1

Shared Challenges: Austere Trauma Anesthesia and Mass Shooting Response

Triaging at the Boston Marathon Bombing

Las Vegas Mass Casualty Incident

2

Disclaimers

Source of grant or financial support: None

The author has no commercial associations that might pose a conflict of interest in connection with this presentation.

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Objectives

- Defining the austere environment
- Outlining the concept of the FRST/ GHOST team
- Incorporating anesthesia in the austere environment and explaining how it differs from a traditional anesthesia setting
- Incorporating the concept of administering whole blood in trauma patients
- Utilizing TIVA as the sole anesthetic in the austere environment
- Applying clinical practice guidelines (cpgs) as it pertains to trauma anesthesia and damage control resuscitation and surgery
- Discussing various transport platforms as it pertains to the austere environment

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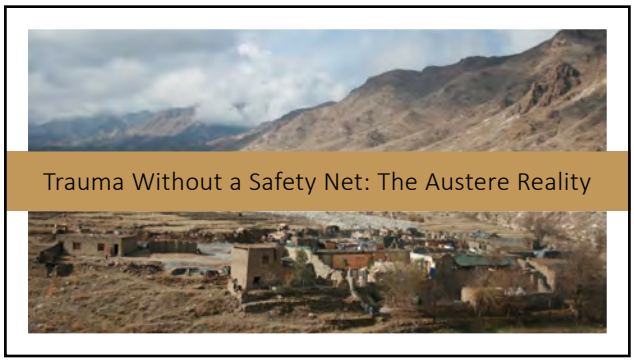
Austere Environments: Challenges and Implications for Mission Success
Austere environment Definition
Major Challenges
Very Limited Resources
Environmental Factors
Patient Considerations
Safety and Logistical Considerations

5


Trauma Without a Safety Net: The Austere Reality

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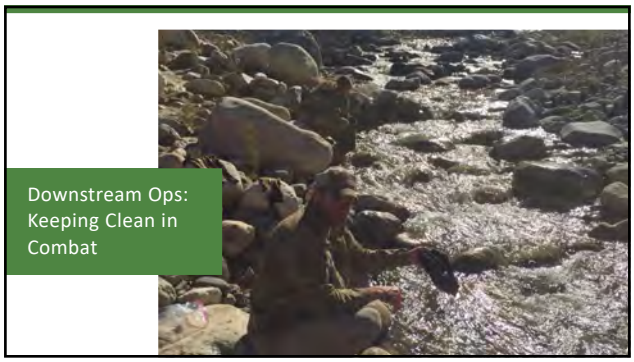
At the Tip of the Spear: Life Near Combat

7

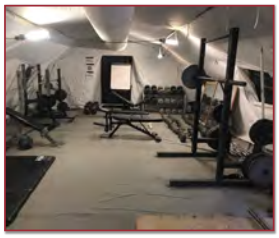

Downstream Ops: Keeping Clean in Combat

8

The Tactical Latrine

Making Do in the Field

9



Deployed Gains: Making Do with What We've Got

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My GHOST FST in Afghanistan 2017/2018

- One CRNA
- Two General Surgeons
- One OR Tech
- Two Medics

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Mission of a FST or FRST

Now known as the Forward Resuscitative Surgical Team (FRST)

Has the ability to separate into two teams while jumping from one site to another.

Highly mobile 20 person medical team that operates close to the front lines

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CRNAs : More Than Anesthesia Providers

Mission Planning Questions that need to be Addressed:

- How many Soldiers will be involved in the operation?
- Will there be both US & Local National Soldiers involved?
- What is the risk assessment and intel obtained?

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Mission Prep

- One of the most important functions of a surgical team.
- Op order will provide time, duration, risks to forces and where the surgical team will be staged.
- Major hurdles
  - Deployment location
  - Logistical constraints

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Number of Cases without Resupply?

- ***Most important question***
- Drives the equipment and blood requirements
- If surgeon brings capabilities for 5 cases and anesthesia only 2 – **MUST BE IN SYNCH with surgeon**

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Situational Awareness

Security:
Identify security detail and establish safety measures.

Medical Assets:
Determine available medical personnel and resources.

Casualty Transport:
Assign responsibility for moving the injured casualty.

Communication:
Ensure effective communication.
Is a translator available?

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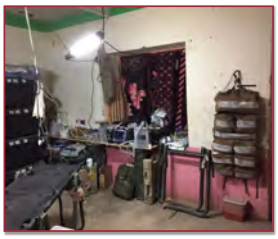
Traditional OR vs.
Forward Surgical Reality

Operating at the Edge



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One Role, Many Missions: CRNA Versatility in the FRST



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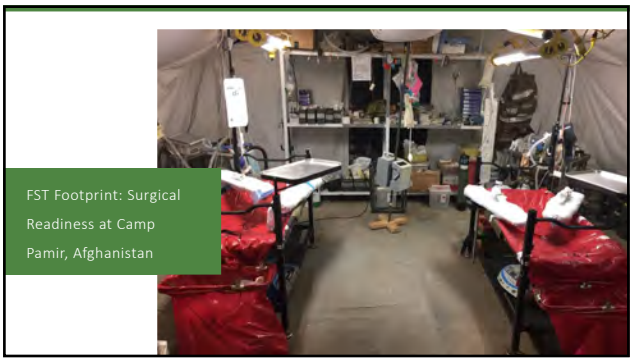
Brick and Mortar Medicine

Resuscitation and Surgery in Non-Traditional Spaces

20


FST Footprint: Surgical Readiness at Camp Pamir, Afghanistan

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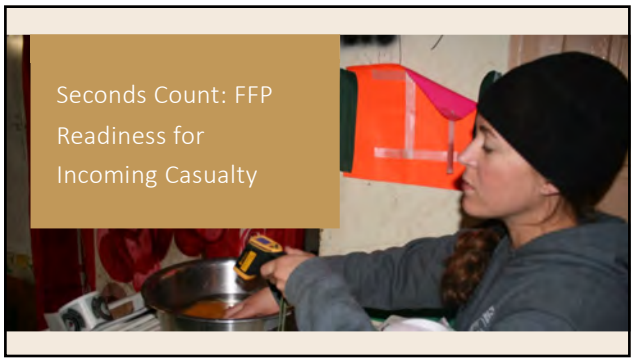
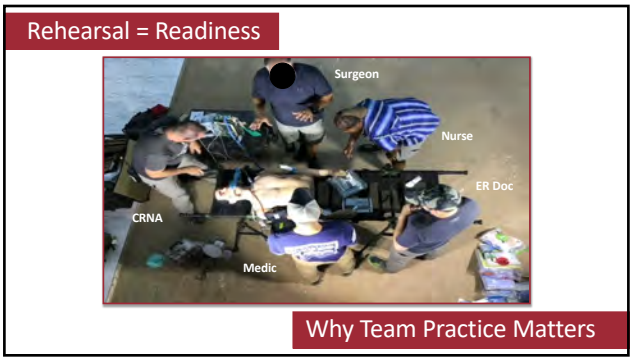

Seconds Count: FFP Readiness for Incoming Casualty

22


Rehearsal = Readiness
Surgeon
Nurse
ER Doc
CRNA
Medic
Why Team Practice Matters

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Anesthesia Made Simple
Enough Supplies for 1 surgical case
• Intubation Equipment to include BVM
• Induction Drugs
• Cric Kit
• OGT
• IV supplies
• TIVA supplies
• EMMA ETCO2 monitor
• Finger Pulse Ox

24

Packable, Portable, Ready: Anesthesia Anywhere

- Capabilities to do 2 Surgical Procedures
  - IV fluids
  - TIVA supplies with medications and narcotics
  - Airway equipment
  - Venous access supplies
  - Arterial Line equipment
  - Regional Block supplies
  - Mindray Monitor
  - SAVE 2 / Sparrow Vent
  - Buddy light Fluid Warmer
- Walking Blood Bank Kit

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Older Technology

VENTILATORS

26

Todays Medical Equipment

Compact, Capable, and Combat-Ready

27

Older Technology: Cardiac Monitors

28

Compact Monitoring Solutions for Austere Environments

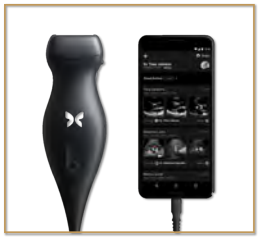
29

Portable Warming and Power in Combat Care

Gear That Moves With You

30

Diagnostic Equipment on the Move



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Electrosurgical Challenges in Damage Control Procedures

- Can only be utilized at fixed facilities
- Can't be utilized on flight platforms

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Anesthesia at the Point of Injury: Role in Trauma Response

- Damage Control Resuscitation
- Airway Management
- Surgical Support
- Line placement
- Pain management
- Flight physiology
- * SOLO Anesthesia Provider- NO Anesthesiologist

33

Vascular Access and Flow Capabilities (Gravity)

- IO- 50-150 mL/min on a pressure bag
- 14 g IV Catheter- 236 mL/min
- 16 g IV catheter- 155 mL/min
- 18 g IV catheter- 98.1 mL/min
- 20 g IV catheter- 64.4 mL/min
- RIC- 850 mL/min
- 9 Fr Central venous Catheter- 1000 mL/min

34

35

Triaging Trauma Patients

- What are your capabilities?
- How many patients can you treat and how much medical supplies do you have with you?
- How much blood products do you have?
- Think of your current situation and the time and resources it will take to get the patient off the X and to the next higher echelon of care

36

Bridging the Gap: ATLS in the Civilian Sector vs. Tactical Combat Casualty Care (TCCC) in Combat

ATLS

- Focuses on x-ABCDE
- Never critically evaluated for efficacy or application for battlefield integration

TCCC

- Divided into 3 phases
  - Care under Fire
  - Tactical Field Care
  - Tactical Evacuation Care
- Focuses on preventable causes of battlefield death

37

Care Under Fire

- Fire Superiority & Cover
- Self- aid
- Hemorrhage Control
- Evacuate ASAP

38

Tactical Field Care

M A R C H P A W S

Massive Hemorrhage	Airway	Respirations
Circulation	Head Injury/ Hypothermia	Pain
Antibiotics	Wounds	Splinting

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Tactical Evacuation Care

- Medical care rendered during evacuation to a higher level of care
- Includes en-route monitoring interventions

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Forward Surgical Response:
Team Arrival to the Casualty

- What care has been rendered to the injured casualty?
- The team performs a primary survey
- Determine the extent of injuries
- Discuss the required interventions needed
- Communication between the CRNA and Surgeon is Critical!!!!

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Triage Case Scenario
Assessing and Prioritizing Care

?

What is your thought process?

24 yo US casualty involved in a vehicle explosion from an IED.

You arrive to the scene and assess:

Bilateral above knee amputations	Perineal penetration and buttock wounds	CPR is in progress by other Soldiers	PEA is noted on monitor when connected

42

Tri-Modal Distribution of Mortality

50%	30%	20%
Of trauma deaths occur within seconds or minutes after the injury	Of trauma deaths occur within the first few hours after the injury	Of trauma deaths occurred days, weeks, or months after the injury

43

TCCC Essentials: Contents of the Individual First Aid Kit (IFAK)

- Combat gauze
- Gauze dressing
- ABD dressing
- Occlusive Chest Seals
- Needle decompression devices
- Tourniquets
- NPA
- Bandage Scissors
- +/- Cricothyrotomy kit

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Reality in Combat

- Treatment can't be rendered until the threat has been neutralized
- When you have a Soldier that is not breathing without a pulse, that Soldier is DEAD!!!!
- You have to move on to the next patient
- Triaging patients is essential!!!!!

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Triage Under Pressure: A Clinical Scenario

How Would you Triage the following patients?

Patient 1	Patient 2	Patient 3
US Soldier walks in to your OR with a GSW to the chest	Afghanistan translator arrives with multiple extremity injuries	Afghanistan Commando arrives unresponsive with barely a pulse and a GSW to the abdomen.

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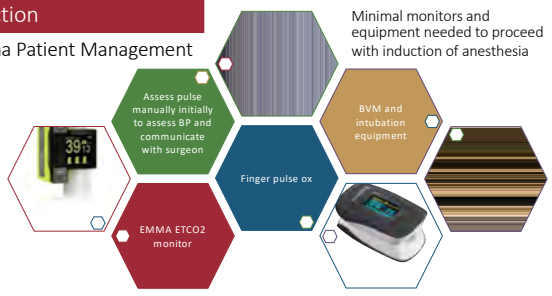
Austere Environment Induction

Trauma Patient Management



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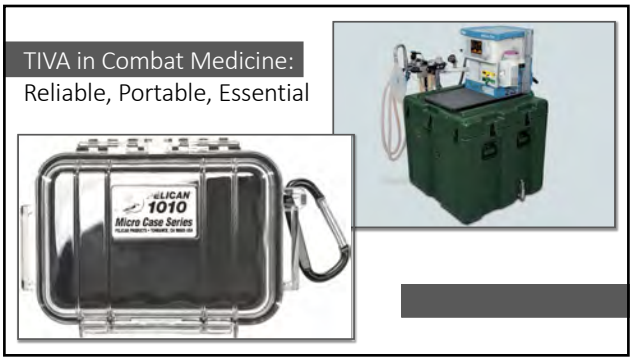
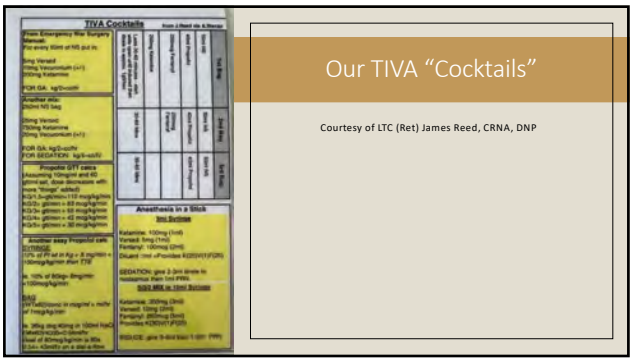
TIVA in Combat Medicine:

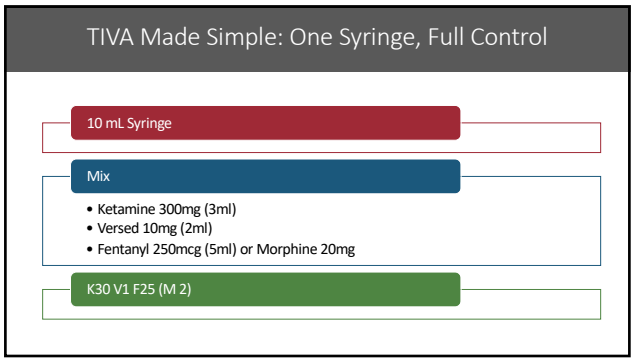
Reliable, Portable, Essential



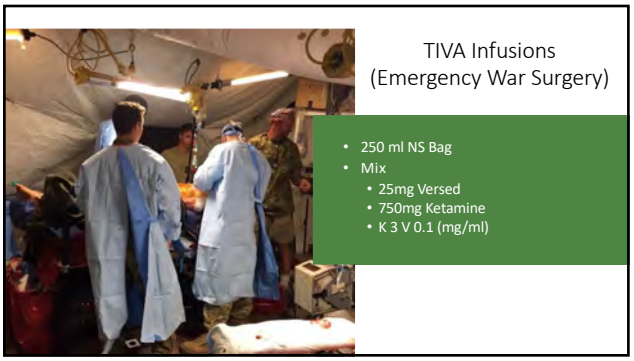
48


TIVA Cocktails
Our TIVA "Cocktails"
Courtesy of LTC (Ret) James Reed, CRNA, DNP

49


TIVA Made Simple: One Syringe, Full Control
10 mL Syringe
Mix
• Ketamine 300mg (3ml)
• Versed 10mg (2ml)
• Fentanyl 250mcg (5ml) or Morphine 20mg
K30 V1 F25 (M 2)

50


TIVA Infusions
(Emergency War Surgery)
• 250 ml NS Bag
• Mix
• 25mg Versed
• 750mg Ketamine
• K 3 V 0.1 (mg/ml)

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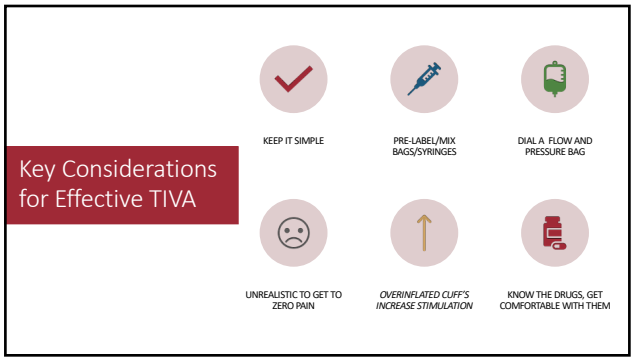
Key Considerations for Effective TIVA
KEEP IT SIMPLE
PRE-LABEL/MIX BAGS/SYRINGES
DIAL A FLOW AND PRESSURE BAG
UNREALISTIC TO GET TO ZERO PAIN
OVERINFLATED CUFF'S INCREASE STIMULATION
KNOW THE DRUGS, GET COMFORTABLE WITH THEM

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Ketamine: A Versatile Agent in Trauma and Austere Anesthesia

- Reliable single- agent induction when limited drugs available
- Can be given IM if no IV/IO access
- Field expedient choice when ventilators/ monitors scarce
- Safe for patients with a TBI or ocular injuries

Primary induction agent of choice

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Inducing of Anesthesia When Resources are Limited

- Prioritize airway control and oxygenation
- Using minimal monitors and equipment until feasible
- Muscle relaxants only if ventilatory support available
- Leverage available personnel
- Mix your induction agents in one bag or syringe

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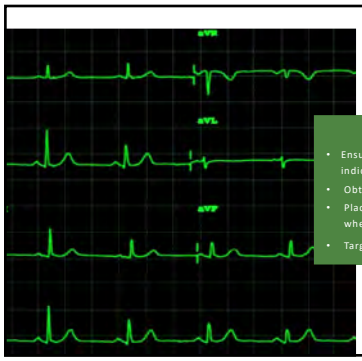

Maintenance of Anesthesia

- Ensure adequate IV Access; place arterial line if indicated
- Obtain labs when feasible
- Place patient on appropriate monitors and equipment when feasible
- Target MAP >55mmHg

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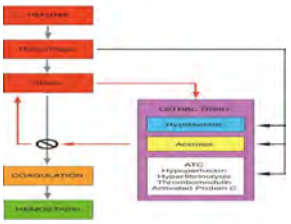
DCR Essentials: Bleeding Control, Access, and Time

- Hemorrhage Control
- Hypotensive Technique
- *Administer TXA*
- *Replace Blood with Blood Products*
- Administer CaCl after Blood Products
- Prevent Hypothermia
- Prevent Acidosis



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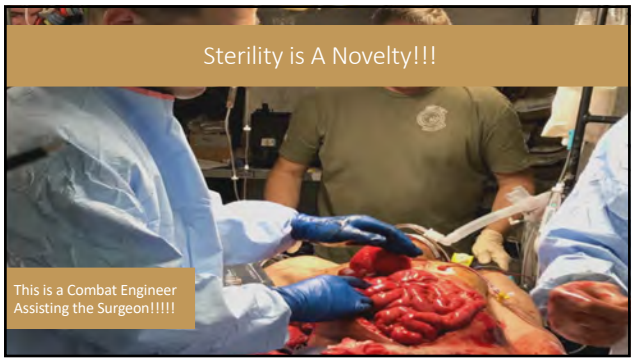
Damage Control Surgery
in the Austere
Environment in a Role 2

57


Sterility is A Novelty!!!
This is a Combat Engineer
Assisting the Surgeon!!!!!

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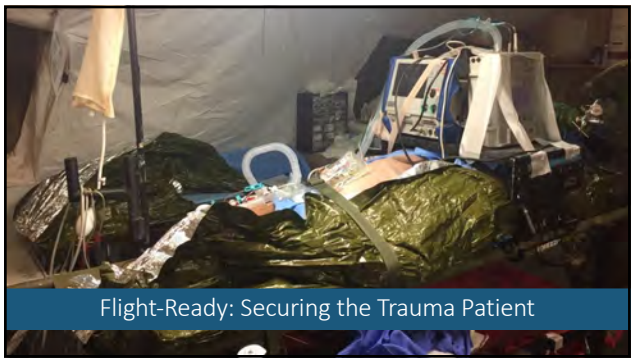
Damage Control Surgery
Tourniquet

59


Flight-Ready: Securing the Trauma Patient

60

Recognizing Hemorrhagic Shock:
Clinical and Laboratory Markers

Proven markers of organ perfusion can be used early for management for resuscitation goals

- Altered Mental Status
- HR, BP, ***pulse pressure***, RR, UO
- Shock Index (HR/SBP)
- Base Deficit
- Blood Lactate

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Whole Blood:
One Bag, Everything Needed

Fresh Whole Blood can be maintained for 4 hours at room temperature and discarded if not used per guidelines.

Whole Blood contains all components of intravascular volume.

Fresh Whole Blood (FWB) can be collected far forward and has the highest quality components.

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Whole Blood Collection at the Point of Care

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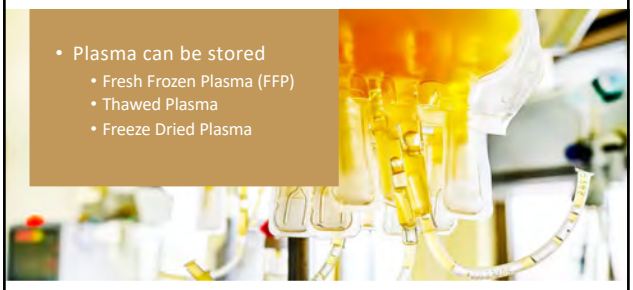
Plasma Types for Austere and Tactical Environments

- Plasma can be stored
  - Fresh Frozen Plasma (FFP)
  - Thawed Plasma
  - Freeze Dried Plasma



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Freeze- Dried Plasma:
Resuscitation in Resource Limited Settings

65

Resuscitation with Blood Components: Evidence-Based Practice (Austere vs Hospital Setting)

Administer DCR fluids from most to least preferred:

- Whole Blood (FDA-approved LTOWB preferred)
- *Plasma, platelets, red blood cells (RBCs), and CRYO in a 1:1:1:1 ratio- most challenging*
- Whole blood in a recently tested donor
- Plasma and RBCs in a 1:1 ratio
- Plasma or RBCs alone

66

Operational Strategies for Blood Storage in the Austere Environment

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Managing Hypotension When Blood Isn't Enough

- If a vasopressor support is required, utilize vasopressin
  - Maintain MAP > 55
  - Associated with a higher mortality if required
- If unresponsive to vasopressors, administer Hydrocortisone 100mg IV
- Avoid routine vasopressors in Hemorrhagic shock!!!

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Multimodal Pain Management in Trauma Care

- Ketamine
- Magnesium
- OFIRMEV
- Regional Anesthesia
  - Bilat TAP Blocks
  - Extremity Blocks
- Local anesthetic injected into incision by surgeon

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What Guides US: Decision- Making in the Combat Environment

Clinical Practice Guidelines (CPGs) are the Backbone of the Joint Trauma System(JTS) Performance Improvement Program for Combat Trauma

"CPGs are evidence-based and developed with subject matter experts in the military and civilian communities, deployed clinicians, trauma care physicians, surgical consultants, and JTS leaders."

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Key CPGs for Anesthesia

- Airway Management in Prolonged Field Care
- Airway Management of Traumatic Injuries
- Analgesia and Sedation Management During Prolonged Field Care
- Anesthesia For Trauma Patients
- Prehospital Blood Transfusion
- Damage Control Resuscitation
- Austere Resuscitative and Surgical Care
- Whole Blood Transfusion
- **Military Working Dog CPGs (approx. 20)**

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Care of the Military Working Dog (MWD) in the Austere Environment

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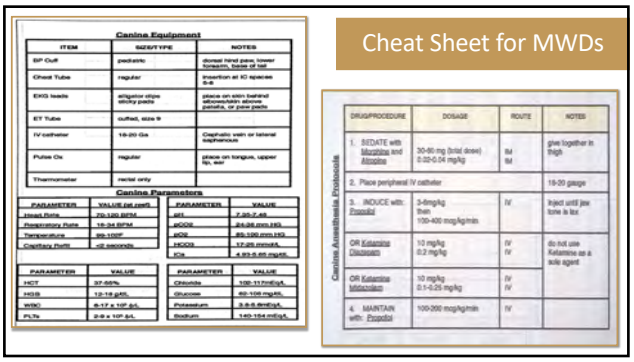

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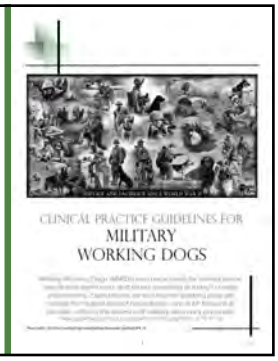
MWD CPGs

- Nearly 150 pages - comprehensive but dense
- Provide care only when:
  - The dog is too instable to transport
  - Immediate life, limb, or eyesight care is required and veterinary personnel is unavailable



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CH-47 Chinook Helicopter

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C-130 Hercules

77

C-17 Globemaster III

78

V 22-Osprey

79

Boeing V22 Osprey

80

AS332 Super Puma

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Why We're Winning the Fight for Lives on the Battlefield

- Improved personal protective equipment
- Tactical Combat Casualty Care (TCCC)
- Faster Evacuation Times
- Better trained medics

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REFERENCES

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