CPP TCCC

COMBAT PARAMEDIC/
PROVIDER

TACTICAL COMBAT CASUALTY CARE COURSE

MODULE 10:
SHOCK RECOGNITION AND MANAGEMENT

Committee on Tactical Combat Casualty Care (CoTCCC)

TCCC TIER 1
All Service Members

TCCC TIER 2
Combat Lifesaver

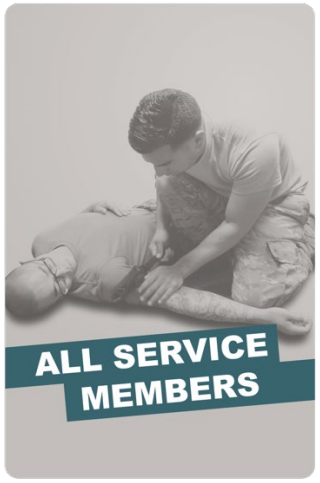
TCCC TIER 3
Combat Medic/Corpsman

TCCC TIER 4
Combat Paramedic/Provider

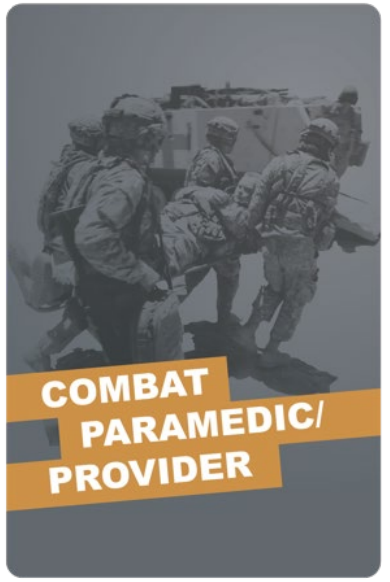
TACTICAL COMBAT CASUALTY CARE (TCCC) ROLE-BASED TRAINING SPECTRUM

ROLE 1 CARE

NONMEDICAL PERSONNEL



MEDICAL PERSONNEL



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STANDARDIZED JOINT CURRICULUM

CPP TCCC

Module 10: Shock Recognition and Management

3 x TERMINAL LEARNING OBJECTIVES

10 Describe shock assessment in Tactical Field Care in accordance with CoTCCC Guidelines.

- **10.1** Identify the signs, symptoms, and management steps of shock in a trauma casualty with life-threatening bleeding.
- **10.2** Identify the importance of level of consciousness and radial pulse as indicators of shock in Tactical Field Care.
- **10.3** Describe the lethal triad of hemorrhagic shock.
- **10.4** Identify signs, symptoms, and potential causes of refractory shock in Tactical Field Care.
- **10.5** Identify any evidence-based medicine, best practices, casualty data, and Subject Matter Expert consensus on the management of hemorrhagic shock in Tactical Field Care.

11 Given a combat or noncombat scenario, perform intravenous or intraosseous access on a trauma casualty during Tactical Field Care in accordance with CoTCCC Guidelines.

- **11.1** Identify the indications, contraindications, and preferred methods of intravenous access in Tactical Field Care.
- **11.2** Demonstrate the initiation of a field-ruggedized intravenous saline lock in Tactical Field Care.
- **11.3** Identify the indications, contraindications, and preferred methods of intraosseous access in Tactical Field Care.
- **11.4** Demonstrate the initiation of an intraosseous access in Tactical Field Care.
- **11.5** Demonstrate intravenous and intraosseous fluid administration in Tactical Field Care.
- **11.6** Identify any evidence-based medicine, best practices, casualty data, and Subject Matter Expert consensus on the indications and limitations of intravenous/intraosseous access in Tactical Field Care.

14 x ENABLING LEARNING OBJECTIVES

= **Terminal Learning Objectives** ● = Cognitive ELOs ▨ = Performance ELOs

3 x TERMINAL LEARNING OBJECTIVES

12 Given a combat or noncombat scenario, perform tranexamic acid administration on a bleeding trauma casualty in accordance with CoTCCC Guidelines.

- **12.1** Identify the TCCC indications, contraindications, and administration methods of tranexamic acid.
- **12.2** Demonstrate administration of tranexamic acid to a trauma casualty in Tactical Field Care.
- **12.3** Identify any evidence-based medicine, best practices, casualty data, and Subject Matter Expert consensus on the indications, contraindications, and administration methods of tranexamic acid in Tactical Field Care.

13 x ENABLING LEARNING OBJECTIVES

= **Terminal Learning Objectives** = Cognitive ELOs = Performance ELOs

MARCH PAWS

LIFE-THREATENING

- **M** MASSIVE BLEEDING — #1 Priority
- **A** AIRWAY
- **R** RESPIRATION *(Breathing)*
- **C** CIRCULATION
- **H** HYPOTHERMIA / HEAD INJURIES

AFTER LIFE-THREATENING

- **P** PAIN
- **A** ANTIBIOTICS
- **W** WOUNDS
- **S** SPLINTING

ETIOLOGY AND PHYSIOLOGY OF SHOCK

SHOCK – cellular and tissue hypoxia leading to organ damage and, if not treated, death

- Shock is **life-threatening**
- Most commonly manifested as **hypotension**

Types of shock:

- Distributive (sepsis, anaphylaxis)
- Cardiogenic (myocardial infarction or heart failure)
- Obstructive (massive pulmonary embolism)
- **HYPOVOLEMIC** (massive hemorrhage or burns)*

*Almost all shock in the Tactical Field Care setting is hypovolemic

⚠ Hemorrhagic shock can result in the casualty's **death**

Level of Evidence: B-NR

MARCH

SIGNS AND SYMPTOMS OF SHOCK

RELIABLE indicators of shock assessment in TFC:

Altered Mental Status

Weak or absent radial pulses

Tachycardia

Tachypnea

Cyanosis

Diaphoresis

Lethargy

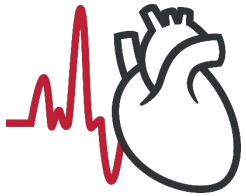
Polydipsia

Nausea & Vomiting

Make sure you frequently assess casualties during TFC for signs of shock.

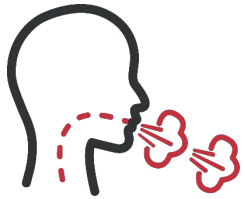
MARCH

SIGNS AND SYMPTOMS OF SHOCK *(cont.)*



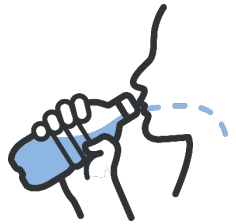
Tachycardia

Tachycardia is typically the first abnormal vital sign of hemorrhagic shock



Tachypnea

When cardiovascular changes occur, it could then cause tachypnea

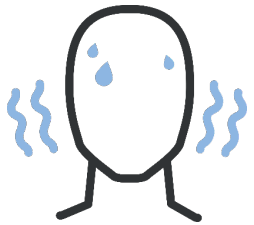


Excess Thirst

Rapid and substantial loss of blood or decreases in intravascular volume can cause dehydration

Cyanosis

The body's response to blood loss are compensatory in nature



Diaphoresis

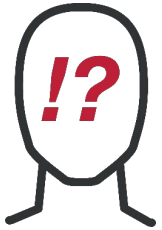
High levels of epinephrine and other related hormones release to counteract the shock

Nausea and/ or vomiting

When the body begins to overcompensate it will release non-vital fluids and chemicals

MARCH

SIGNS AND SYMPTOMS OF SHOCK *(cont.)*



Level of Consciousness

Altered Mental Status

Altered Level of Consciousness as blood shunts from the cortex to preserve brainstem function

Check casualty every 15 minutes for **AVPU**

- **A**lertness - Knows who, where they are
- **V**erbal - Orally responds to verbal commands
- **P**ain – Level of pain felt when the sternum is briskly rubbed with the knuckle (**if needed**)
- **U**nconscious - Unresponsive

Pulse Assessment

Weak or absent radial pulses

Diminishing Peripheral Pulses as blood is diverted to preserve essential organs

Assess for weak or absent **radial pulses** and confirm all **bleeding control** measures are still effective

It is better to prevent shock with hemorrhage control than to treat it

DO NOT WAIT for signs and symptoms of shock to occur

MARCH

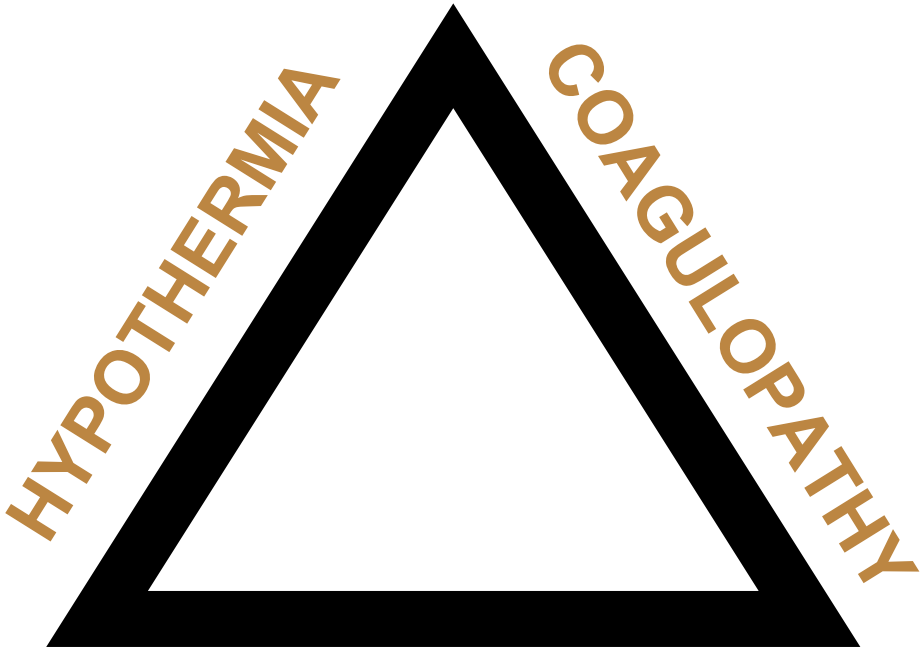
PROGRESSIVE CHANGES IN SHOCK

	Blood Volume	Blood Loss	Signs/Symptoms	Effects/Outcome
	**4,500 ml**	**500 ml**	Possible mild tachycardia	Usually, no effects
	**4,000 ml**	**1,000 ml**	Radial pulse >100 Normal respiratory rate	Low likelihood of effects, if bleeding stopped
	**3,500 ml**	**1,500 ml**	Mental status changes Weak radial pulse >100 Tachypnea	Requires quick management, but not necessarily fatal
	**3,000 ml**	**2,000 ml**	Confusion and lethargy Very weak radial pulse >120 Significant tachypnea	Fatal if not managed properly
	**2,500 ml**	**2,500 ml**	Unconscious No radial pulse or carotid pulse HR >140 Respiratory rate >35	Fatal without immediate and rapid interventions

MARCH

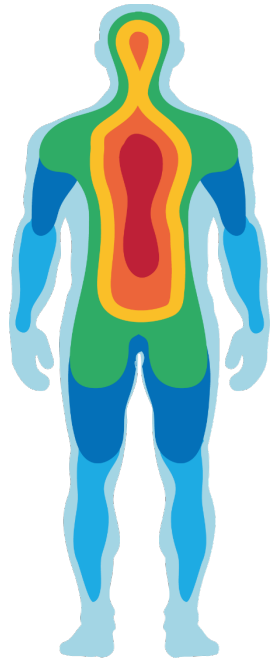
THE LETHAL TRIAD OF HEMORRHAGIC SHOCK

- **Direct losses** of **clotting factors** and **platelets**
- **Hemodilution** from IV fluids
- **Clotting factor dysfunction** from hypothermia



Buildup of **lactic acid**

- **Environmental** factors
- **Physiologic response** to **BLOOD LOSS**



Level of Evidence: B-NR

LETHAL TRIAD
PREVENTIVE MEASURES

PREVENTATIVE MEASURES Include:

- Control Hemorrhage
- Prevent and treat shock
- Fluid resuscitation
- Hypothermia (active/passive)
- Reassess frequently for recurrence

INDICATIONS for establishing IV access:

- Shock
- Significant risk of developing shock
- Needs medications, **cannot** take orally

⚠ **Not every** casualty needs an IV

- **18-gauge IVs** are adequate, even for rapid blood transfusions
- **Flush saline locks** after insertion and every 2 hours
- When administering fluids, secure the IV lines to avoid dislodging the catheter

Field-ruggedized **SALINE LOCK ADVANTAGES**:

- **Easier to move a casualty** without an IV line and bag
- **Less likely to dislodge** during movement
- Conservation of limited IV fluids
- **Rapid IV access** is still available
- **Reduced equipment loads** for the Combat Medic

MARCH

REFRACTORY HEMORRHAGIC SHOCK

REFRACTORY SHOCK is potentially a fatal manifestation of cardiovascular failure with inadequate response to shock interventions resulting in ***poor tissue perfusion, hypotension*, and *organ failure*.**

Signs and Symptoms:

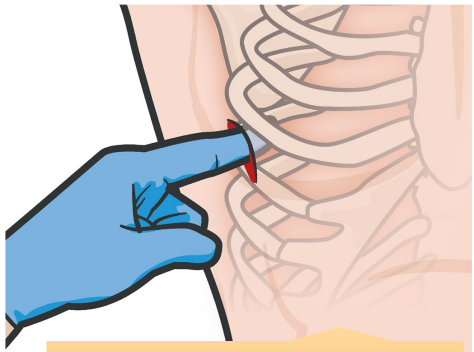
- Thoracic trauma
- Persistent respiratory distress
- Absent breath sounds
- SPO2 < 90%

If a casualty in shock is not responding to fluid resuscitation, **CONSIDER** unrecognized tension pneumothorax (PTX)

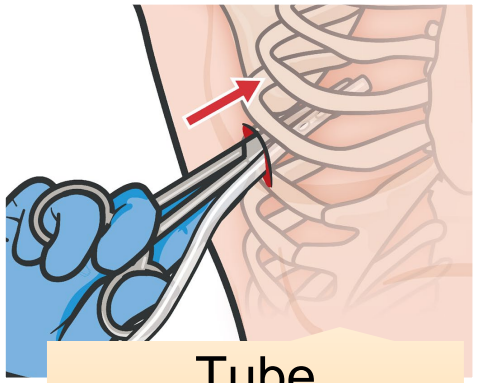
Level of Evidence: B-NR

If not already done, perform needle decompression of the chest (NDC), up to 2 times

If shock persists, perform a finger thoracostomy or chest tube insertion



Finger Thoracostomy



Tube Thoracostomy

Consider injury to the other side, as well

MARCH

INDICATIONS/METHODS OF INTRAVENOUS (IV) ACCESS

Indications for establishing IV access:

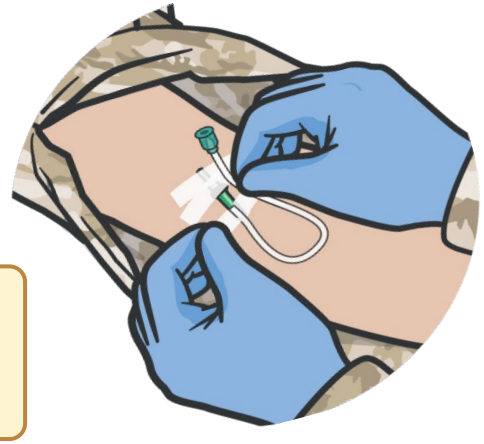
- Shock or significant risk of developing shock
- **Cannot** take medications orally

⚠ **Not every** casualty needs an IV

- **18-gauge IVs or Saline Lock** are preferred, even for rapid blood transfusions
- **Flush saline locks** after insertion and every 2 hours
- When administering fluids, **secure the IV** lines to avoid dislodging the catheter

Field-ruggedized saline lock advantages:

- Easier to move a casualty without an IV line and bag
- Less likely to dislodge during movement
- Conservation of limited IV fluids
- Rapid IV access is still available
- Reduced equipment loads

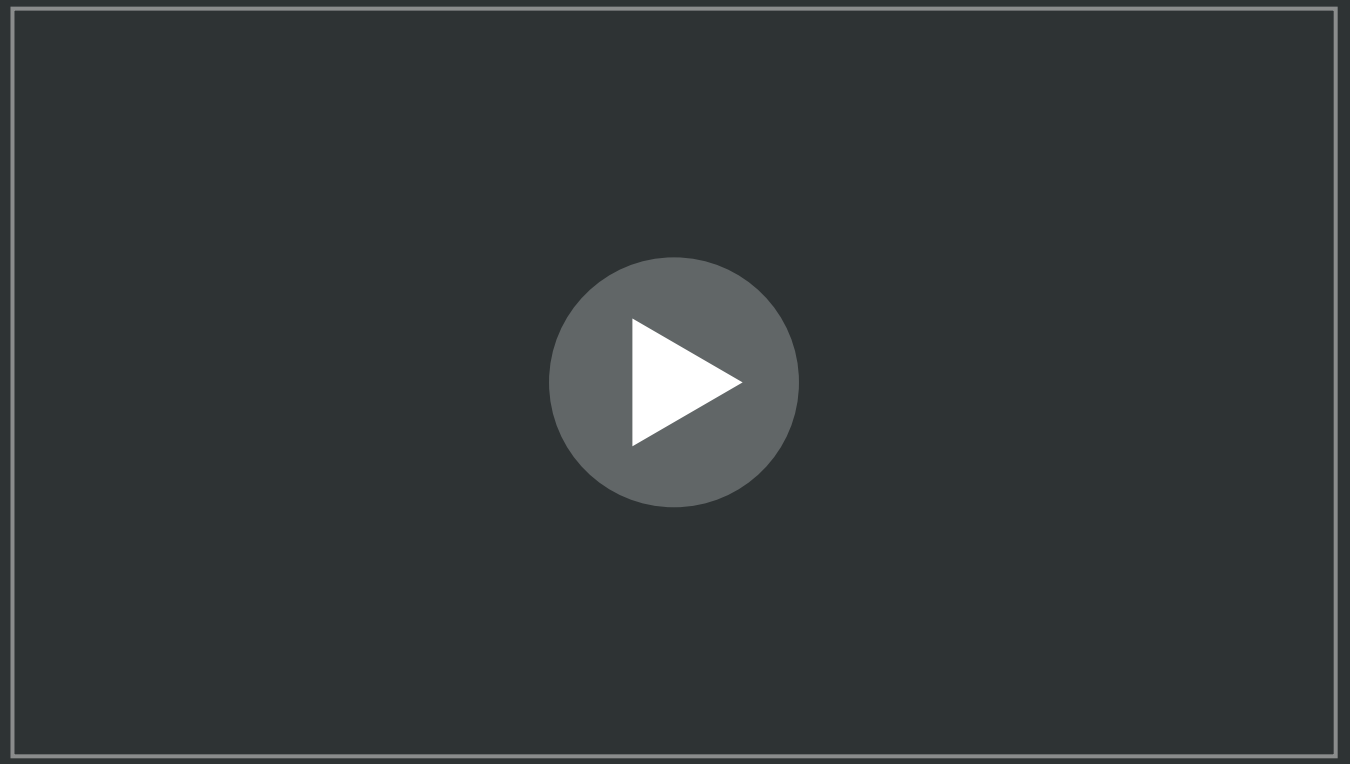


⚠ **Contraindication:**
Trauma proximal to IV Site

ℹ **Level of Evidence:** B-NR

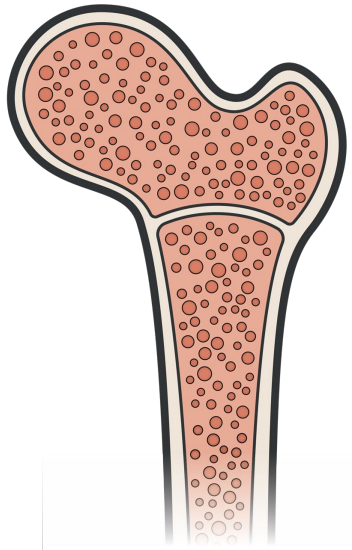
MARCH

FIELD-RUGGEDIZED IV SALINE LOCK



Video can be found on deployedmedicine.com

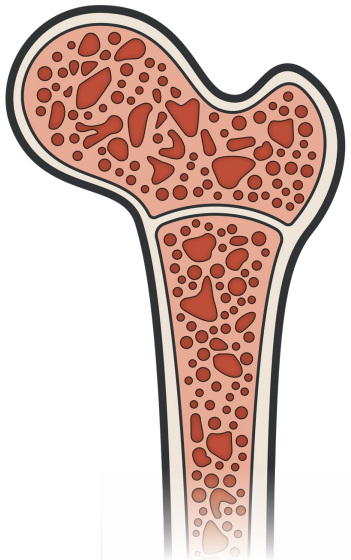
INDICATIONS/CONTRAINDICATIONS OF INTRAOSSEOUS (IO) ACCESS



Healthy Bone

INDICATIONS for establishing IO access:

- Two failed peripheral vascular access attempts
- IV access was difficult or unattainable
- Intraosseous access has a higher success rate when compared to IV access in limited visibility environments



Osteoporosis

CONTRAINDICATIONS for establishing IO access:

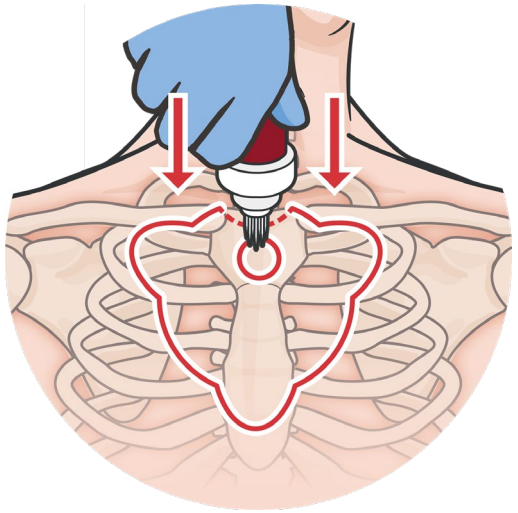
- Fractures, infections, and/or injury at the IO site
- Osteoporosis
- Osteogenesis imperfecta
- **FAST1®** Casualties of small stature or less than 50 kg (110 lbs)
- Significant chest trauma (in particular a flail chest)
- Scar indicating a prior sternotomy

⚠ **OSTEOMYELITIS**, can result from IO devices

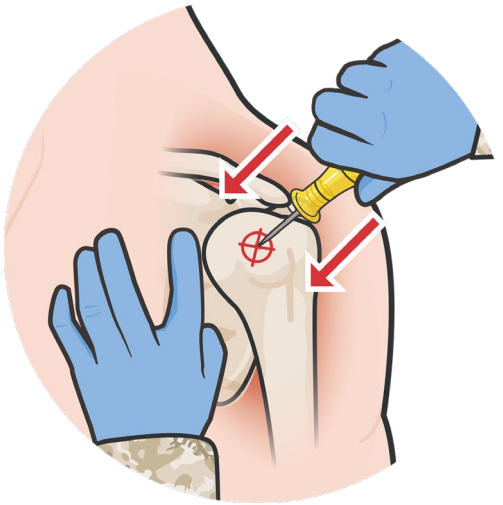
MARCH

METHODS OF INTRAOSSEOUS (IO) ACCESS

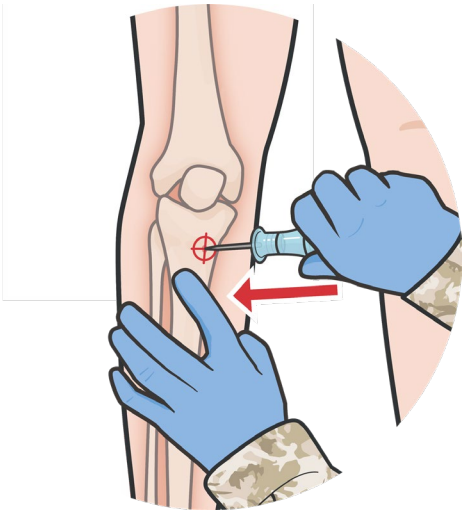
- IO access is preferred when IV vascular access is not quickly obtainable
- Starting IVs on casualties in shock is challenging; IO techniques do not rely on expanded veins
- There is **NO** list of specific CoTCCC-recommended IO devices



FAST1® Sternum
Flow Rate: **469 ml**
(5 min under pressure)



EZ-IO® Humerus
Flow Rate: **286 ml**
(5 min under pressure)



EZ-IO® Tibia
Flow Rate: **154 ml**
(5 min under pressure)

⚠ Avoid **FAST1** devices in casualties with significant chest injuries or small in stature

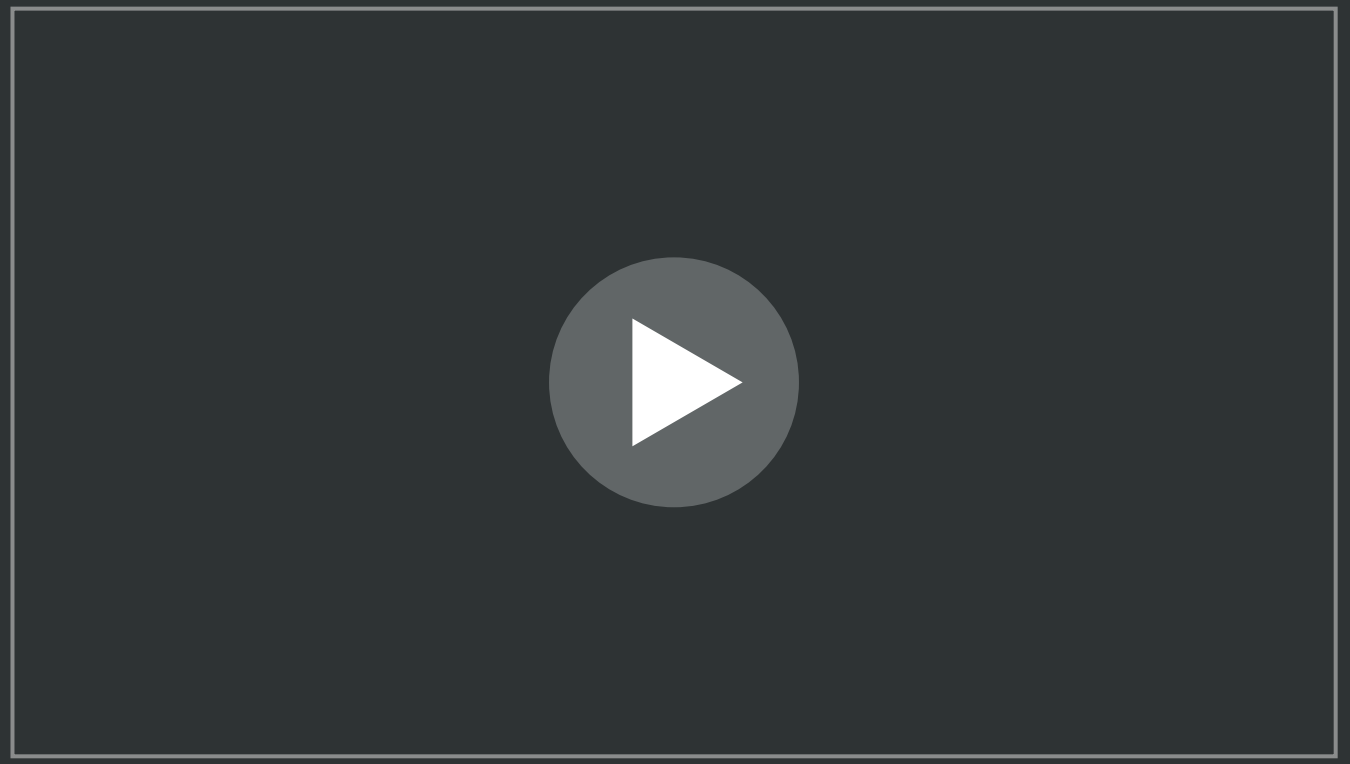
⚠ **EZ-IO** can be inserted manually or with drill kits

EZ-IO has varying needle sizes based on insertion site and casualty size

Level of Evidence: B-NR

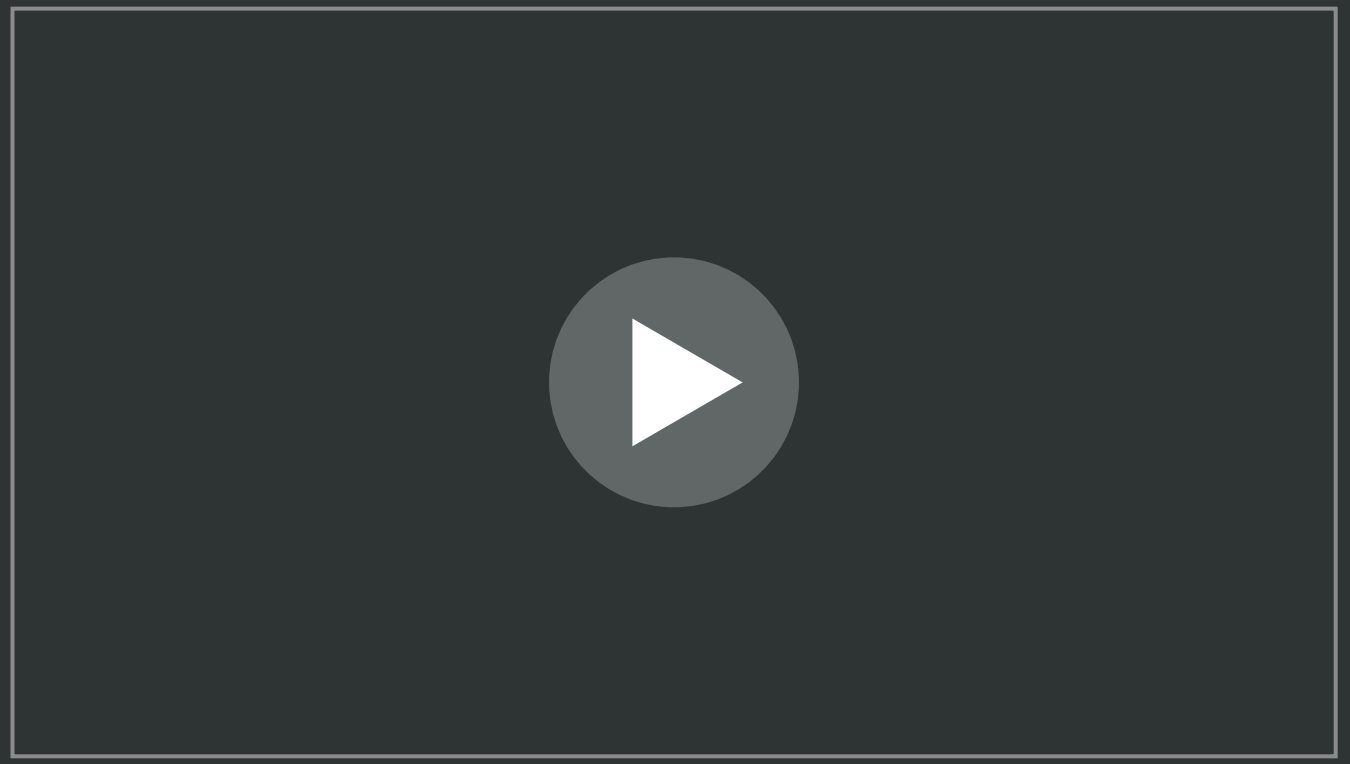
MARCH

FAST1® INTRAOSSEOUS ACCESS



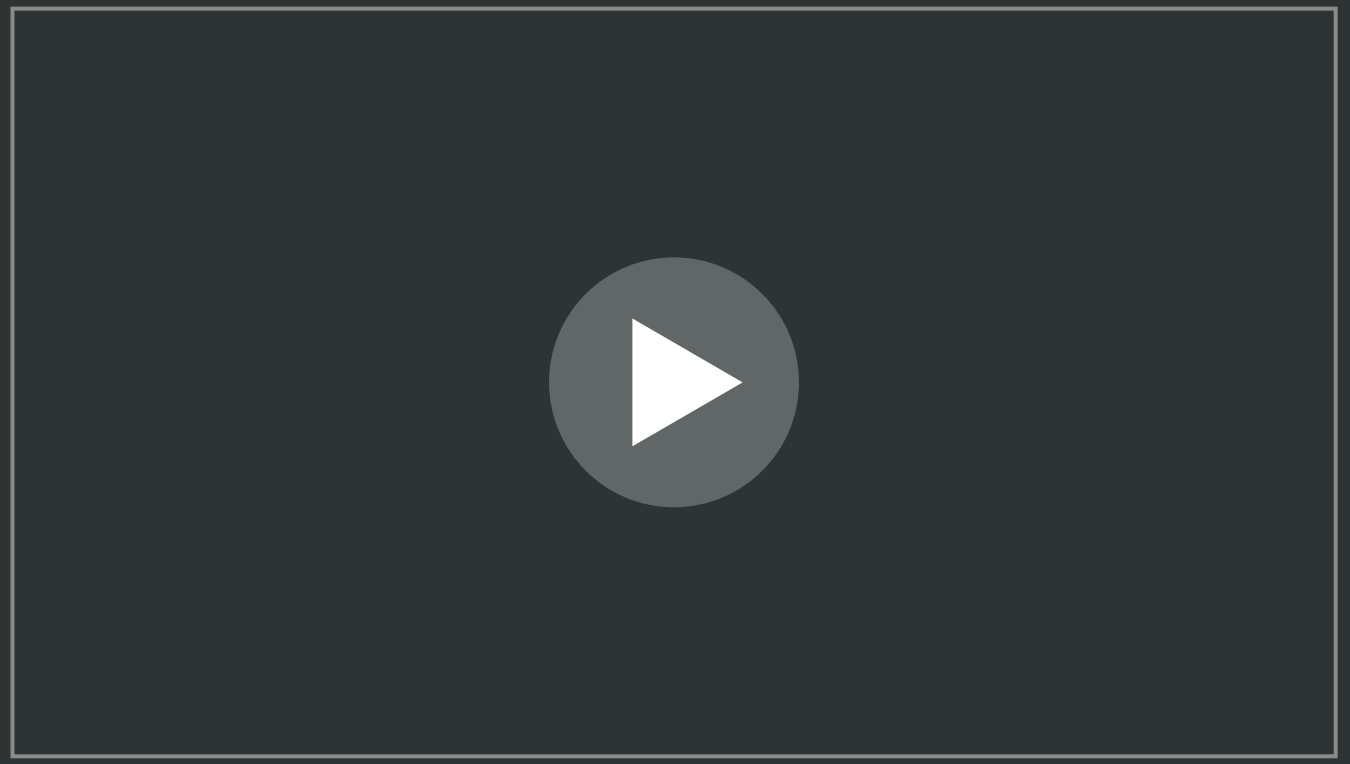
Video can be found on deployedmedicine.com

EZ-IO® HUMERUS INTRAOSSEOUS ACCESS



Video can be found on deployedmedicine.com

EZ-IO® TIBIA INTRAOSSEOUS ACCESS



Video can be found on deployedmedicine.com

TXA Evidence-Based Research

TXA Evidence-Based Research from TCCC Proposed Change Paper 20-02		
Proposed Change Questions	**Answer:**	**Rationale:**
Can TXA Be Safely Given as a Slow (1-minute) IV Push rather than over 10 minutes?	YES	We recommend that TXA administration should be an IV/IO slow push. This bolus should be given over approximately 1 minute without adverse outcomes or observed hypotension.
Should the Second Dose of TXA Be Administered If More Than 3 Hours Have Elapsed Since the Time of Wounding?	NO	There is not enough data at the present time to recommend redosing in the prehospital setting.
If removed from glass vials in preparation for administration, how long can TXA be kept in a syringe?	UNKNOWN	Although TXA is very stable throughout a range of temperatures for several days, there are no studies to support storage outside of the original packaging (for example, in a pre-drawn syringe).
Can TXA Be Given in the Same IV/IO Line as Blood/Blood Products?	YES	There is no known contraindication to administration of TXA with blood or blood products. If blood or blood products are being given, the recommendation is giving TXA in the port closest to the skin.
Can TXA Be Administered through the Same Line as Hextend?	YES/NO	Yes, it can be administered through the same line, but Hextend is no longer one of the recommended fluids for resuscitation in accordance with the TCCC Guidelines.

TRANEXAMIC ACID (TXA) INDICATIONS AND CONTRAINDICATIONS

- TXA widely used for decades in surgical settings
- TXA **does not** promote clotting, it **helps prevent clots from dissolving**
- Multiple studies have demonstrated improved mortality and morbidity in severe bleeding and in traumatic brain injury (TBI)
- Noncompressible hemorrhage is now the cause of up to **67%** of hemorrhagic deaths

INDICATIONS for administering TXA include:

- Hemorrhagic shock
- Elevated lactate
- One or more major amputations
- Penetrating torso trauma
- Evidence of severe bleeding

OR

- Signs or symptoms of significant TBI
- Altered mental status associated with blast injury or blunt trauma

Contraindication:
Prior allergic reaction to TXA

Level of Evidence: A

M A R C H

TXA ADMINISTRATION

DOSAGE:

2 gm *slow IV or IO push, as soon as possible (NOT later than 3 hours after injury)*

ROUTE(S):

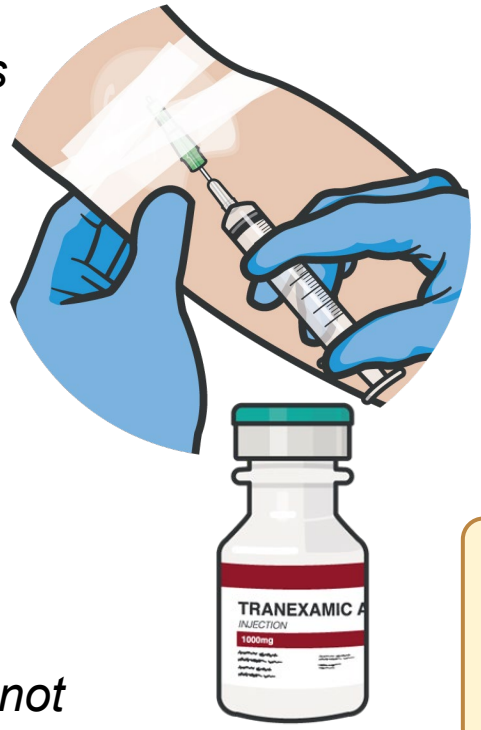
Tranexamic Acid is available IV or IO form

ONSET/PEAK/DURATION:

30 sec-5 min/30 min-2 hr/24 hr

TACTICAL CONSIDERATIONS:

Administer as soon as possible but *not later than 3 hours after injury*



POTENTIAL SIDE EFFECTS:

Blurred vision or impaired color vision, nausea, vomiting, diarrhea (temporary)

DRUG INTERACTIONS:

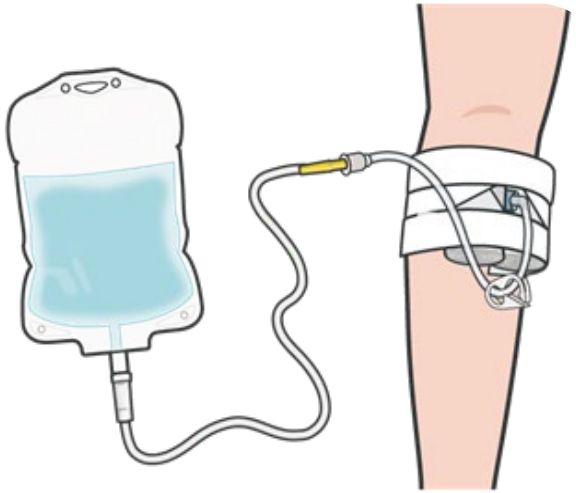
Factor IX complex concentrates or anti-inhibitor coagulant concentrates (risk of thrombosis may be increased)

NOTE: TXA can be safely administered in the same IV line as blood and CoTCCC recommended fluids of choice

MARCH

INTRAOSSEOUS AND INTRAVENOUS FLUID ADMINISTRATION

KEY POINTS OF IV/IO ADMINISTRATION
GATHER ALL needed supplies
PREPARE fluids and infusion set tubing (**NOTE:** Close the clamp on the tubing set)
SPIKE the fluid bag with the tubing spike and hang the bag or place in a pressure bag
SQUEEZE the drip chamber until ½ full
OPEN the tubing clamp to prime the tubing and **CLOSE** the clamp once primed
CLEAN the IV or IO tubing extension with alcohol or povidone-iodine pad
INSERT the needle into the IV/IO extension set and **SECURE** it in place; **INITIATE** the flow of fluids
CHECK for signs and symptoms of infiltration at the infusion site
MONITOR the casualty and **DOCUMENT** all findings on the DD Form 1380 Casualty Card



NOTE: Attach an 18-gauge needle/catheter or if using blood products, use at least a 16-gauge needle/catheter (preferred)

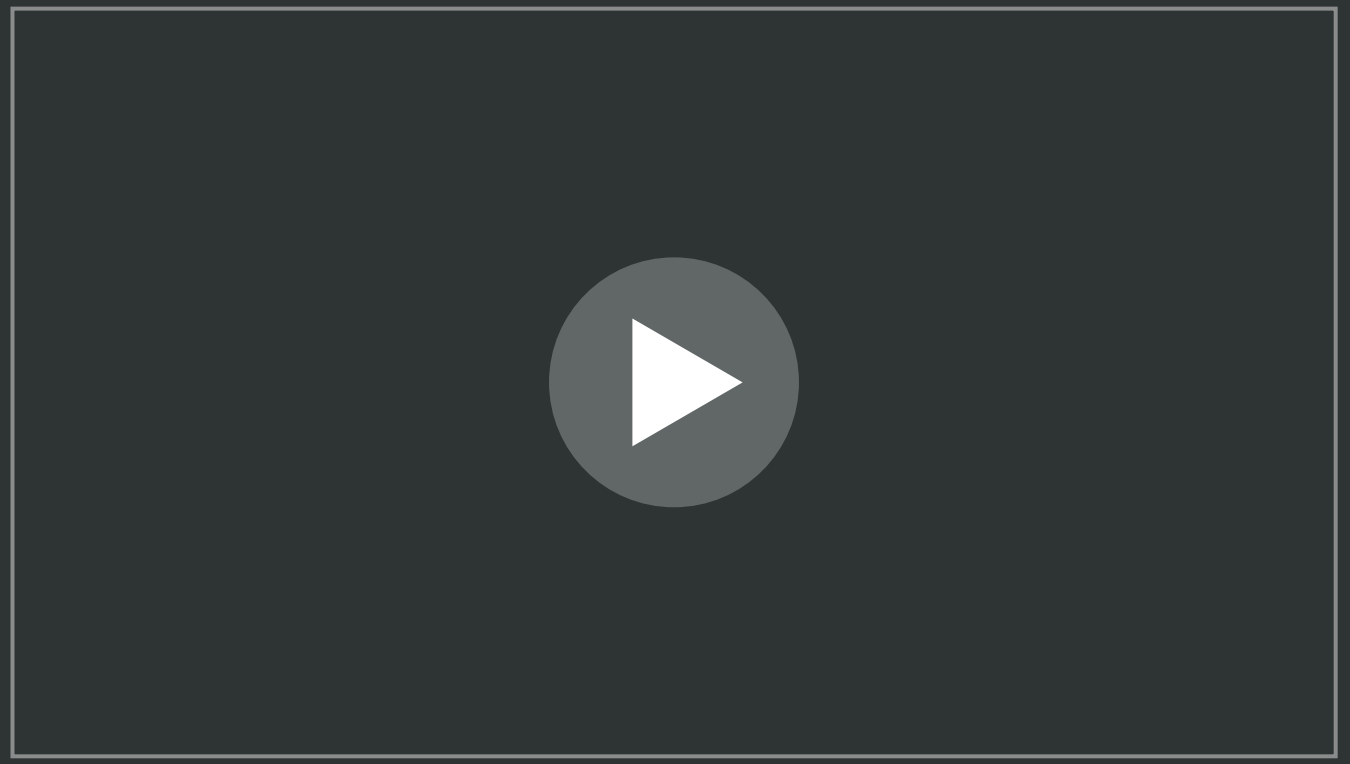
MARCH

SKILL STATION

Intravenous and Intraosseous Access, TXA and Fluid Administration Skill Stations

- Field-Ruggedized IV Saline Lock Insertion
- FAST1 Intraosseous Access
- EZ-IO Intraosseous Access
- TXA Administration
- Intravenous and Intraosseous Fluid Administration

CIRCULATION (SHOCK RECOGNITION AND MANAGEMENT) OVERVIEW



Video can be found on deployedmedicine.com

EVIDENCE SUPPORTING SHOCK MANAGEMENT STRATEGIES

Subject Category	Study Types	Level of Evidence
Shock Recognition and Management	Retrospective Observational Study	**B-NR**
Refractory Shock Treatment	Retrospective Observational Study	**B-NR**
Intravenous Access in Shock Management	Retrospective & Prospective Observational Study	**B-NR**
Intraosseous Access in Shock Management	Meta-analysis of Randomized and Non-randomized studies	**B-NR**
Tranexamic Acid in Shock Management	Randomized controlled study-high quality	**A**

ASSESSING THE EVIDENCE FOR GUIDELINES

Level of Evidence	AHA Recommendation System Terminology Explanation	Why the AHA Classification System?
A	Evidence from multiple randomized clinical trials (RCT) with concordant results or from **HIGH-QUALITY** meta-analyses.	• The level of evidence recommendations allow readers to quickly glean information on the strength, certainty, and quality of evidence supporting each recommendation. • A recommendation with Level of Evidence (LOE) C does not imply that the recommendation is weak. • Although, RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.
B-R	Evidence from moderate-quality trials, or a meta-analysis of moderate quality (RCT) followed by an R to denote **RANDOMIZED** studies	
B-NR	Evidence from moderate-quality trials, or a meta-analysis of moderate quality followed by NR to denote **NON-RANDOMIZED** studies	
C-LD	There is no convincing evidence and is followed by LD to indicate **LIMITED DATA**	
C-EO	There is no convincing evidence and is followed by EO if the consensus is based on **EXPERT OPINION**, case studies or standards of care.	

SUMMARY

Knowledge Topics

- Signs and symptoms of **shock**
- Use of **peripheral pulses** and **mental status** to identify shock
- The **lethal triad** of hemorrhagic shock
- Signs and Symptoms of **refractory shock**
- Indications for establishing both **intravenous** and **intraosseous** access
- Indications for administering **TXA**
- **Level of evidence** supporting shock recognition, IV/IO access, and TXA administration

Skills and Abilities

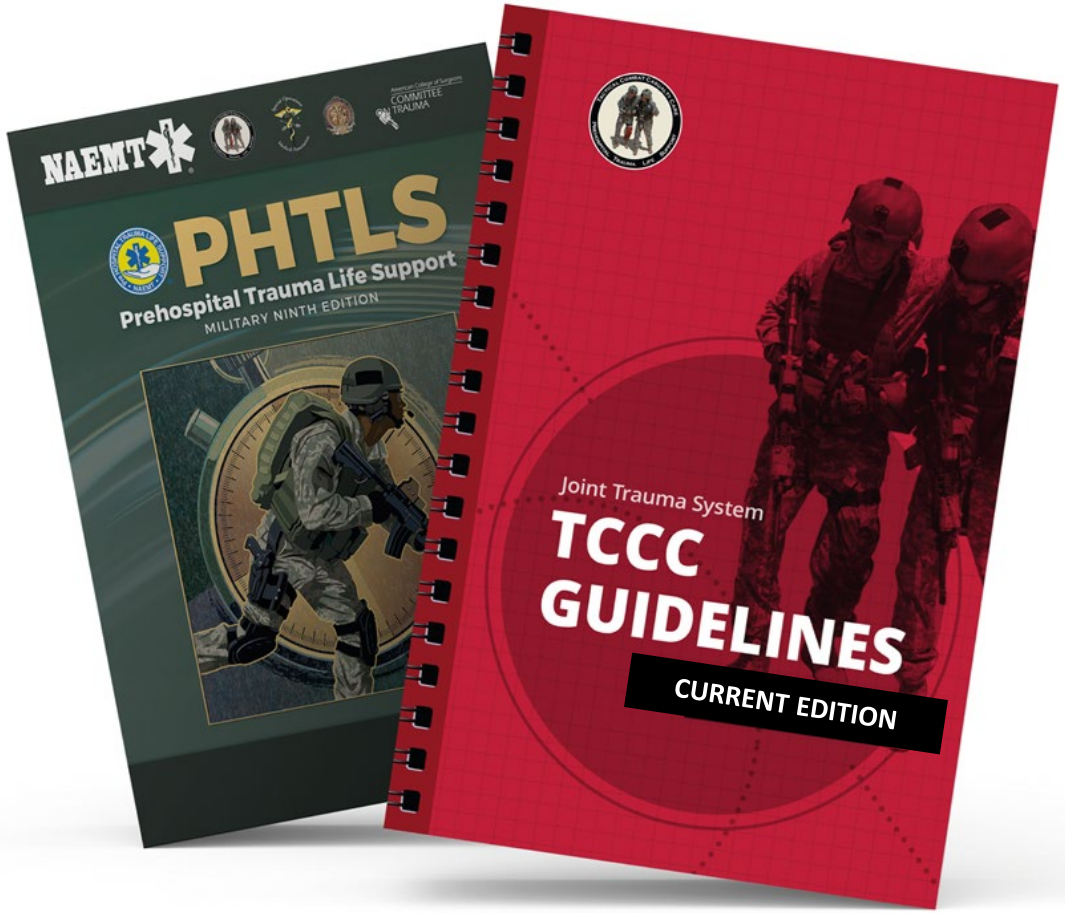
- Insert Field Ruggedized Saline-lock
- Insert FAST1 intraosseous devices
- Insert EZ-IO intraosseous devices
- Administer Tranexamic Acid
- Intravenous and Intraosseous Fluid Administration

CHECK ON LEARNING

- What are the most reliable indicators of shock in a TFC setting?
- What type of shock is most common in trauma patients, and what are the two main causes?
- If all hemorrhage control measures have been applied and fluid resuscitation does not improve shock (refractory shock), what potentially unrecognized injury should be considered, and how would you treat it?
- Should you establish IV access on all casualties in case they deteriorate?
- What is the proper protocol for administering tranexamic acid?

ANY QUESTIONS?

REFERENCES



TCCC: Guidelines

by JTS/CoTCCC

These guidelines, updated regularly, are the result of decisions made by CoTCCC in exploring evidence-based research on best practices.

PHTLS: Military Edition, Chapter 25

by NAEMT

Prehospital Trauma Life Support (PHTLS), Military Edition, teaches and reinforces the principles of rapidly assessing a trauma patient using an orderly approach.