



TBI Prehospital care in the IDF

CPT Inbal Dym, MD

August 2026



At the moment of truth,
IDF MEDICAL CORPS.

Disclosures

- CPT Inbal Dym, MD has no conflict to report.
- This study was performed as part of the Israel Defense Forces Trauma and Combat Medicine Branch effort to improve the quality of combat casualty care and received no external funding or support.



Introduction

Treatment of Traumatic Head Injury Protocol

Updated on 23.12.2021

In casualties with suspected head trauma — and only after life-threatening injuries have been treated

Decline in level of consciousness, reflected by a change in GCS (assessed by an ALS provider) and level of consciousness by change in AVPU

Monitor pupils – dilation/constriction, reaction to light, and movement

Maintain systolic blood pressure **above 90 mmHg**

Maintain oxygen saturation **above 90%**

Prevent hypothermia

Maintain PCO₂ between 35–40mmHg



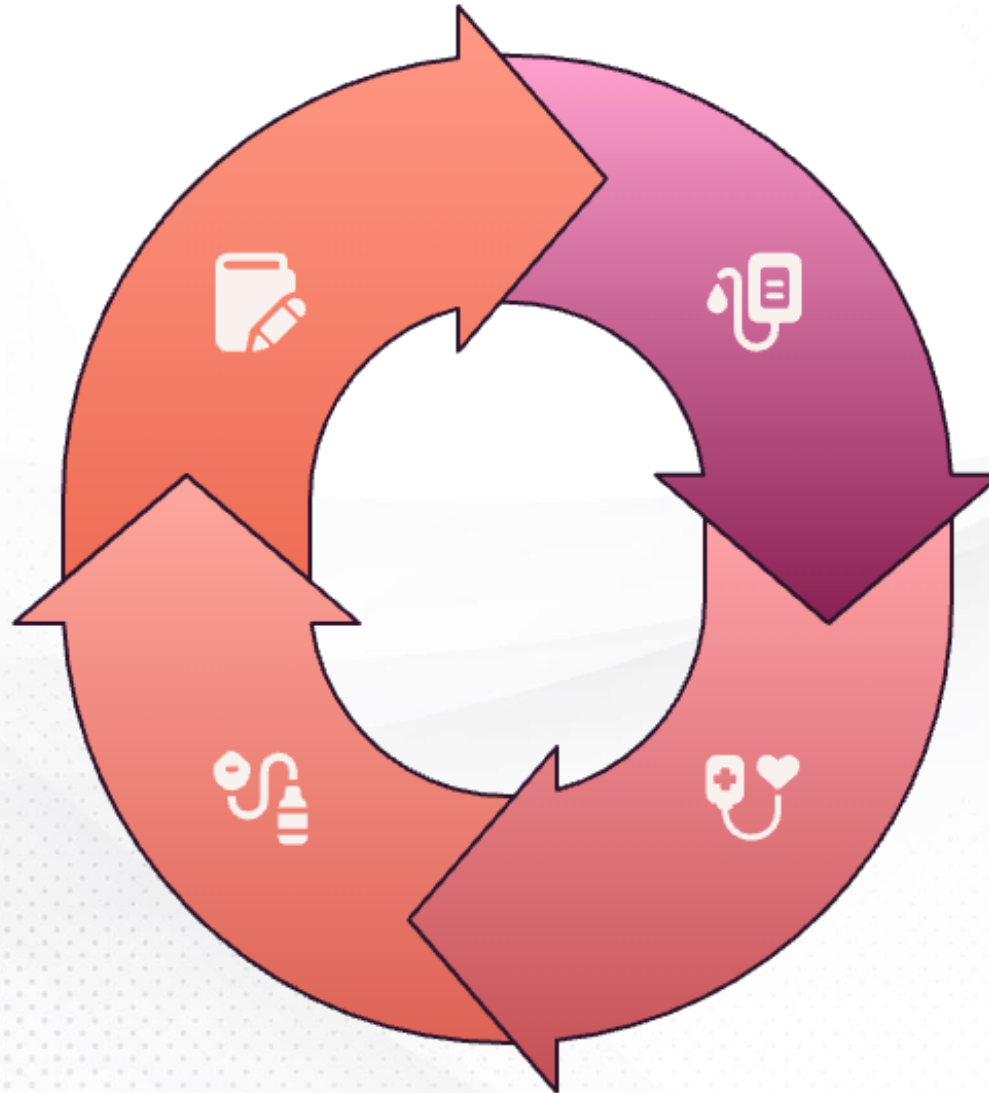
Introduction

Definition Challenge

Head injury VS TBI

Optimize Oxygenation

Elevated oxygenation
targets in the updated
guidelines



Evidence for
therapeutic benefits
of plasma
administration in
head injuries

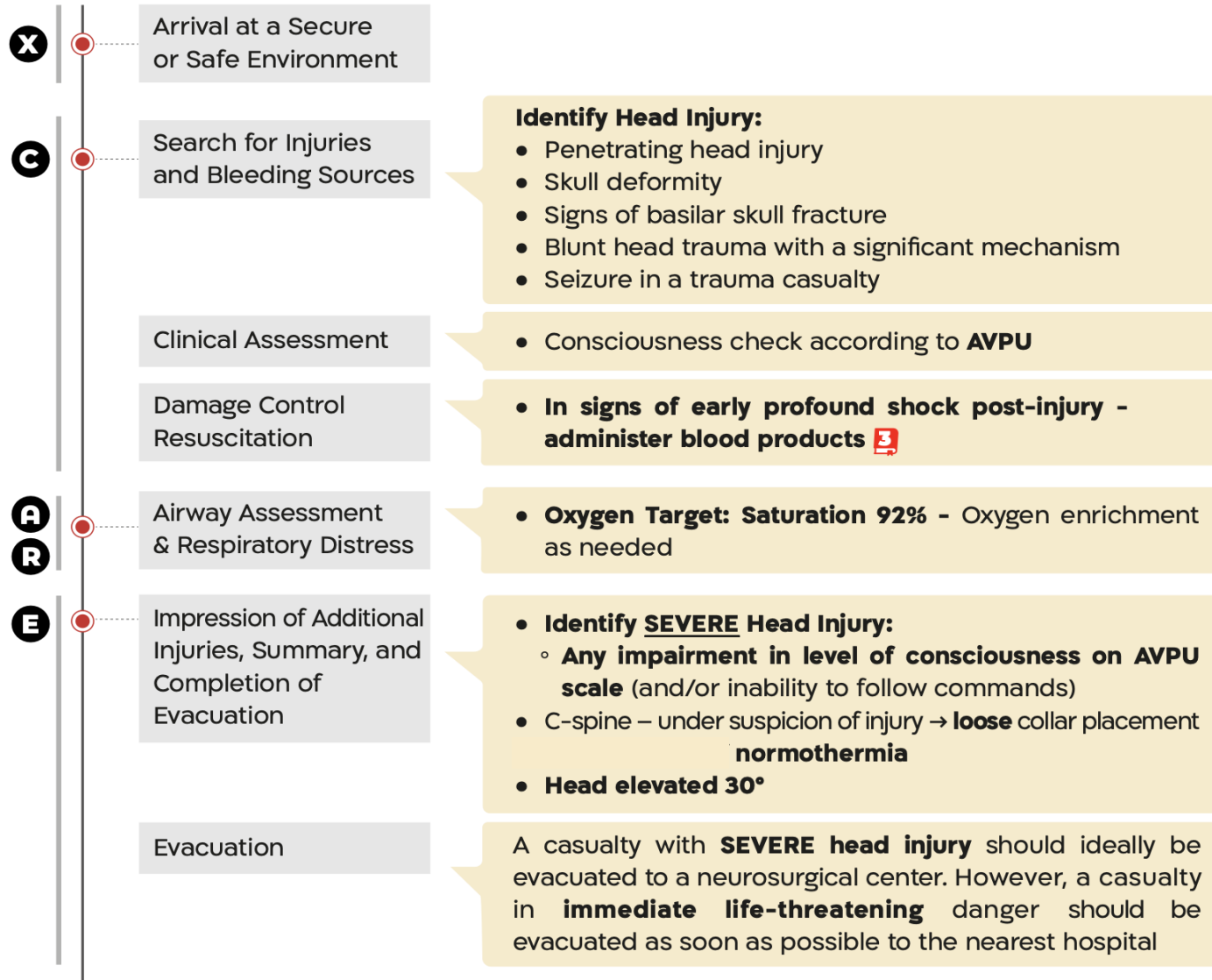
Optimize Hemodynamics

Elevated hemodynamic
targets in the updated
guidelines



Traumatic Head Injury Management Protocol

PRIMARY SURVEY



C

Volume
Resuscitation

- In casualties with **suspected SEVERE head injury**, target **Systolic Blood Pressure (SBP) is 110 mmHg**:

- In profound shock**: according to definitions in the chapter "Damage Control Resuscitation in the Field", continue administration of **the best available blood product** (whole blood → freeze-dried plasma) until reaching target SBP of 110 mmHg **3**
- Without profound shock**: if **SBP < 110 mmHg** → **administer 1 unit of freeze-dried plasma**, repeat BP measurement → if **SBP < 110 mmHg** → **administer an additional unit of freeze-dried plasma. Do not give additional units** **3**

P
RRe-evaluation
of Airway

- Airway intervention will be performed only per indications** as in any trauma casualty **4**
- Do NOT hyperventilate!**
- Capnography target: $35 \text{ mmHg} \leq \text{ETCO}_2 \leq 45 \text{ mmHg}$ **4**

E

Full Body Scan

- Assessment of GCS**, impression of arm and leg movement, and pupil examination
- In penetrating trauma - Antibiotics** **16**
- In seizure - Midazolam treatment**

Prolonged Care

- Glucose monitoring and avoidance of hyper- or hypoglycemia **20**

Identification of Severe Head Injury

Decrease in level of consciousness on AVPU scale and/or inability to follow commands

**Target Systolic Blood Pressure is 110 mmHg**Is the casualty in profound shock per definitions in "Damage Control Resuscitation in the Field"? **3**

NO

YES

Monitoring
including repeat
BP measurement

NO

Systolic blood pressure < 110 mmHg?

YES

Administer FDP, re-evaluate
& repeat vitals at end of unit

NO

Systolic BP < 110 mmHg?

YES

Administer FDP
Up to 2 units ONLY! **!****Continue** administration of blood products by priority order:

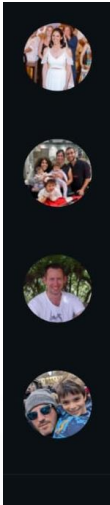
1. Whole blood
 2. Freeze-dried plasma
- Re-evaluate and repeat vital signs at the end of each volume unit



Continue volume resuscitation until reaching target SBP of 110 mmHg



Methods – The whole is greater than the sum of its parts



Focused
Workgroup



Expert
Committee



Expert Committee
Blood Products for the
Treatment of
Traumatic Brain
Injuries

December 17th 2025
15:00–17:00 (Israel Time)
08:00–10:00 AM (Eastern Time)
Israel Defense Forces Medical Corps, Tel Hashomer

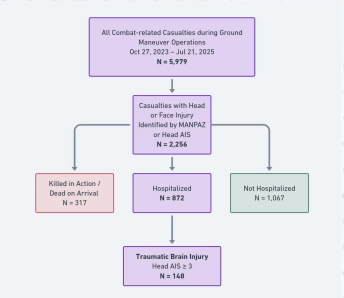
zoom
IDF MEDICAL CORPS

Expert
consultation
&
collaboration



Literature
Review

- 1. Neurosurgery Publications Associate Editors: Alonch and Pao.
- 2. The efficacy and safety of pre-hospital plasma in patients at risk for hemorrhage... Alonch et al.
- 3. High-ratio plasma resuscitation decreases mortality in moderate traumatic brain... Alonch et al.
- 4. Brain Trauma Foundation Guidelines for the Management of Penetrating Trauma... Bell et al.
- 5. Association Between Prehospital Transverse Acid Administration and Outcomes... Brown et al.
- 6. Role of Transverse Acid in Severe Traumatic Brain Injury... Brown et al.
- 7. Guidelines for the Management of Severe Traumatic Brain Injury... Carney et al.
- 8. Early plasma transfusion is associated with improved survival after isolated tra... Chang et al.
- 9. COMBAT: Initial experience with a randomized clinical trial of plasma-based res... Chapman et al.
- 10. Prehospital Pharmacotherapy in Moderate and Severe Traumatic Brain Injury: A... Colman et al.
- 11. Effects of transverse acid on death, disability, vascular occlusive events and o... Cohn et al.
- 12. Early posttraumatic brain injury transverse acid prevents blood-brain barrier by... Cuklan et al.
- 13. Epidemiology, patterns of care and outcomes of traumatic brain injury in depl... Dangher et al.
- 14. A Joint Trauma System Clinical Practice Guideline: Traumatic Brain Injury Manag... Dangher et al.
- 15. Position statement: definition of traumatic brain injury... De et al.
- 16. Death on the battlefield (2005–2015): implications for the future of combat cas... Saville et al.
- 17. Prioritizing circulation over airway to improve survival in trauma patients with... Fennell et al.
- 18. Body Temperature After EMS Transport: Association With Traumatic Brain Inju... Gathier et al.
- 19. Association of Prehospital Plasma With Survival in Patients With Traumatic Brain... Grant et al.
- 20. Pre-hospital transfusion of plasma in hemorrhaging trauma patients independent... Hendrickson et al.
- 21. Care of War Veterans with Mild Traumatic Brain Injury – Flashed Perspectives... Hoge et al.
- 22. Glasgow Coma Scale... Jain et al.
- 23. Prehospital Lymphatic Plasma Transfusion for Trauma-Induced Coagulopathy L... Jost et al.
- 24. Transverse acid is associated with reduced mortality, hemorrhage exposure, a... July and Forrester
- 25. Injury severity and causes of death from Operation Iraqi Freedom and Operation... Kelly et al.
- 26. Executive summary of the Brain Trauma Foundation Guidelines for the Manage... Kragness et al.
- 27. Hypothermia and Adverse Outcomes in Moderate to Severe Traumatic Brain Inju... Lee et al.
- 28. Comparing Model Performance for Survival Prediction Using Total Resuscitatio... Loftholm et al.
- 29. Prehospital Guidelines for the Management of Traumatic Brain Injury – 3rd Edition... Loftholm et al.



SOI war
data



December 2025 Expert Committee

19

expert participants

- 9 external experts
- 10 IDF Medical Corps personnel

Specialties represented: trauma care, neurosurgery & neurotrauma, neurology, anaesthesiology, general surgery, and military medicine – from Israel and the United States.

A structured questionnaire reflecting the meeting's data, proposals and discussion was then distributed to all participating experts.



Four Key Questions

- 1 Defining & predicting moderate–severe TBI in the field
- 2 Optimal prehospital blood-pressure target
- 3 Role of prehospital freeze-dried plasma (FDP)
- 4 Use of tranexamic acid (TXA)



Expert Committee Blood Products for the Treatment of Traumatic Brain Injuries



December 17th 2025



15:00–17:00 (Israel Time)

08:00–10:00 AM (Eastern Time)

Israel Defense Forces Medical Corps, Tel Hashomer



John Holcomb

Raquel Gardner

Debra West

Sami Gendler

Guy Rosenthal

Sagi Harnof

Aaron Krom

Enrique Ginzburg

Yoram Klein

Tomer Talmy

Teva Amir

Harel Gershgoren

danielle akler

Pavel Eidelman

Omri Shental

Inbal Dym

Guy Avital

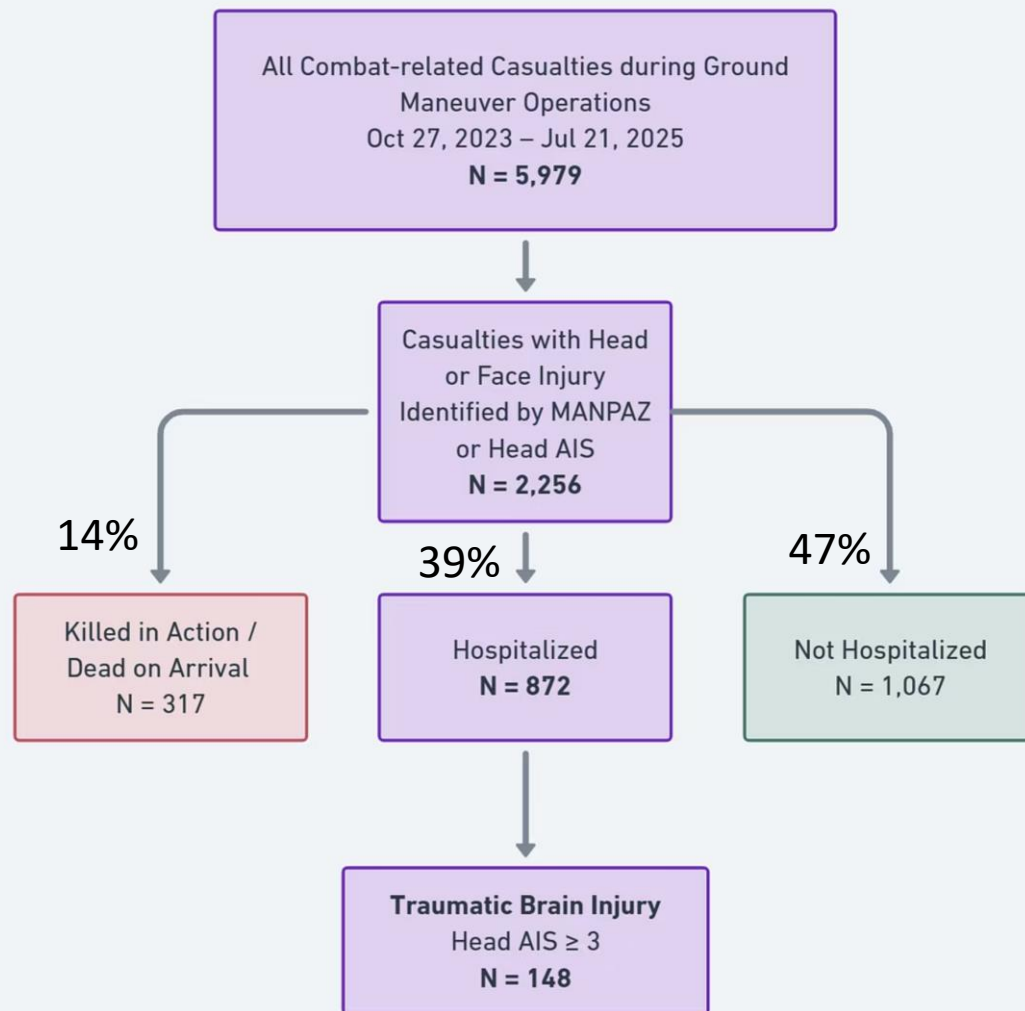
Arthur Shapiro

Avi Benov





The Burden: IDF Combat Data (Oct 2023 – Dec 2025)



6.6%

of head/face casualties met AIS ≥ 3 (TBI)

84%

sustained a penetrating head-injury mechanism

72% vs 98%

GCS vs. AVPU documentation in the field



The purpose of this protocol is the identification and treatment of head-injured casualties suffering from TBI that requires treatment in the immediate prehospital setting.

Accordingly, this chapter will not discuss the management of mild TBI or Concussion.

Taumatic Head Injury $\neq$ Moderate – severe TBI





Head Injury Definition

Proper field triage is critical for adult and pediatric patients with suspected TBI. Trauma patients with TBI can require rapid resuscitation, surgical intervention, and critical care management to prevent secondary brain injury. Refer to the ACS National Guideline for the Field Triage of Injured Patients.¹ Emergency medical services clinicians are directed to transport all patients to the highest-level trauma center when TBI is suspected and any of the following high-risk criteria are present:

- Glasgow Coma Scale (GCS) motor score < 6
- GCS total score < 13
- Skull deformity or suspected skull fracture
- Signs of basilar skull fracture
- Penetrating head injury
- Caregiver report of baseline behavior change in an infant/child following injury

ACS high-risk TBI criteria

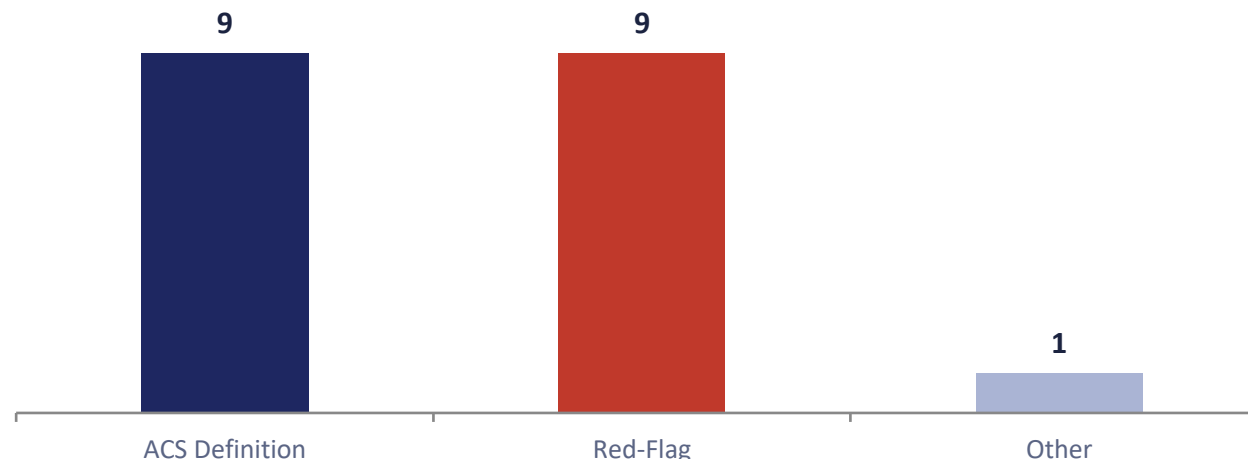


**Brain
Trauma
FOUNDATION**

Lulla A, Lumba-Brown A, Totten AM, et al. **Prehospital Guidelines for the Management of Traumatic Brain Injury – 3rd Edition**. Prehospital Emergency Care. **2023**;27(5):507–38.

Bell R, Selph S, Ghajar J, et al. **Brain Trauma Foundation Guidelines for the Management of Penetrating Traumatic Brain Injury**, Second Edition. Neurosurgery. **2025** Dec;97(6 Supl):S1-S183.

Q1 · Pre-Hospital Definition



Distribution of expert opinion across all four questions (N = 19)





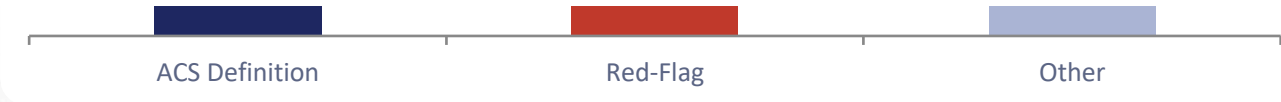
Head Injury Definition

Proper field triage is essential for patients with suspected TBI. Trauma management includes rapid resuscitation, surgical management to prevent secondary injury, and the ACS National Guideline for the Field Triage of Trauma Patients.¹ Emergency medical services clinicians are directed to transport all patients to the highest-level trauma center when TBI is suspected and any of the following high-risk criteria are present:

Search for Injuries and Bleeding Sources

Identify Head Injury:

- Penetrating head injury
- Skull deformity
- Signs of basilar skull fracture
- Blunt head trauma with a significant mechanism
- Seizure in a trauma casualty



Distribution of expert opinion across all four questions (N = 19)

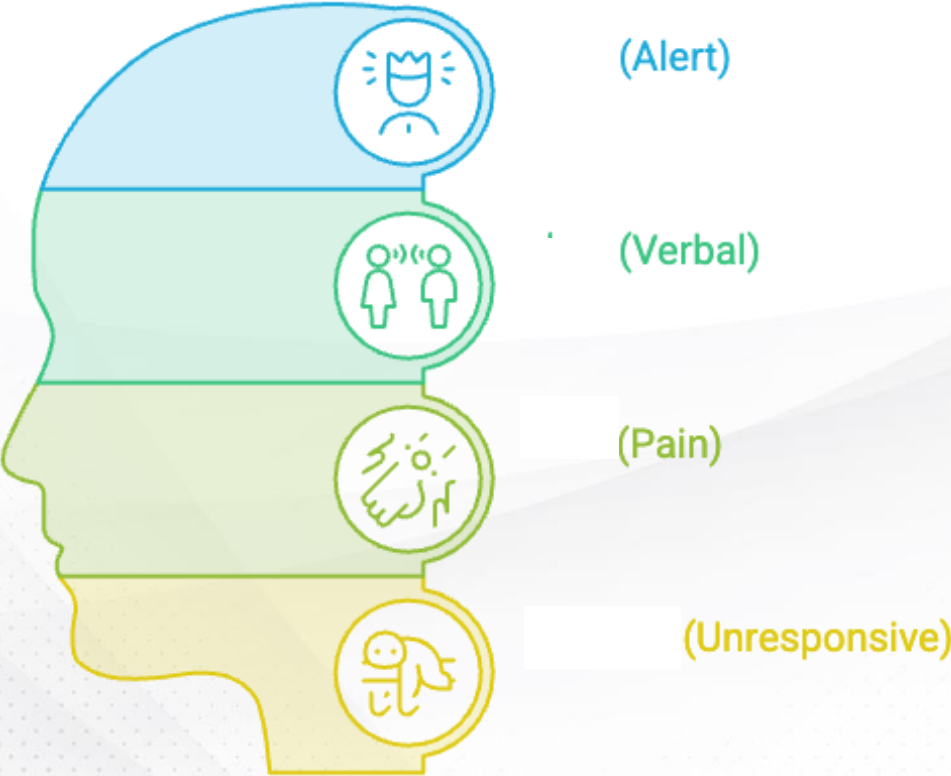


Head Injury – field diagnosis that requires specialized supportive care as it raises suspicion of traumatic brain injury (TBI) across all levels of severity.

Prehospital Traumatic Brain Injury Care.
Brain Trauma Foundation Guidelines for the Management of Penetrating Traumatic Brain Injury, Second Edition. Neurosurgery. 2025 Dec;97(6 Suppl):S1-S183.



Head Injury Definition – AVPU scale



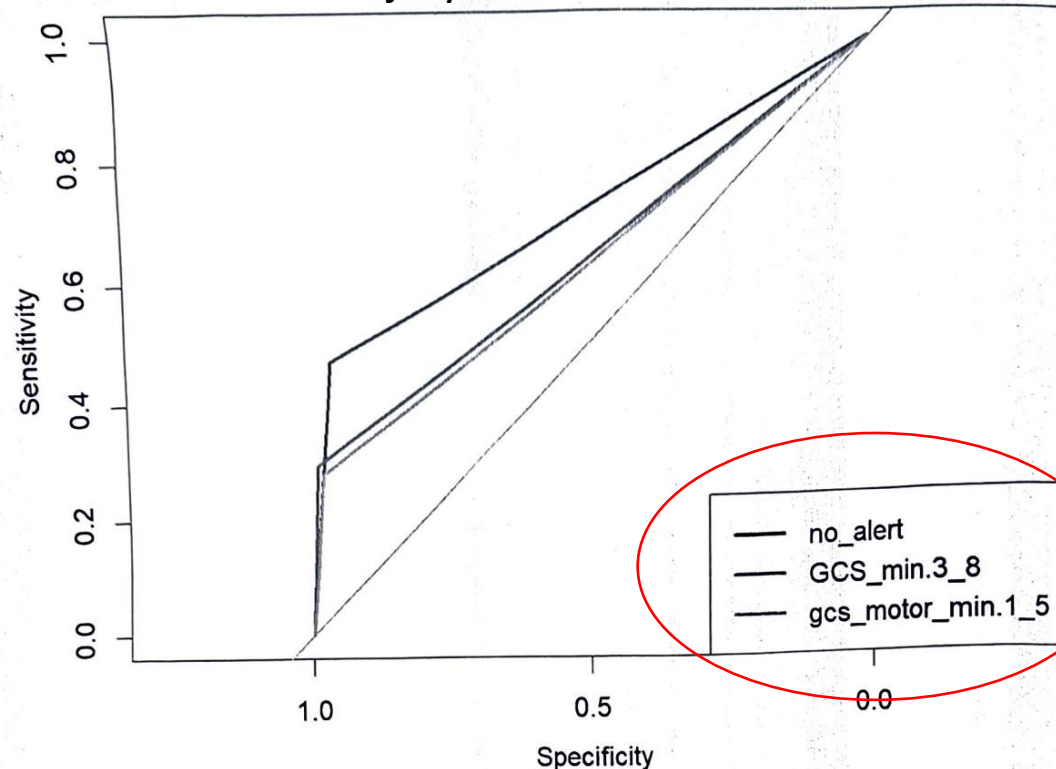
Head Injury Definition

Severe Head Injury is a field-based diagnosis that raises a high suspicion of moderate-to-severe traumatic brain injury (TBI)

Identifying severe head injury:

- Any decline in level of consciousness on the AVPU scale (and/or inability to follow commands)

IDF Head or facial injury casualties 10.2023-07.2025



	Actual 0	Actual 1
Predicted 0	1590 (TN)	109 (FN)
Predicted 1	58 (FP)	95 (TP)

Area under the curve: 0.7152

95% CI: 0.6806–0.7498 (DeLong)

Area under the curve: 0.6388

95% CI: 0.6076–0.6701 (DeLong)

Area under the curve: 0.6266

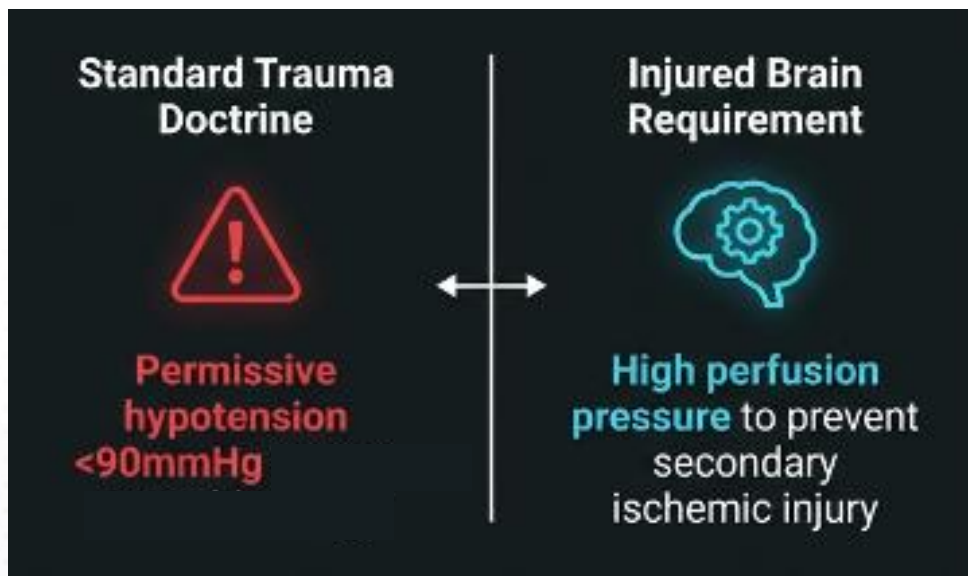
95% CI: 0.5957–0.6575 (DeLong)

**Z>5
P<0.01**





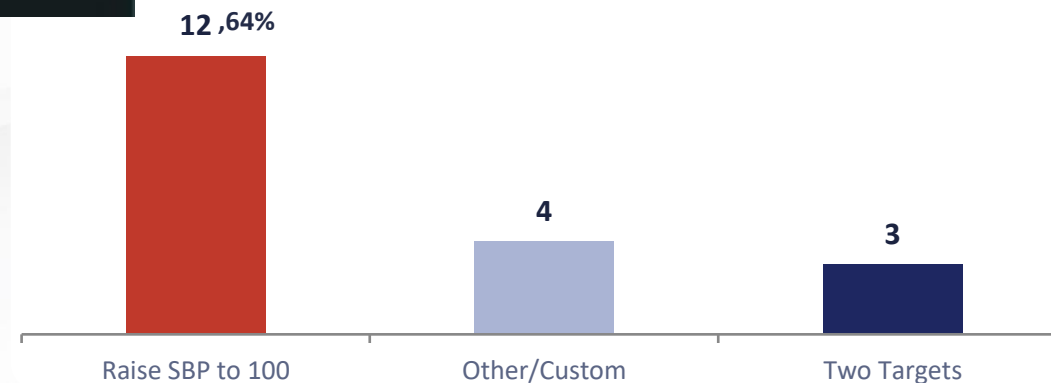
Optimal Blood-Pressure Target



IDF Head or facial injury casualties 10.2023-07.2025

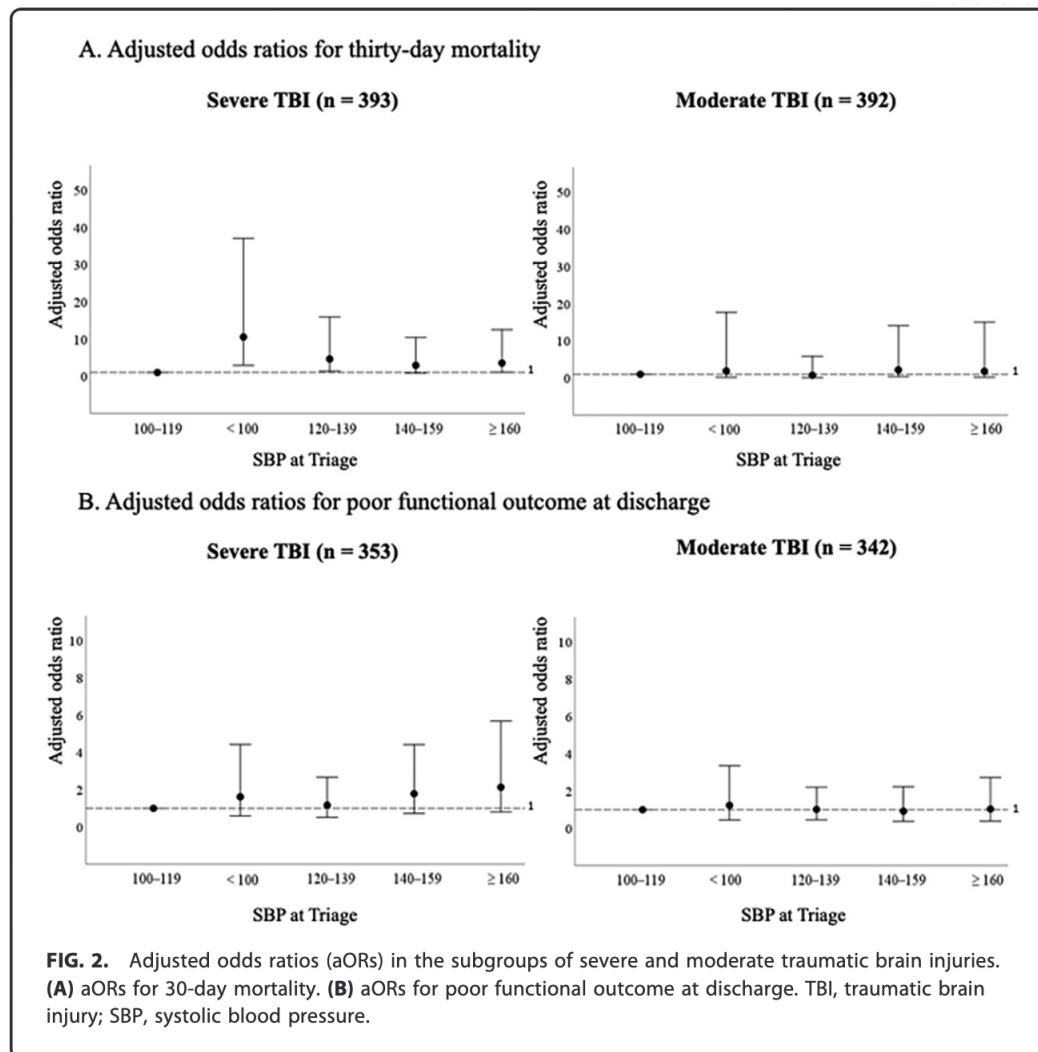
Characteristic	Overall (N=1852) W/O KIA	Head AIS 1-2 (N=1648)	AIS 3+ (N=204)
no shock	1653 (89%)	1507 (91%)	146 (72%)
shock	98 (5.3%)	42 (2.5%)	56 (27%)

Q2 · Blood-Pressure Target



Distribution of expert opinion across all four questions (N = 19)





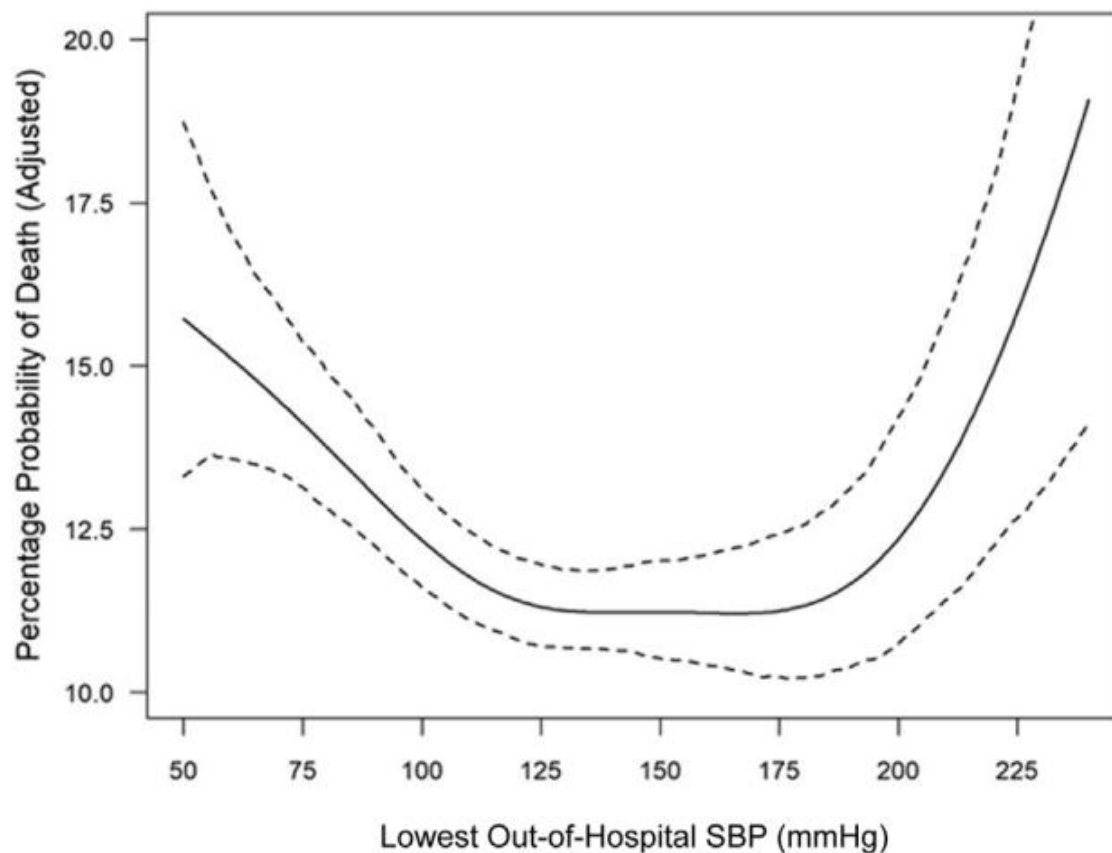
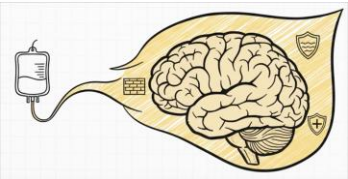


Figure 3. Adjusted analysis of probability of death by SBP. Adjusted analysis of the probability of dying in the hospital plotted against lowest out-of-hospital SBP. The dotted lines represent 95% confidence bands.

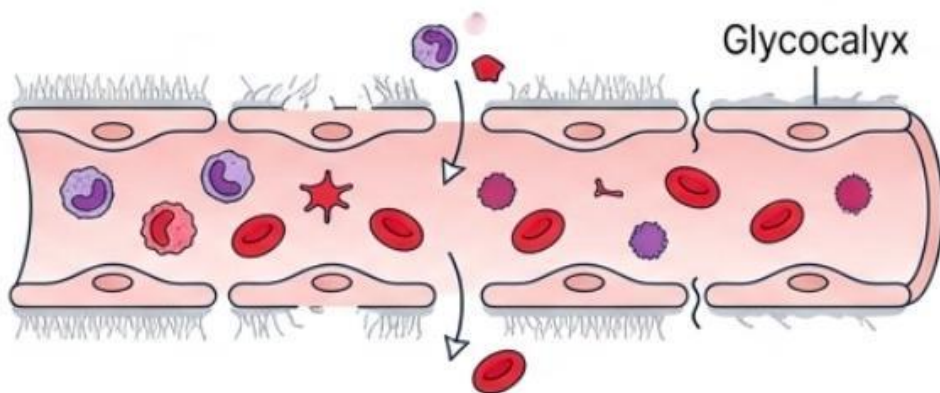
3 distinct attributes: first, a rapidly decreasing probability of death as the lowest EMS SBP increased from 40 mmHg to approximately 130 mmHg; second, a broad, flat valley of low death probability ranging up to approximately 180 mmHg; and third, a rapidly increasing mortality as the SBP increased above this value. This severely hypertensive cohort (SBP 180 mmHg)

TBI, AIS $\geq$ 3

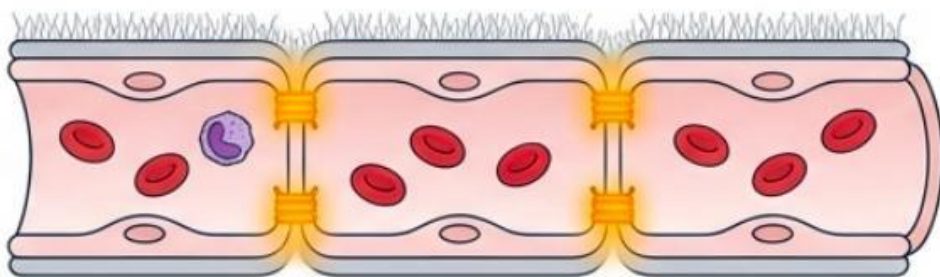


Prehospital Freeze-Dried Plasma (FDP)

Damaged BBB

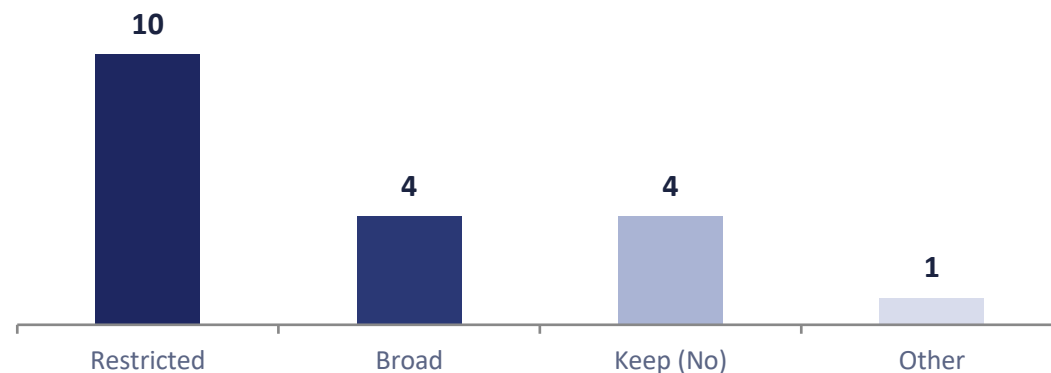


Plasma-Stabilized BBB



Plasma restores glycocalyx & tight junctions, stabilizing the blood-brain barrier

Q3 · Blood-Product (FDP) Use

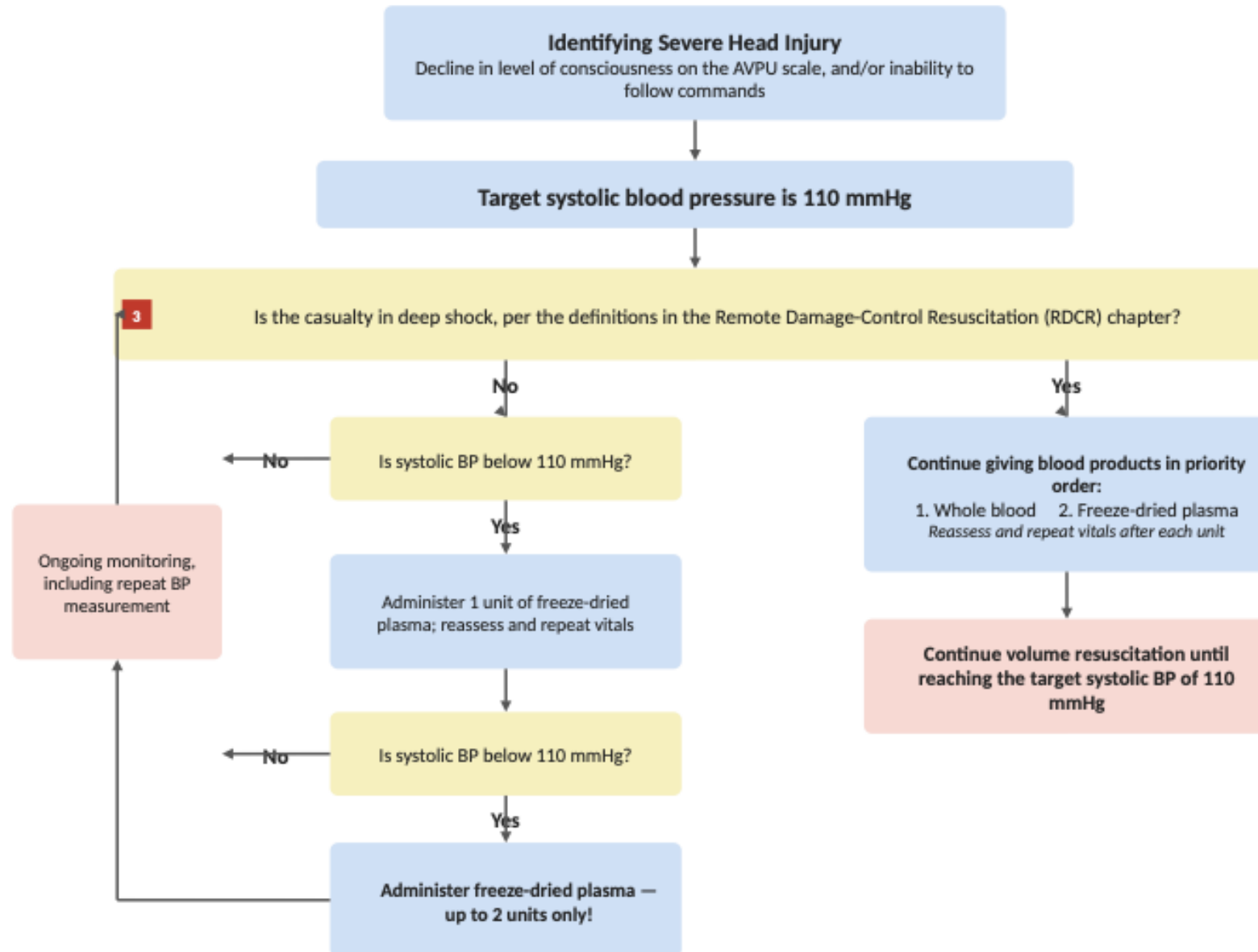


Distribution of expert opinion across all four questions (N = 19)

74% of experts (14/19) supported plasma for moderate–severe TBI — 53% restricted to high-risk casualties, 21% broader indication



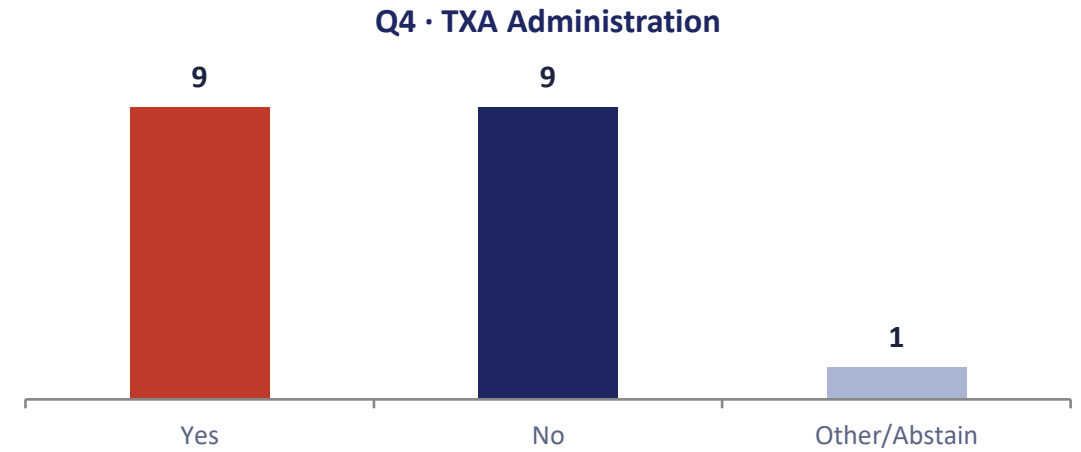
Volume Resuscitation in Suspected Severe Head Injury — Expanded Decision Tree



Referenced from the main protocol timeline (Volume Resuscitation, Secondary Survey)

Tranexamic Acid (TXA)

- Hypothesis: TXA may limit intracranial hemorrhage, restore BBB permeability, and attenuate neuroinflammation
- CRASH-3: marginal, non-significant mortality reduction (RR 0.94, 95% CI 0.86–1.02)
- Rowell et al. (JAMA 2020) & PATCH-Trauma (NEJM 2023): no improvement in long-term functional/neurologic outcome
- Zhang et al. meta-analysis concluded that TXA treatment within less than 3 hours reduces hemorrhage volume; however, TXA administration was not found to be associated with a decrease in mortality or disability rates among TBI patients.



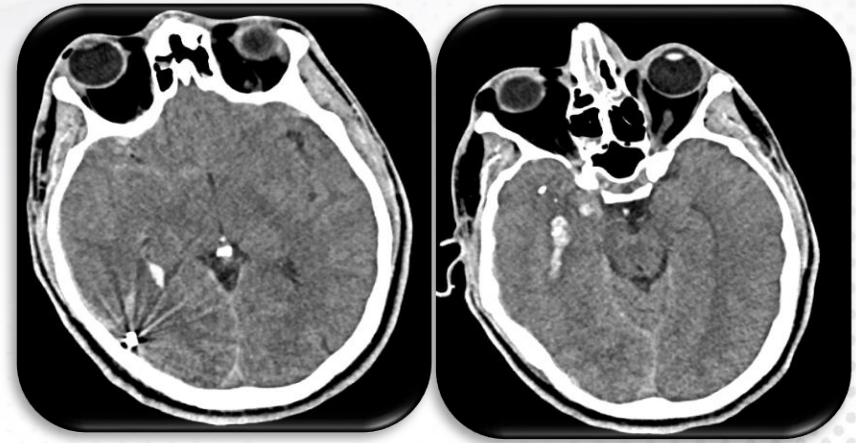
No Consensus

Decision: await further evidence before adopting TXA for isolated TBI



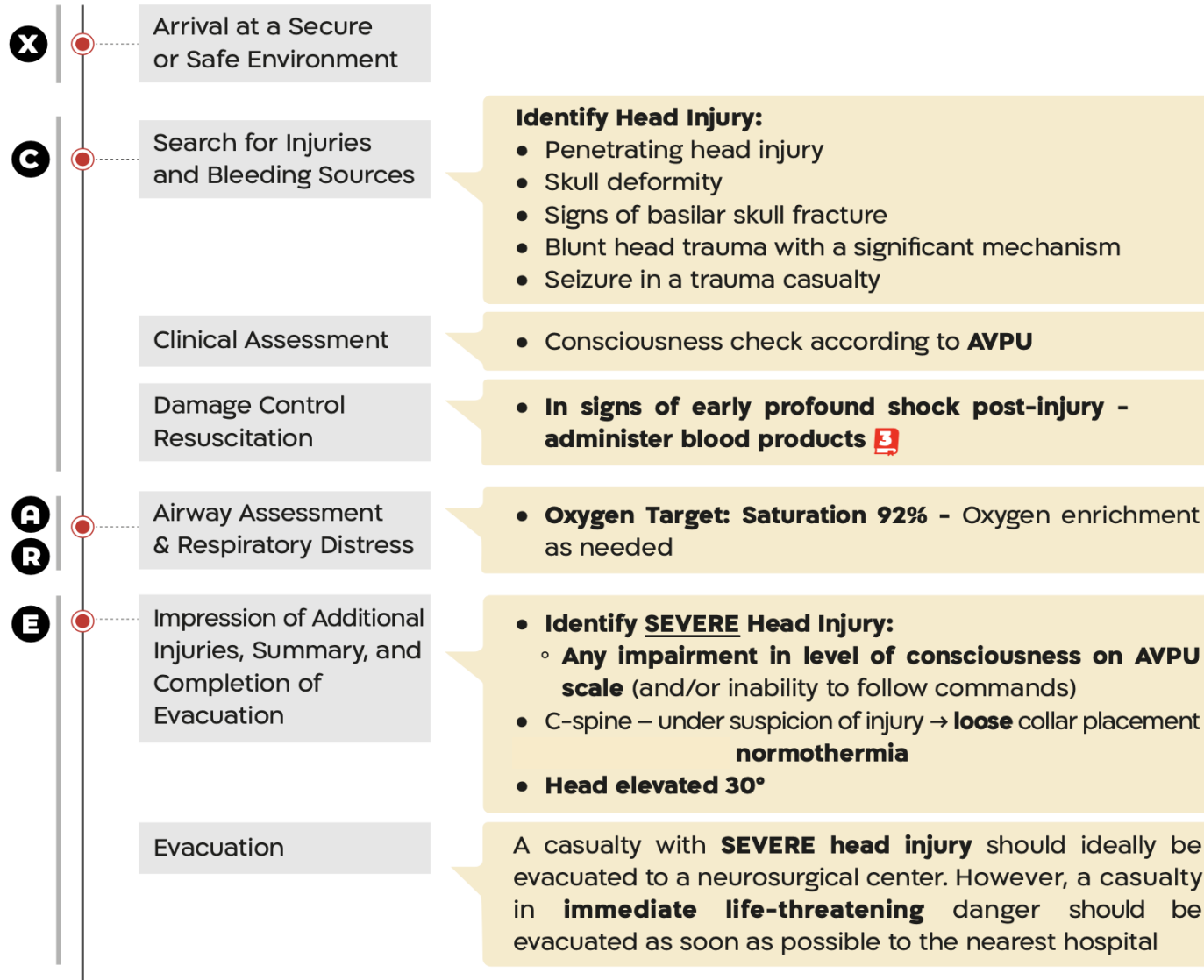
Conclusions and Summary – Changes in the Current IDF Traumatic Head Injury Protocol

- Definition of Pre-hospital Head Injury:
Any penetrating head injury | skull deformity | signs of a basilar skull fracture | blunt head trauma resulting from a significant mechanism of injury | post-traumatic seizure in a trauma casualty
- Severe head injury now defined by AVPU decline and/or inability to follow commands
- SpO₂ target raised to $\geq 92\%$
- SBP target 110 mmHg for severe head injury, titrated with whole blood / plasma (up to 2 units)
- ETCO₂ window widened to 35–45 mmHg



Traumatic Head Injury Management Protocol

PRIMARY SURVEY



C

Volume
Resuscitation

- In casualties with **suspected SEVERE head injury**, target **Systolic Blood Pressure (SBP) is 110 mmHg**:

- In profound shock**: according to definitions in the chapter "Damage Control Resuscitation in the Field", continue administration of **the best available blood product** (whole blood → freeze-dried plasma) until reaching target SBP of 110 mmHg **3**
- Without profound shock**: if **SBP < 110 mmHg** → **administer 1 unit of freeze-dried plasma**, repeat BP measurement → if **SBP < 110 mmHg** → **administer an additional unit of freeze-dried plasma. Do not give additional units** **3**

P
RRe-evaluation
of Airway

- Airway intervention will be performed only per indications** as in any trauma casualty **4**
- Do NOT hyperventilate!**
- Capnography target: $35 \text{ mmHg} \leq \text{ETCO}_2 \leq 45 \text{ mmHg}$ **4**

E

Full Body Scan

- Assessment of GCS**, impression of arm and leg movement, and pupil examination
- In penetrating trauma - Antibiotics** **16**
- In seizure - Midazolam treatment**

Prolonged Care

- Glucose monitoring and avoidance of hyper- or hypoglycemia **20**

Identification of Severe Head Injury

Decrease in level of consciousness on AVPU scale and/or inability to follow commands

**Target Systolic Blood Pressure is 110 mmHg**Is the casualty in profound shock per definitions in "Damage Control Resuscitation in the Field"? **3**

NO

YES

Monitoring
including repeat
BP measurement

NO

Systolic blood pressure < 110 mmHg?

YES

Administer FDP, re-evaluate
& repeat vitals at end of unit

Systolic BP < 110 mmHg?

YES

Administer FDP
Up to 2 units ONLY! **!****Continue** administration of blood products by priority order:

- Whole blood
 - Freeze-dried plasma
- Re-evaluate and repeat vital signs at the end of each volume unit

Continue volume resuscitation until reaching target SBP of 110 mmHg



Thank you!



At the moment of truth,
IDF MEDICAL CORPS.

