CPP TCCC

COMBAT PARAMEDIC/ PROVIDER

TACTICAL COMBAT CASUALTY CARE COURSE

MODULE 13: HEAD INJURIES

Committee on Tactical Combat Casualty Care (CoTCCC)

TCCC TIER 1
All Service Members

TCCC TIER 2
Combat Lifesaver

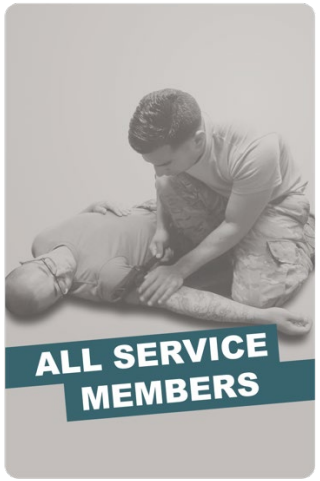
TCCC TIER 3
Combat Medic/Corpsman

TCCC TIER 4
Combat Paramedic/Provider

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

ROLE 1 CARE

NONMEDICAL PERSONNEL



MEDICAL PERSONNEL

YOU ARE HERE

STANDARDIZED JOINT CURRICULUM

1 x TERMINAL LEARNING OBJECTIVE

15 Identify a head injury IAW DoDI 6490.11, Change 1, 1 June 2018.

- **15.1** Identify the signs, symptoms, and external forces that cause head injuries in Tactical Field Care.
- **15.2** Identify the indications for performing a Military Acute Concussive Evaluation 2 (MACE 2) for a casualty with a suspected head injury.
- **15.3** Identify the progressive strategies and constraints for management of a suspected head injury in Tactical Field Care.
- **15.4** Identify the signs and symptoms of impending cerebral herniation in Tactical Field Care.
- **15.5** Identify the TCCC indications, contraindications, and administration methods of 3%, 5%, or 23% hypertonic saline to a traumatic brain injury casualty in Tactical Field Care.
- **15.6** Identify any evidence-based medicine, best practices, casualty data, and Subject Matter Expert consensus on the management of traumatic brain injury in Tactical Field Care.

06 x ENABLING LEARNING OBJECTIVES

● = Cognitive ELOs

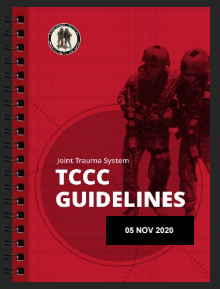
Three PHASES of TCCC

1 CARE UNDER FIRE (CUF) / THREAT

RETURN FIRE AND TAKE COVER

2 TACTICAL FIELD CARE (TFC)

WORK UNDER COVER AND CONCEALMENT



Additional Traumatic Brain Injury guidance outlined in TEC phase of the TCCC Guidelines

3 TACTICAL EVACUATION CARE (TACEVAC)

MORE DELIBERATE ASSESSMENT AND PRE-EVACUATION PROCEDURES

MARCH PAWS

LIFE-THREATENING

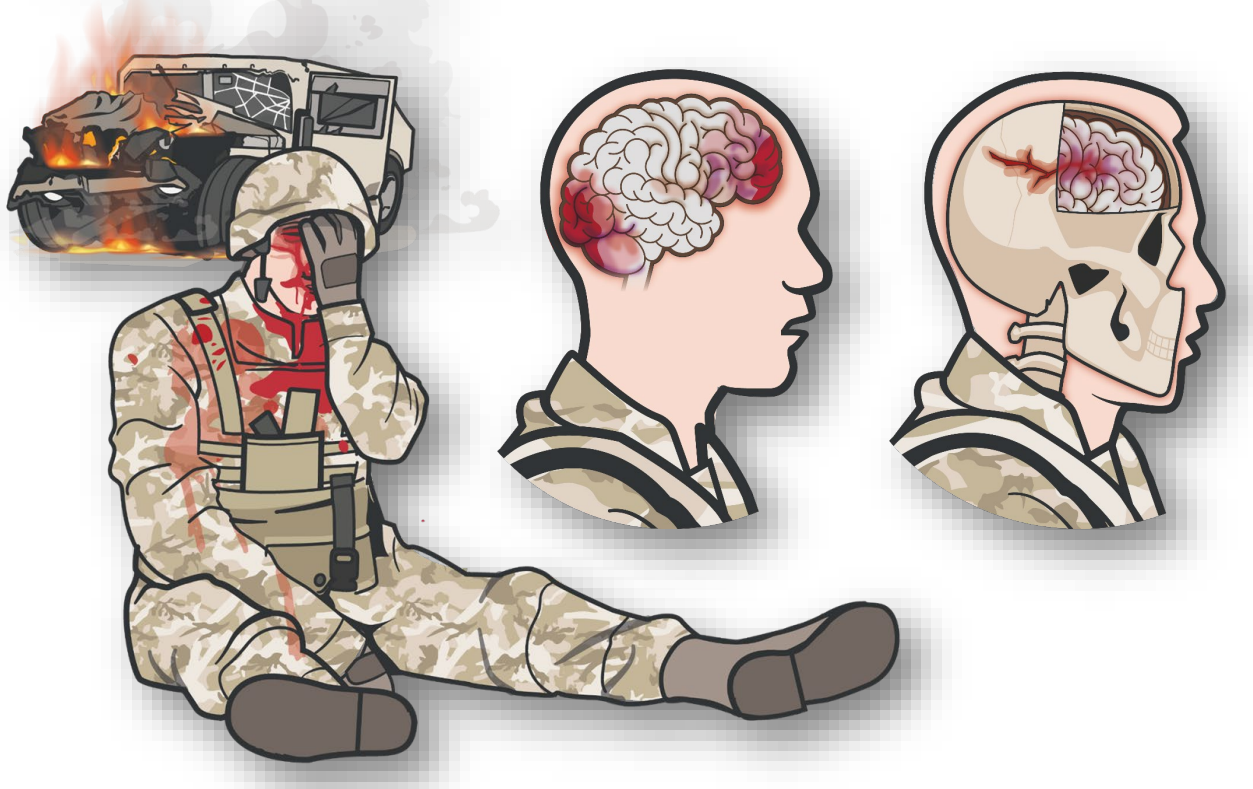
- **M** MASSIVE BLEEDING — #1 Priority
- **A** AIRWAY
- **R** RESPIRATION *(Breathing)*
- **C** CIRCULATION
- **H** HYPOTHERMIA / HEAD INJURIES

AFTER LIFE-THREATENING

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

HEAD INJURIES / TRAUMATIC BRAIN INJURY

HEAD INJURY IS TRAUMA TO THE SCALP, SKULL, FACE, OR BRAIN



Penetrating TBI/open head injury -
Skin is broken and often the skull has been penetrated

Blunt TBI/closed head injury -
Skin is not broken and no damage to the skull is noted

Primary injuries -
Direct impact, rapid acceleration-deceleration, or penetration

Secondary Injuries -
Systemic hypotension, hypoxia or an increase in intracerebral pressure after initial insult

⚠ **Open head injuries** may be obvious while **Closed head injuries** may subtle

EXTERNAL FORCES IN HEAD INJURIES

Blasts

MVAs

Direct Blow to the Head

Gunshot/ Shrapnel

PENETRATING

- Gunshot or shrapnel wound
- Falls, accidents, assault

CLOSED

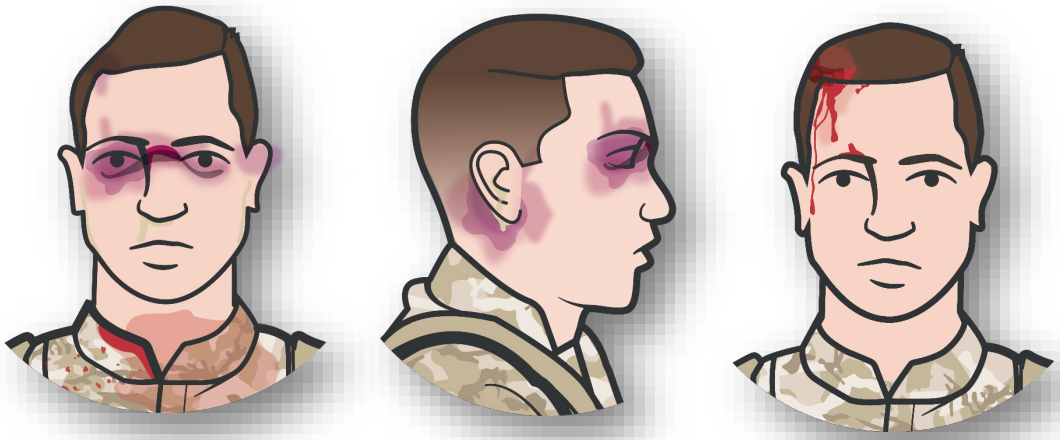
Blunt

- MVA/rollover
- Direct blow to the head without penetrating wound
- Witnessed loss of consciousness

Blast

- Presence within **50 meters** of a **blast** (**inside or outside**)
- Exposure to more than one blast event

SIGNS AND SYMPTOMS OF HEAD INJURY



- Obvious scalp, skull wound, or deformity
- Raccoon's Eyes or Battle's Sign
- Otorrhea or rhinorrhea (leakage of cerebrospinal fluid)
- Pupillary dilation/focal neuro signs
- Altered mental status

A lert

V erbal Stimuli

P ainful Stimuli

U nresponsive

COMMUNICATE WITH THE CASUALTY TO ASSESS FOR ALTERED MENTAL STATUS

INDICATIONS FOR REFERRAL
FOR MEDICAL EVALUATION

I njury	Physical damage to the body or body part of a Service member?	YES	NO
E valuation	**H:** Headaches and/or vomiting?	YES	NO
	E: Ear ringing?	YES	NO
	A: Amnesia, altered consciousness, and/or loss of consciousness?	YES	NO
	D: Double vision and/or dizziness?	YES	NO
	S: Something feels wrong or is not right?	YES	NO
D istance	Was the Service member within 50 meters of the blast? Record the distance from the blast.	YES	NO

Not applicable

DoDI 6490.11 (section 3, para 2.a)

Traumatic Brain Injury Center of Excellence

TRAUMATIC BRAIN INJURY CLASSIFICATION

Mild TBI (or concussion)

- Casualty may remain conscious or lose consciousness only briefly (a few seconds or minutes up to 30 minutes)
- Headache, ringing in ears, blurred vision, nausea/vomiting
- Dizziness/lightheadedness, impaired balance/coordination
- Confusion/disorientation and/or memory loss (<24 hours)

Severe TBI (symptoms similar to mild TBI)

- Confusion or disorientation (>24 hours)
- Loss of consciousness (> 24 hours)
- Memory loss (>7 days)

Moderate TBI (symptoms similar to mild TBI)

- Confusion or disorientation (>24 hours)
- Loss of consciousness (> 30 minutes but < 24 hours)
- Memory loss (>24 hours but < 7 days)

Penetrating TBI –

in which the scalp, skull and dura mater are penetrated

*Unclassified TBI –

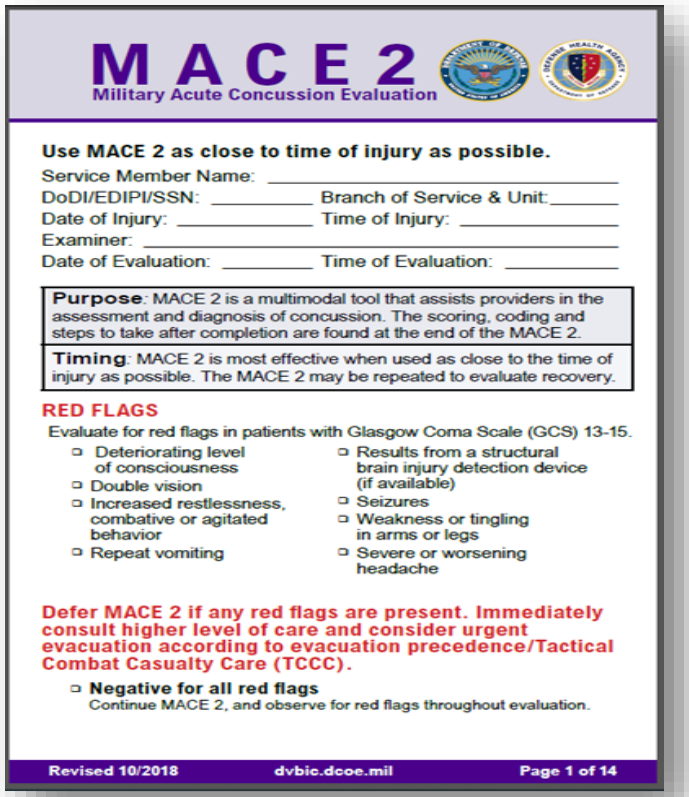
Limited surveillance information

MILITARY ACUTE CONCUSSIVE EVALUATION 2 (MACE 2)

Trauma casualties with suspected head injury/TBI should be referred to the CMC and/or CPP as soon as possible for **Military Acute Concussive Evaluation 2 (MACE 2)**

If **ANY** of the following **RED FLAG** signs and symptoms are present, MACE 2 should be deferred and urgent evacuation considered:

- **Deteriorating** level of consciousness
- Double vision
- Increased restlessness; combative or agitated behavior
- Repeat vomiting
- Results from a structural brain injury detection device (if available)
- Seizures
- Weakness or tingling in arms or legs
- **Severe** or **worsening** headache



MACE 2
Military Acute Concussion Evaluation

Use MACE 2 as close to time of injury as possible.

Service Member Name: _____
DoDI/EDIPI/SSN: _____ Branch of Service & Unit: _____
Date of Injury: _____ Time of Injury: _____
Examiner: _____
Date of Evaluation: _____ Time of Evaluation: _____

Purpose: MACE 2 is a multimodal tool that assists providers in the assessment and diagnosis of concussion. The scoring, coding and steps to take after completion are found at the end of the MACE 2.

Timing: MACE 2 is most effective when used as close to the time of injury as possible. The MACE 2 may be repeated to evaluate recovery.

RED FLAGS

Evaluate for red flags in patients with Glasgow Coma Scale (GCS) 13-15.

- Deteriorating level of consciousness
- Double vision
- Increased restlessness, combative or agitated behavior
- Repeat vomiting
- Results from a structural brain injury detection device (if available)
- Seizures
- Weakness or tingling in arms or legs
- Severe or worsening headache

Defer MACE 2 if any red flags are present. Immediately consult higher level of care and consider urgent evacuation according to evacuation precedence/Tactical Combat Casualty Care (TCCC).

- **Negative for all red flags**
  Continue MACE 2, and observe for red flags throughout evaluation.

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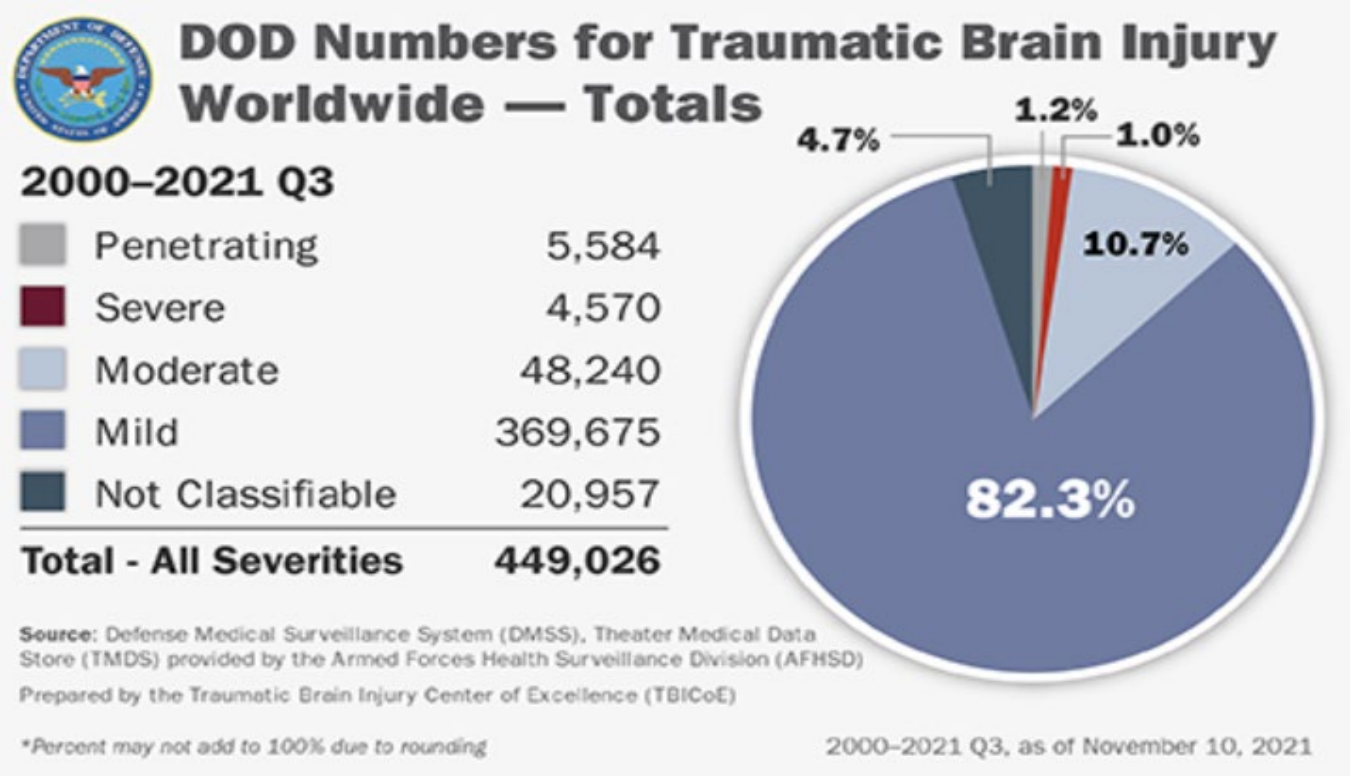
Level of Evidence: C-EO

MANAGEMENT OF SUSPECTED HEAD INJURIES



DOD TBI Worldwide Numbers – Traumatic Brain Injury Center of Excellence

Level of Evidence: C-LD

Head Injury Management Guidance

- TCCC Guidelines
- JTS CPG on Traumatic Brain Injury Management in Prolonged Field Care
- Defense Health Board – Management of Traumatic Brain Injury in TCCC
- Brain Trauma Foundation

CAUTION: Be Alert and Prevent **Secondary Brain Injury** caused by hypoxia and hypotension

MANAGEMENT OF HEAD INJURIES

Avoid hypotension and decreased cerebral perfusion

- Control hemorrhage from head and other injuries
- Administer TXA as indicated
- Resuscitate with blood products to a maintain SBP 100-110 mmHg
- Avoid medications that lower blood pressure

Control airway, ventilate, oxygenate

- Secure airway (low threshold for advanced airways)
- Ventilate to avoid hypo- or hypercapnia; ETCO2 target range 32-38mmHg
- Prevent hypoxemia, maintain SPO2 >90%; provide supplemental O2, when available
- Consider **URGENT EVACUATION** to a higher level of care

Ensure low oxygen saturations are not due to **tension pneumothorax** and intervene if needed

MANAGEMENT OF HEAD INJURIES

Avoid elevated intracranial pressure (ICP)

- Elevated head/litter stretcher
- Administer hypertonic saline

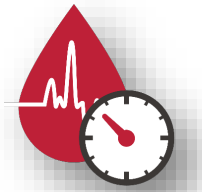
Other considerations

- Prevent/treat hypothermia
- Administer antibiotics, if appropriate
- Manage pain per TCCC guidelines
- Treat other immediately life-threatening injuries to prevent hypoxia and hypotension

Remember to **remove weapons and comm equipment** from casualties with altered mental status

SIGNS AND SYMPTOMS OF IMPENDING CEREBRAL HERNIATION

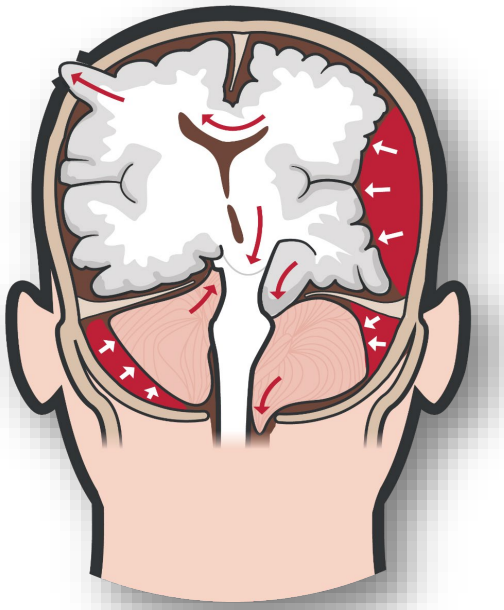
CUSHING'S TRIAD



HIGH PULSE PRESSURE

LOW HEART RATE

IRREGULAR RESPIRATIONS



Increased Intracranial Pressure	Impending Cerebral Herniation
Severe Headaches	Unilateral pupillary dilation (blown or fixed pupils)
Nausea and/or vomiting	Focal neurologic signs
Altered mental status	Acute loss of consciousness
Deteriorating level of consciousness	Decorticate and/or Decerebrate
Seizures	
Cushing's triad	

Level of Evidence: C-LD

Signs of **impending brain herniation** are an indication for **URGENT EVACUATION**

INDICATIONS AND ADMINISTRATION OF HYPERTONIC SALINE

Hypertonic Saline is indicated for signs of impending cerebral herniation

- Administer 30 ml 23.4% hypertonic saline slow IV/IO push over 10 minutes followed by a saline flush

OR

- 250 ml of 3% or 5% hypertonic saline IV/IO bolus

IMPORTANT CONSIDERATION:
Do not hyperventilate the casualty unless signs of impending herniation are present

Level of Evidence: B-R

CONTRAINDICATIONS:

- Hypersensitivity and infusion reactions
- History of cardiac disease
- Heart Failure
- Some Endocrine disorders
- Electrolyte imbalances

- Elevate casualty's head 30 degrees
- Hyperventilate at 20 breaths per minute
- End-tidal CO2 goal 32-38 mmHg
- Highest oxygen concentration possible

TBI AND TACTICAL EVACUATION CARE

Monitor casualties with signs and symptoms of **Moderate/Severe TBI** for:	For casualties with **Impending Cerebral Herniation,** take the following actions:
• Decreases in level of consciousness	• Administer 30 ml 23.4% hypertonic saline slow IV/IO push or 250 ml of 3% or 5% hypertonic saline IV/IO bolus
• Pupillary dilation	• Elevate the casualty's head 30 degrees
• SBP (maintain 100-110mmHg)	• Hyperventilate the casualty (RR 20 breaths/min)
• O2 Sat (should be > 90%)	• Maintain end-tidal CO2 between 32-38 mmHg
• Hypothermia	• Use highest oxygen concentration possible
• End-tidal CO2 (maintain between 32-38 mmHg)	
• Penetrating head trauma (if present, administer antibiotics)	**NOTE:** Unilateral pupillary dilation accompanied by a decreased level of consciousness, may signify impending cerebral herniation.
• Assume a spinal (neck) injury until cleared	

EVIDENCE SUPPORTING HEAD INJURY MANAGEMENT STRATEGIES

Subject Category	Study Types	Level of Evidence
Use of MACE 2 in TBI Assessment	Clinical Consensus, Expert Opinion & Discussion	**C-EO**
Basic Management of Suspected Head Injuries	Retrospective Reviews & Some Prospective Studies	**C-LD**
Identification of Impending Cerebral Herniation	Retrospective Observational Registry Study	**C-LD**
Use of Hypertonic Saline in Increased ICP Treatment	Retrospective Descriptions & Subject Expert Opinion	**B-R**

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

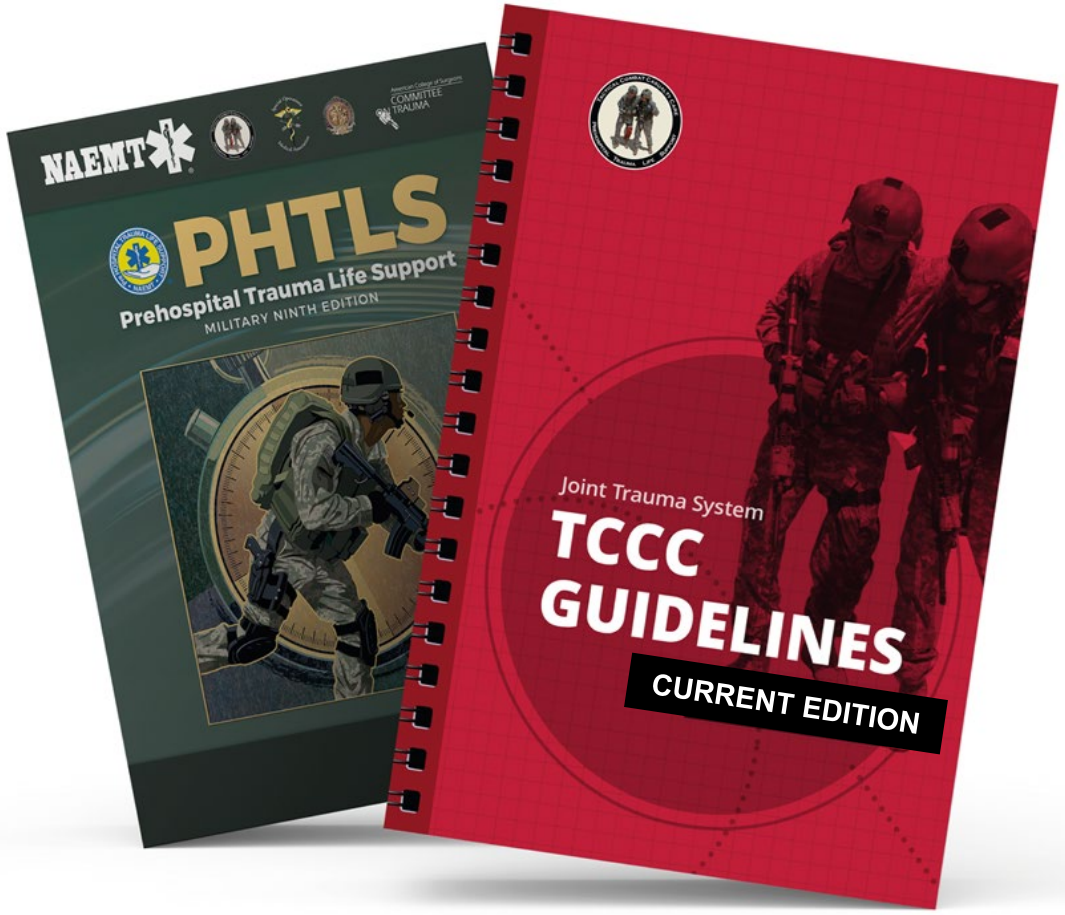
- Signs and symptoms of head injuries
- Mechanisms of head injuries
- Indications for performing a MACE 2 evaluation for casualties suspected of head injury/TBI
- Management of suspected head injury in Tactical Field Care
- Signs and symptoms of impending cerebral herniation in Tactical Field Care
- Use of hypertonic saline to treat increased intracranial pressure
- Level of evidence supporting traumatic brain injury management strategies

CHECK ON LEARNING

- What external forces can cause a head injury?
- What are the critical observations that should be reported to medical personnel for trauma casualties with a suspected head injury, in accordance with the Military Acute Concussive Evaluation 2 (MACE 2)?
- What is the goal of management of casualties with suspected head injury/TBI in TFC?
- What are the methods of administration for Hypertonic Saline for a casualty with impending cerebral herniation?


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.