Cardiopulmonary resuscitation (CPR) and defibrillation are typically not successful in patients of any age who have suffered traumatic cardiac arrest or blast injuries. In certain circumstances (e.g., electrical injuries, drowning, suffocation, etc.), CPR may be of benefit and should be considered in the context of available resources.

c. Oral intake of fluids may be encouraged if the patient is conscious and the airway is patent

5. Prevent and treat hypothermia

a. Reduce heat loss from conduction with the ground

b. Remove wet clothing and dry the patient

c. Cover the patient with warm, dry insulating material covered with a barrier to keep it dry

6. Prevent and treat hypoglycemia

a. Check fingerstick blood glucose if able-- low blood sugar is a common co-pathology in injured children. Consider using 70 mg/dL as the threshold for hypoglycemia in infants and children.

b. Treatment could involve oral intake of high-carbohydrate food or IV administration of dextrose at 2 mg/kg. D10 is the preferred formulation for pediatric dosing.

7. Provide analgesia as needed

a. Assess the pain level

b. Consider acetaminophen (15 mg/kg) every four hours for mild to moderate pain

c. In patients over 3 months old, consider ketamine for analgesia for moderate to severe pain as it has a favorable risk profile[ii]. Use weight-based dosing and administer slowly to mitigate possible side effects.

i. Suggested oral dose is 0.2-0.5 mg/kg every 8 hours

ii. Suggested IM dose is 0.2-0.5 mg/kg slow push

iii. Suggested IV dose is 0.1-0.2 mg/kg slow push

d. In an infant, sugar is a proven analgesic. If the airway is patient and the child is awake, dip a pacifier or gloved finger into a sugary solution (not honey) and offer as often as needed
e. Narcotic pain medications are also appropriate for use in the pediatric population under local protocol guidance, with IV, IM, and intranasal (IN) options available. Use weight-based dosing and ensure that there is immediate access to the reversal agent naloxone. Suggested dosages:
    i. Fentanyl IM/IN: 1 mcg/kg (not to exceed 100mcg)
    ii. Fentanyl IV/IO: 1 mcg/kg titrate to effect at rate of 50 mcg/min slow IVP (not to exceed 100mcg)
    iii. Morphine IM: 0.1 mg/kg
    iv. Morphine IV/IO: 0.1 mg/kg titrate to effect at rate of 2 mg/min slow IVP (not to exceed 20 mg)
f. Consider the use of ondansetron if nausea or vomiting occurs in a child over 8kg.
    i. Suggested dose: 0.1 mg/kg IV for patients 1 month-12 years
    ii. Suggested dose: 4 mg IV for patients over 12 years
    iii. Suggested dose: 4 mg PO children 4-12 years
    iv. Suggested dose: 8 mg PO children over 12 years

8. Head injury

a. Consider use of a pediatric-modified GCS scale for infants and children in patients with traumatic head injuries[iii] (Appendix 1)
    i. Peds GCS ≤ 12 suggests non-mild traumatic brain injury
    ii. Peds GCS ≤ 8 suggests need for airway support
    iii. Peds GCS ≤ 6 suggests need for surgical management of TBI
b. Restrict cervical spine motion if indicated based on mechanism of injury
    i. In the absence of commercial immobilization devices, consider manual stabilization, a towel roll, or other improvised technique
c. Avoid hypoxia (see above)
d. Avoid hyper- or hypoventilation- the goal is normocarbia ($ETCO_2$ of 35-40 mmHg)
e. Consider elevating the head to about 30°
f. Treat aggressively for shock if present. Hypotension can double the mortality associated with traumatic brain injury.
g. Avoid hypothermia

9. Package for Movement

a. Utilize a movement assistive device if possible (basket, portable stretcher, wheeled litter, etc.)
b. Minimize unnecessary movement
c. Ensure patient is well secured and is ready for the anticipated mode of extraction
d. Prevent hypothermia

10. Mitigate the psychosocial impact

a. As detailed above, plus
b. With all ages of children it is important to express empathy-- tell them the truth about what to expect, warn them if something will hurt, and describe what you are doing to help them
c. Talk to the child directly if possible
d. Keep the patient with the caregiver to the extent possible

Section III: Evacuation Care

Goals:

- Now that the patient and providers are removed from the probability of ongoing injuries from the threat, the top priority is the maintenance and improvement of the lifesaving interventions initiated during the Direct and Indirect Threat phases of care
- Additionally, a more comprehensive patient management approach can be taken to identify and treat any remaining threats to the patient's health
- The focus continues toward moving the patient to definitive care with minimal delays

Key Principles:

- Closely monitor the patient for changes in condition
- The medical management goals for this section overlap significantly with those from Indirect Threat

Guidelines:

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    a. General appearance
    b. Work of Breathing
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2. **Reassess and control any ongoing severe bleeding**
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        i. Assess for distal pulses on extremities with tourniquets applied and tighten device if present
        ii. Expose skin and apply a tourniquet 2-3 inches above wound for severe extremity bleeding if not already done
    e. Expose and clearly mark tourniquet site with the time of application if possible
    f. For longer transport times, consider a tourniquet conversion
        i. If the delay to definitive care will be longer than 2 hours and
            1. The patient is not in hemorrhagic shock

2. The bleeding wound can be visualized and accessed
3. The tourniquet is not controlling bleeding from a partial or complete amputation
4. The patient has not already had a tourniquet downgrade attempted

ii. Apply a new tourniquet proximal to the existing device and be prepared to tighten if necessary
iii. Expose and pack the previously bleeding wound site
1. Use a hemostatic trauma dressing if available
iv. Apply a pressure dressing to the wound site
v. Slowly remove the first tourniquet and continuously assess for bleeding
1. If bleeding recurs, tighten the new tourniquet until hemostasis is obtained

g. Consider the use of tranexamic acid (TXA) in patients with suspected or actual massive hemorrhage
i. TXA use should only be undertaken in a pediatric trauma system-of-care setting where pre-event coordination with local medical infrastructure has taken place
ii. Suggested dose: 15 mg/kg loading dose followed by 2 mg/kg/hour for 8 hours
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iv. Consider administering TXA after resuscitation with whole blood has occurred

3. Reassess and support airway and breathing

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i. Look, listen, and feel
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iii. Allow patient to assume most comfortable position, which may be lateral recumbent or sitting up. For recumbent infants and younger children, elevate the shoulders with gentle support (e.g., folded towel) to optimize airway positioning
c. Support ventilations as needed

i. basic airway adjunct (NP or OP airway) and effective bag-valve-mask ventilation are the initial intervention
ii. If unable to ventilate, consider more advanced airway support
    1. Extraglottic (supraglottic) airway
    2. If a surgical airway is indicated, needle cricothyroidotomy is recommended over surgical approach for pediatric patients
    3. Intubation if unable to manage airway with extraglottic airway
iii. Consider administering oxygen
iv. Avoid hyperventilation with assisted ventilations

d. Consider the need to prevent or treat a tension pneumothorax in patients with unstable or deteriorating respiratory effort
    i. Apply a seal to any open chest, back, or neck wounds
        1. Ideally this is a vented commercial chest seal
        2. Monitor patient for possible development of tension pneumothorax, especially if a non-vented chest seal is applied
    ii. Perform NEEDLE DECOMPRESSION (terminology change at SOMA?) on the side of the injury
        1. Infants and small children require a smaller needle than adults for decompression. Consider a 5cm 14g or 16g needle[iv].
        2. Landmarks for insertion are the same as for adults
            a. 2nd intercostal space at the mid-clavicular line
            b. 4-5th intercostal space at the mid-axillary line
        3. Consider bilateral needle decompression in the peri-cardiac arrest and traumatic arrest patient

4. Reassess circulatory status

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    iii. Warm fluids are preferred
    iv. Consider blood products for a patient in suspected hemorrhagic shock:
        1. Transfuse with low-titer O-negative whole blood (LTOWB) 10 mL/kg in children one year or older
        2. Transfuse a 1:1 ratio of packed red blood cells (PRBC) and plasma at 10 mL/kg each
    v. If blood not available, or suspected shock of non-hemorrhagic etiology, consider a bolus of 20 mL/kg normal saline or lactated Ringer's solution
    vi. Consider repeat bolus up to a maximum of 60 mL/kg if still demonstrating signs/symptoms of shock

vii. Continually assess patient and slow the rate of IV fluid administration if patient improves or recovers to minimal blood pressure range for age or recovers a strong peripheral pulse
    1. Systolic BP goal: 60 mmHg <1 month of age, 70 mmHg + [2 x age in years] in children 1 month to 10 years of age, 90 mmHg in children 10 years of age or older

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c. Oral intake of fluids may be encouraged if the patient is conscious and the airway is patent

5. Prevent and treat hypothermia
a. Reduce heat loss from conduction with the ground
b. Remove wet clothing and dry the patient
c. Cover the patient with warm, dry insulating material covered with a barrier to keep it dry

6. Prevent and treat hypoglycemia
a. Check fingerstick blood glucose if able-- low blood sugar is a common co-pathology in injured children
b. Treatment could involve oral intake of high-carbohydrate food or IV administration of dextrose at 2 mg/kg. D10 is the preferred formulation for pediatric dosing.

7. Reassess for pain and provide analgesia as needed
a. Assess the pain level
b. Consider acetaminophen (15 mg/kg) every four hours for mild to moderate pain
c. In patients over 3 months old, consider ketamine for analgesia for moderate to severe pain as it has a favorable risk profile[v]. Use weight-based dosing and administer slowly to mitigate possible side effects.
    i. Suggested oral dose is 0.2-0.5 mg/kg every 8 hours
    ii. Suggested IM dose is 0.2-0.5 mg/kg slow push
    iii. Suggested IV dose is 0.1-0.2 mg/kg slow push
d. In an infant, sugar is a proven analgesic. If the airway is patient and the child is awake, dip a pacifier or gloved finger into a sugary solution (not honey) and offer as often as needed
e. Narcotic pain medications are also appropriate for use in the pediatric population under local protocol guidance, with IV, IM, and intranasal (IN) options available. Use weight-based dosing and ensure that there is immediate access to the reversal agent naloxone. Suggested dosages:

i. Fentanyl IM/IN: 1 mcg/kg (not to exceed 100mcg)
ii. Fentanyl IV/IO: 1 mcg/kg titrate to effect at rate of 50 mcg/min slow IVP (not to exceed 100mcg)
iii. Morphine IM: 0.1 mg/kg
iv. Morphine IV/IO: 0.1 mg/kg titrate to effect at rate of 2 mg/min slow IVP (not to exceed 20 mg)

f. Consider the use of ondansetron if nausea or vomiting occurs in a child over 8kg.
i. Suggested dose: 0.1 mg/kg IV for patients 1 month-12 years
ii. Suggested dose: 4 mg IV for patients over 12 years
iii. Suggested dose: 4 mg PO children 4-12 years
iv. Suggested dose: 8 mg PO children over 12 years

8. Consider the use of antibiotics for patients with penetrating trauma, including eye injuries[vi]

a. For situation where extraction will be delayed beyond several hours, consider the one-time administration of an antibiotic under local protocol guidance to reduce to risk of infectious complications
i. Cefazolin 30 mg/kg IV (up to 2g) for open extremity or thoracic injuries
ii. Levofloxacin 16 mg/kg IV/PO (up to 750mg) for penetrating eye injuries
iii. Cefazolin (as above) plus metronidazole 15 mg/kg IV loading dose for maxillofacial trauma or involvement of the esophagus, stomach, or gut

9. Head injury

a. Consider use of a pediatric-modified GCS scale for infants and children in patients with traumatic head injuries[vii] (Appendix 2)
i. Peds GCS ≤ 12 suggests non-mild traumatic brain injury
ii. Peds GCS ≤ 8 suggests need for airway support
iii. Peds GCS ≤ 6 suggests need for surgical management of TBI

b. Restrict cervical spine motion if indicated based on mechanism of injury
i. In the absence of commercial immobilization devices, consider manual stabilization, a towel roll, or other improvised technique

c. Avoid hypoxia (see above)

d. Avoid hyper- or hypoventilation- the goal is normocarbia ($ETCO_2$ of 35-40 mmHg)

e. Treat aggressively for shock if present. Hypotension can double the mortality associated with traumatic brain injury.

f. Consider elevating the head to about 30°

g. Avoid hypothermia

10. Burn and Smoke Inhalation

a. Aggressively monitor airway and respiratory status

b. Have a low threshold for intubation if airway burns are suspected

c. Apply high-flow oxygen via non-rebreather mask if carbon monoxide toxicity is suspected
d. Have a low threshold for suspecting cyanide toxicity
    i. Symptoms are non-specific and may be similar to CO toxicity
    ii. Patients may have a "cherry red" appearance to their skin
    iii. Treatment includes oxygen and the use of an antidote:
        1. Cyanide Antidote Kit- in pediatric patients consider using only the sodium thiosulfate component of the kit at 1.5 mL/kg up to 50 mL IV. The other components of the kit contain nitrates which can cause complications in children with smoke inhalation.
        2. Hydroxocobalmin is frequently and effectively used off-label in children at a dose of 70 mg/kg up to 5 g IV over 15 minutes
e. Manage burns
    i. Use the "rule of 9's" in infants and children (see Appendix 3) or estimate burned surface area using the surface area of the palm of the patient which represents approximately 1% of the body surface area
    ii. Cover burned areas with dry, clean dressings (sterile if possible)
    iii. Aggressively mitigate hypothermia (see above)
    iv. For burns >20% TBSA begin fluid resuscitation. A suggested strategy is:
        3. If patient suffering from hemorrhagic shock as well, this condition takes priority for fluid resuscitation strategy (see above)
        4. For TBSA ≥ 20% and Weight < 30 kg
            a. Calculate estimated intravenous fluid needs
                i. >10 kg use LR, < 10kg use D5LR
                ii. 3 ml x weight in kg x %TBSA
                iii. Include previously administered fluids in total fluid amount
                iv. Administer half of calculated amount over the first 8 hours post burn (from time of injury)
                v. Administer remaining amount over the next 16 hours
                vi. In addition to burn resuscitation fluid requirements, also infuse maintenance IVF of D5LR
                    1. 4ml/kg/hr for the first 10 Kg of body weight, then 2ml/kg/hr for the next 10 Kg of body weight, then 1ml/kg/hr for the remaining Kg of body weight
        5. Proactively monitor and maintain normal blood sugars
        6. For children >30kg use adult strategy for burn resuscitation

v. Provide analgesia (see above)

11. Transfer safely

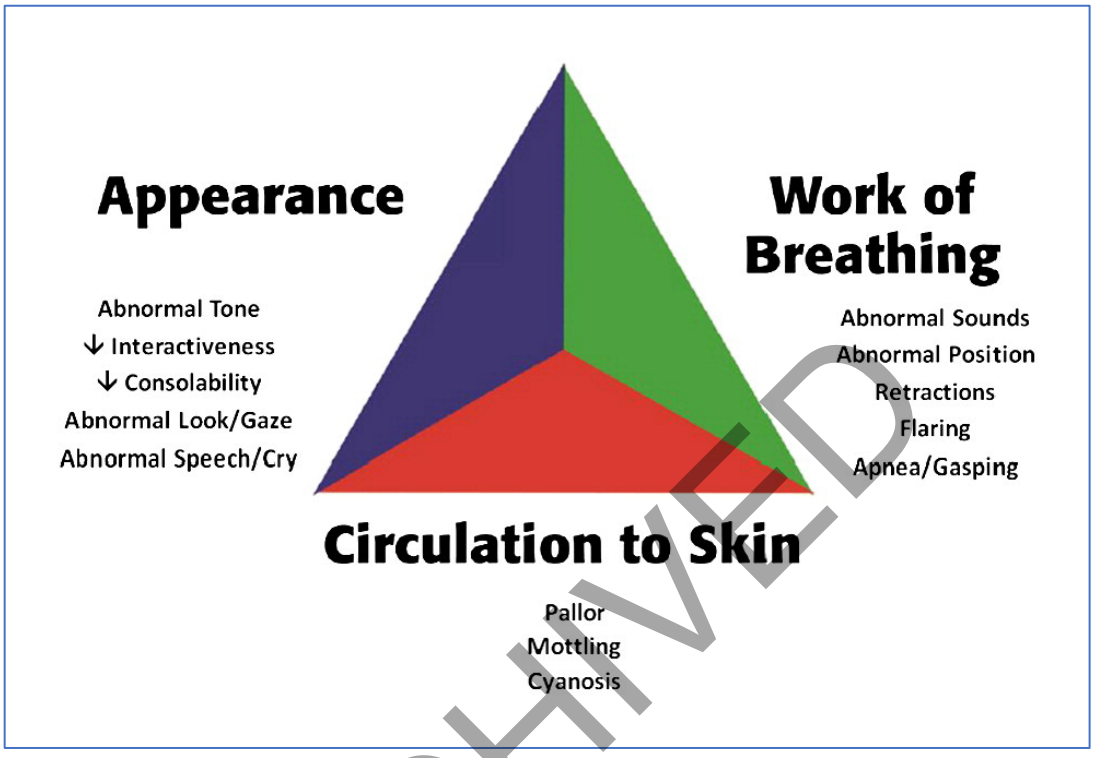
a. Ensure that proper restraints are fully applied to the victim before initiating air or ground transport:
   i. Including forward/deceleration restraints over the shoulders
   ii. Infants and very young children should be transported in a car safety seat if stable
   iii. Providers should be restrained as well
   iv. Equipment must be secured
b. Arrive safely- be judicious with the use of lights and sirens as they are a significant cause of patient and provider injuries and fatalities
c. When considering atypical transport platforms:
   i. Address preventable causes of death prior to initiating transport
   ii. If possible, patient should remain under care by a rescuer or responder (other than the vehicle operator) during transport. Maintain any lifesaving intervention initiated during prior phases.
   iii. Ideally, patient transport platform is enclosed and optimizes safety and minimizes environmental threats to the patient
   iv. Patient should be safely restrained to the extent possible
d. Consider the most appropriate receiving facility and notify them

12. Mitigate the psychosocial impact

a. With all ages of children it is important to express empathy-- tell them the truth about what to expect, warn them if something will hurt, and describe what you are doing to help them
b. Talk to the child directly if possible
c. Keep the patient with the caregiver to the extent possible
d. Use techniques of distraction as needed
   i. For infants- keys, a penlight, a pacifier or blanket
   ii. For older children- conversation, a toy, jokes, electronic device
e. Contact the caregiver if they are not with the child
f. Don’t make promises you can’t keep
g. Be calm around the patient

APPENDIX 1

Pediatric Assessment Triangle[viii]



APPENDIX 2

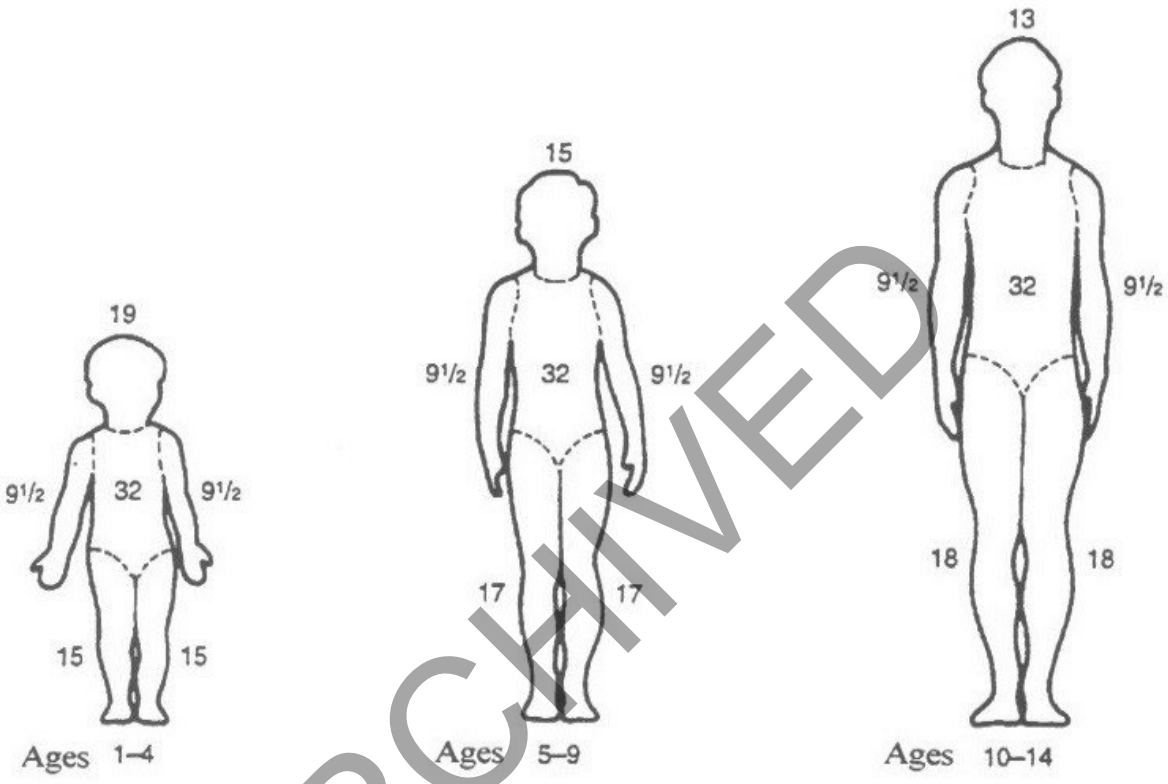
Pediatric Glascow Coma Scale[ix]

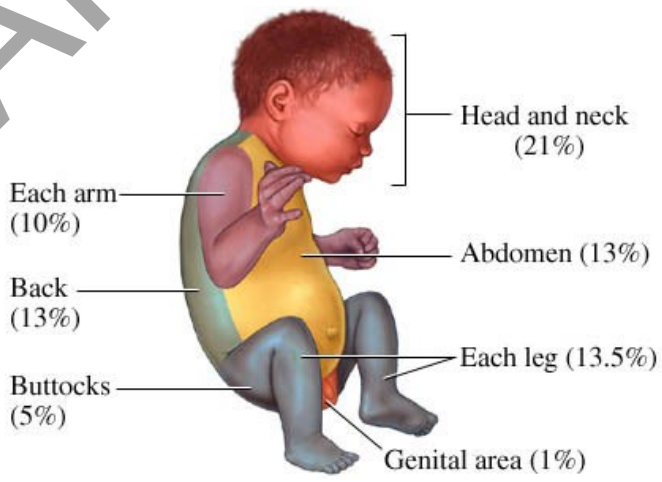
		>1 year	<1 year	
Eye opening	4	Spontaneously	Spontaneously	
	3	To verbal command	To shout	
	2	To pain	To pain	
	1	No response	No response	
Best motor response	6	Obeys	Spontaneous movements	
	5	Localizes pain	Localizes pain	
	4	Flexion-withdrawal	Flexion-withdrawal	
	3	Abnormal flexion	Abnormal flexion	
	2	Abnormal extension	Abnormal extension	
	1	No response	No response	
		>5 years	**2–5 years**	**0–23 months**
Best verbal response	5	Oriented and converses	Appropriate words and phrases	Coos and smiles appropriately
	4	Disoriented and converses	Inappropriate words	Cries
	3	Inappropriate words	Cries and/or screams	Inappropriate crying and/or screaming
	2	Incomprehensible sounds	Grunts	Grunts
	1	No response	No response	No response

APPENDIX 3

Estimating burns in the context of total body surface area (TBSA) for infant, younger child, older child, and adolescent

Courtesy of the American Burn Association





APPENDIX 4 – Limiting Factors for Pediatric Care

Direct Threat phase:

- Data is extremely limited as to the comparative effectiveness of commercial tourniquet use in the pediatric population
- A 2021 American Heart Association consensus statement suggests the use of a windlass tourniquet for life-threatening bleeding in the pediatric population, but does not recommend for or against other styles of tourniquet. For children with extremities that do not allow adequate tightening of a windlass tourniquet, the recommendation is for direct manual pressure and the use of hemostatic dressing[x].
- A 2021 systematic review found that commercial windlass tourniquets were typically able to obtain hemostasis in children as young as 2 years old with minimal arm circumference of 13 cm (5.1 in)[xi].

Indirect Threat phase:

1. Some EMS systems have discontinued the use of pediatric intubation given the availability of less invasive airway management options that pose less risk to the patient, such as bag-valve-mask ventilation with or without airway adjuncts such as nasopharyngeal and oropharyngeal airways, or supraglottic airways.
2. Observational studies have repeatedly documented that both in-hospital and field EMS providers tend to hyperventilate patients of all ages when they are supporting ventilations mechanically. Hyperventilation can worsen the physiologic response to trauma and decrease survival through mechanisms such as increasing intrathoracic pressure, diminishing venous return, decreased coronary perfusion pressure, and vomiting.

Evacuation phase:

1. Whole blood transfusion continues to be validated as safe for pediatric trauma in >1 year old in a 2021 review by the American Association of Blood Banks Clinical Transfusion Medical Committee. Recent observational data provides a rationale for current limited use with a trend toward superior outcomes[xii].
2. While infants <1 year do routinely receive PRBC and FFP in the neonatal ICU for catastrophic bleeding, there is very limited data about the resuscitation of infants with whole blood or PRBCs, especially in the setting of traumatic injuries
3. Evidence for or against the pediatric use of tranexamic acid (TXA), a plasminogen inhibitor, is limited for pediatric patients, especially in the prehospital setting. A 2021 meta-analysis found that TXA use in pediatric trauma patients did not significantly affect in-hospital outcomes and is associated with a higher risk of seizures and a trend towards lower risk of thromboembolism[xiii], however a military study from 2014 demonstrated

that TXA was used in about 10% of 766 pediatric combat trauma patients, and was associated with decreased mortality with no adverse complications identified[xiv]. A small randomized clinical trial intending to explore the feasibility of a larger study was published in 2022 and demonstrated no statistical significance of measured clinical outcomes[xv].

4. While hypocalcemia in the pediatric trauma patient is well established and likely correlates with increased mortality, there is extremely limited information about the use of calcium in pediatric field trauma resuscitation. The treatment of hypocalcemia is variable in the pediatric patient and can be complex[xvi]. Consult local medical direction.

APPENDIX 5 – CTECC Best Practice Recommendations

Direct Threat Care:

- Responders must be familiar with the limitations and use of the equipment they carry and have a PACE plan for exsanguinating hemorrhage in a patient with small extremities, such as applying direct or circumferential pressure with:
    - Primary: Use commercial windlass tourniquet
    - Alternate: Use commercial elastic tourniquet
    - Contingency: Use a tightly stretched elastic or polymer compression bandage (e.g., ACE® bandage)
    - Emergency: Apply direct pressure and hemostatic dressing
- Patient age, coping skills, and maturity level will determine their ability to take direction and share information in a life-threatening crisis. Some children will not be able to follow even the simplest directions under extreme conditions, and responders must be prepared to assume positive control over the situation. Other children may be highly capable of assisting themselves or others.

Indirect Threat Care:

- Do not delay the initiation of ventilatory support to set up supplemental oxygen equipment. It is far more important to immediately begin respiratory support if needed using room air. Oxygen can be added later if need be.
- Utilize length-based tapes to estimate patient weight for medication dosing as provider and parent estimates of pediatric patient weight are often inaccurate
- Ketamine is gaining popularity for analgesia in trauma patients of all ages (> 3 months), including those with head injuries given its favorable side effect profile. Ketamine should not be used in patients 3 months or younger, however[xvii].

Evacuation Care:

- If a department or agency has a blood transfusion or TXA administration protocol in place for prehospital providers, consider including pediatric patients

APPENDIX 6 – Skills Sets and Information to Reinforce with Training

Direct Threat:

- Application of size-appropriate tourniquet using commercial and field-expedient devices
- Rapid positioning of patient to protect airway
- Tactical casualty extraction to definitive care

Indirect Threat

- While these guidelines include some interventions that are dependent on availability of certain medical equipment, the priority here is still on basic lifesaving interventions using simple skills
- Pediatric patients can compensate for shock differently than adults—they may appear to be well for longer and then rapidly deteriorate
- Infants and children have a smaller circulating blood volume than adults
    - A 4 kg (9 lb) infant has about 350 mL (12 oz.) total blood volume
    - A 35 kg (80 lb) child has about 2500 mL (just over ½ a gallon)
    - For comparison, an adult has about 5000 mL (just under 1 ½ gallons)
- Infants and young children have different normal respiratory rates (faster) based on age[xviii] so it is important to rely on a more holistic assessment of breathing adequacy
- Altered mental status and the presence of a delayed (>2 second) capillary refill time are important indicators of likely shock in the pediatric patient. Consider assessing capillary refill time on the forehead as well as extremities.
- Infants and young children are at an extreme risk for hypothermia due to an increased surface to body ratio. Hypothermia decreases the chance for a successful outcome in trauma patients of all ages, but especially in younger children.
- D_{10}, D_{25}, and D_{50} can all be used as a source for IV dextrose
- Where possible, infants typically receive D_{10}. Children can receive D_{25}. If necessary, dilute D_{50} prior to administration to reduce the risk of a serious injury if an IV infiltration occurs.
- Head injuries are common in pediatric patients. Infants and younger children have relatively large and heavy heads that can predispose them to injuries during falls, accidents, and violent incidents.
- A GCS <9 or deteriorating GCS is suggestive of a serious traumatic brain injury

Skills Sets to Reinforce:

- Hemorrhage Control
    - Apply tourniquet
    - Apply direct pressure

  - Apply pressure dressing
  - Apply wound packing
  - Apply hemostatic agent

- Airway:
  - Apply manual airway maneuvers (chin lift, jaw thrust, recovery position, shoulder elevation)
  - Insert nasopharyngeal airway
  - Insert supraglottic device
  - Perform tracheal intubation
  - Perform needle cricothyrotomy

- Breathing:
  - Application of effective occlusive chest seal
  - Assist ventilations with Bag Valve Mask
  - Apply oxygen
  - Apply occlusive dressing
  - Perform needle chest decompression

- Circulation:
  - Gain intravascular access
  - Gain intraosseous access
  - Apply saline lock
  - Calculate and administer IV/IO medications and IV/IO fluids

- Wound management:
  - Apply eye shield
  - Apply dressing for evisceration
  - Apply extremity splint
  - Apply pelvic binder

- Initiate Basic Burn Treatment

- Initiate Treatment for Traumatic Brain Injury

- Prepare Casualty for Evacuation:
  - Move casualty (drags, carries, lifts)
  - Apply spinal immobilization devices
  - Secure casualty to litter
  - Initiate hypothermia prevention

- Other Skills:
  - Perform hasty decontamination
  - Blood glucose monitoring
  - Initiate casualty monitoring

  - Establish casualty collection point
  - Perform triage
  - Utilize length-based tapes for weight estimation and medication dosing
-

Evacuation

- CO toxicity symptoms are nonspecific- most common are headache, nausea, vomiting, and altered mental status. Serious cases can result in coma, arrhythmia, and seizures.
- Pulse oximetry is not useful for screening for CO toxicity, but pulse CO-oximetry is a new capability on some devices in the field, and it is useful for screening for possible CO toxicity as well as monitoring the recovery

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