

Management of Seriously Wounded Patients During Transport



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Disclosures

I have no financial disclosures.



Overview

- Familiarize audience with USAF Critical Care Air Transport Team (CCATT) Mission
- Review acute management goals of TBI
- Review acute management goals of other injuries
- Review and Questions

ICU in the sky

(picture from an article by Dr. T. Carter in ASA March 2006)



Mission

- CCATTs assist in carrying out the mission of the Aeromedical Evacuation (AE) system, which includes air transport of patients under medical supervision while delivering optimal care
- Enhance the AE of critically ill or injured patients who require continuous stabilization and advanced care during transport to the next level of care

CCATT

- Critical Care Air Transport Team
 - Physician
 - Emergency Medicine, Anesthesiologist, Pulmonologist/Critical Care, Cardiologist
 - Critical Care Nurse
 - Respiratory Therapist



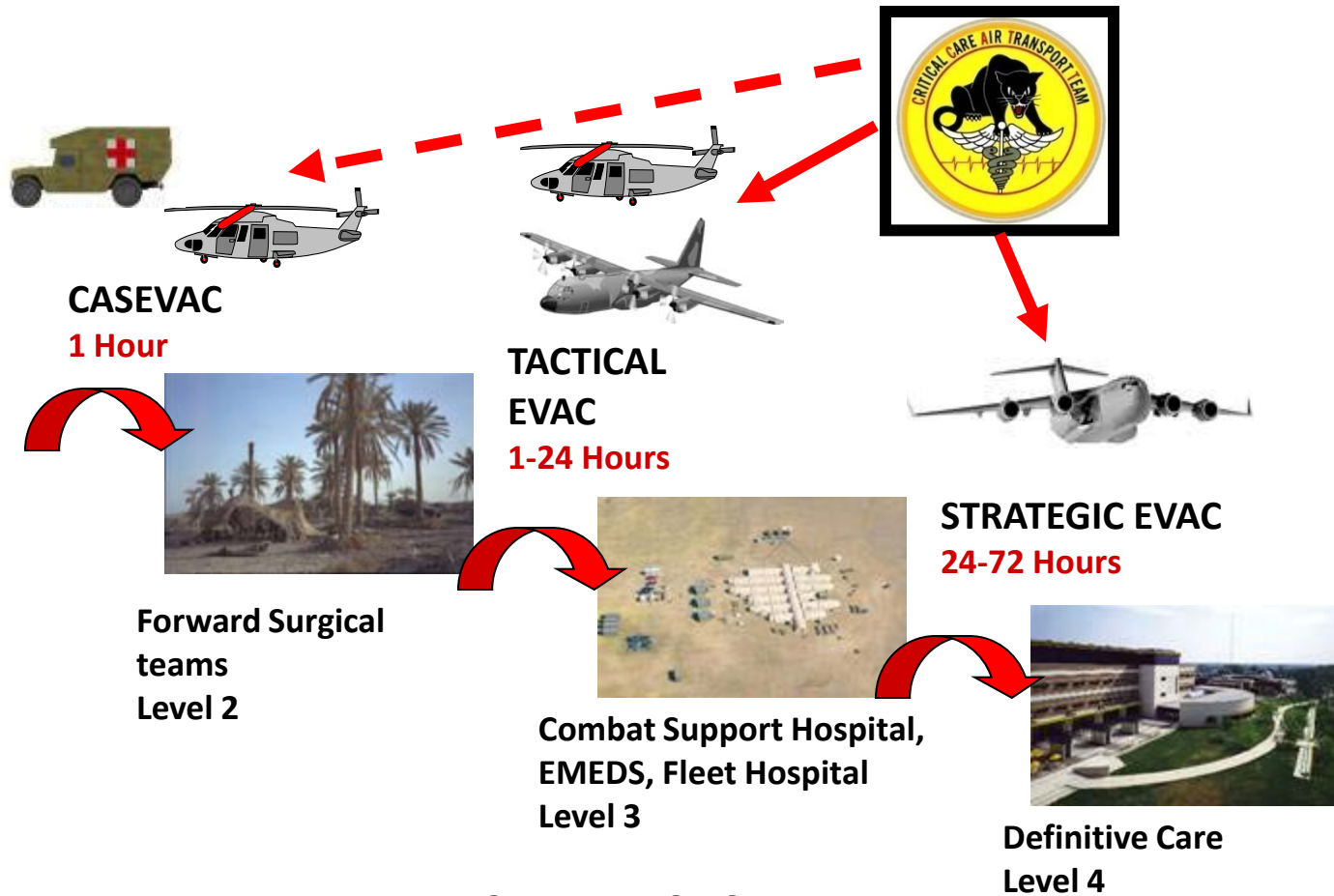
Scope of Care

- Upon arrival of the stabilized patient to the staging location the role of the CCATT is to prepare the critically ill or injured patient for AE
- The CCATT will accompany the patient to the aircraft and continue to monitor and intervene in-flight as required
- This team does not routinely provide primary stabilization and does not replace forward surgical or medical team capabilities
- Maximum patient load being **three high acuity** patients or care for up to **six relatively low acuity** stabilized patients for up to **72 hours** (6 patients maximum)

Types of Missions

- Operation Enduring Freedom, Operation Iraqi Freedom, and numerous peacetime and humanitarian missions, including:
 - Hurricane Katrina/Rita evacuation
 - Guantanamo detainee transport support
 - Presidential international travel support
 - Support for the earthquake in Haiti
 - High-profile patient transport

Care En-route



Inter-Theater Routes



CCATT Equipment (585 pounds total)



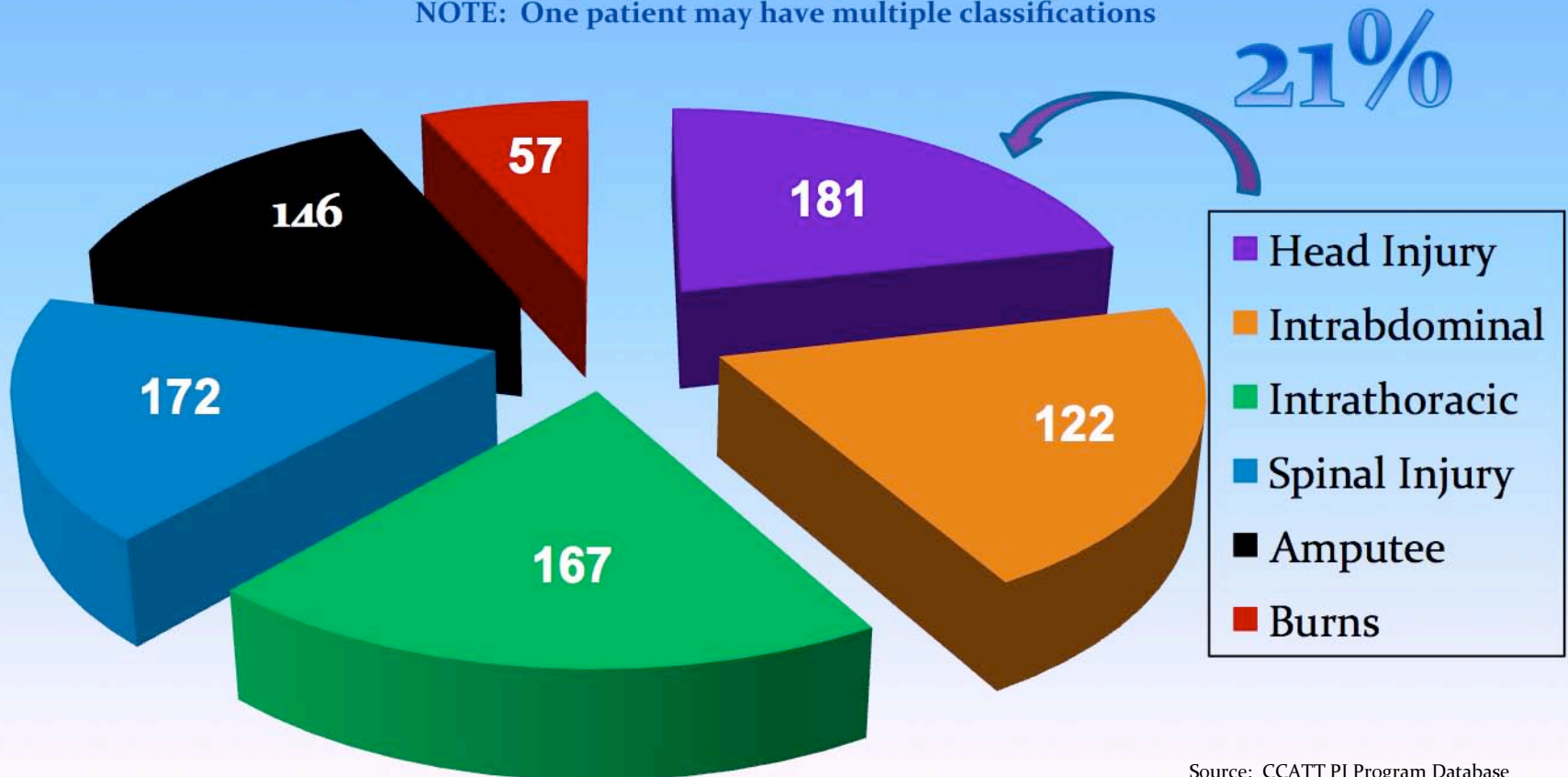
Patient Setup on Aircraft



CCATT Transports - Trauma

January 2009 - January 2010

NOTE: One patient may have multiple classifications



Source: CCATT PI Program Database

Traumatic Brain Injury (TBI)



Traumatic Brain Injury Goals in Flight

- 65% mortality for Glasgow Coma Scale (GCS) 3-5
- 10% mortality for GCS 6-8
- Survivors of severe TBI, independent living statistics:
 - >40% for GCS 3-5
 - 60% for GCS 6-8
- Goal is to prevent secondary brain injury
 - Hypoxia (keep SpO₂ >93%)
 - Shock (keep systolic blood pressure > 90 mmHg)
- Document serial neurological examinations
- Avoid intracranial hypertension

TBI Management Goals in Flight

- **Neurologic:** ICP <20 mm Hg, CPP >60 mm Hg, seizure prophylaxis, elevate head of bed and prevent jugular vein obstruction
- **Hemodynamic:** Support MAP to maintain CPP goals
CVP >5 mm Hg
- **Pulmonary:** SpO₂ > 93% PaCO₂ 35-40 in 1st 24hr
30-35 24hr – 7 days
- **Hematologic:** avoid anemia, coagulopathy, & thrombocytopenia
- **Metabolic:** Glucose 80 – 150 mg/dl; avoid hyperthermia
- **Renal:** Serum Osmolality 280–320 mOsm
Serum Sodium 138-165 mEq (3% saline protocol)

Intracranial Devices

Codman Ventricular Drain



Codman Intracranial Monitor



Thoracic Trauma



Thoracic Trauma

- Blunt vs Penetrating
- Cardiac and Pulmonary Contusions
 - Supportive care (arrhythmias, cardiogenic shock, oxygenation and ventilations problems)
- Cardiac Tamponade
 - Pericardiocentesis
- Tension pneumothorax
 - Needle thoracostomy and chest tube placement
- Massive hemothorax
 - Adequate fluid resuscitation
 - May auto-transfuse shed blood

Thoracic Trauma Goals in Flight

- Monitor for central venous and arterial pressure, chest tube(s) output
- Maintain intravenous (IV) access with large bore peripheral IV's, central line
- Consider taking blood products for continued resuscitation
- Be prepared to perform needle thoracostomy and/or perform chest tube placement
- Maintain adequate oxygenation and ventilation (FiO₂ at least 40%) (Tidal volumes of 6-8 ml/kg)

Damage Control Laparotomy after Abdominal Trauma



Abdominal Trauma

- Blunt vs Penetrating
- Frequently requires laparotomy
- Risk factors for massive transfusion (MT)
 - SBP < 110mmHg
 - Hct < 32%
 - 3 of 4 have 70% risk of MT, 4 of 4 have 85% risk of MT
 - Heart Rate > 105 bpm
 - pH < 7.25
- Transport problems
 - Hemorrhage
 - Associated with injury to liver, spleen, kidney, vascular structures
 - Hypothermia
 - Open abdomen
 - Coagulopathy
 - Sepsis
 - Difficulty in ventilation (abdominal compartment syndrome)

Abdominal Trauma Goals in Flight

- Maintain intravenous (IV) access with large bore peripheral IV's and/or central line
- Consider continuous blood pressure monitoring
- Consider taking blood products for continued resuscitation
- Monitor for evidence of abdominal compartment syndrome (checking urine output, bladder pressures, and peak airway pressures)
- Monitor and treat for possible hypothermia and acidosis, coagulopathy, and sepsis

Orthopedic Trauma

- Blunt versus Penetrating
- May involve neurovascular injury
- Patients may require repeated care
- Many patients will have other injuries



Orthopedic Trauma Issues and Goals

- Pelvic Fractures
 - Significant blood loss (stabilize the pelvis and consider taking additional blood products)
 - Major hemodynamic swings
 - High mortality rates
 - 18-40% in civilian population
 - Major cause of death is exsanguination (70% venous, 30 arterial bleed)
 - Ensure pelvis is adequately stabilized (Surgical stabilization, Vacuum Spine Board use (VSB))
- Extremity injuries
 - Potential for significant blood loss
 - Neurovascular injuries – evaluate prior to flight for baseline
 - Potential for fat embolism
 - Potential for compartment syndrome (consider pre-flight fasciotomies)
 - Potential for rhabdomyolysis

Spine Injury



Flight Considerations

- Carefully evaluate neurologic status pre-flight
 - Note deficits before flight
 - Consider pre-flight intubation
- Avoid hypotension
 - Consider taking blood products
 - Consider vasopressors to improve mean arterial pressure and subsequent spinal cord perfusion
- Ensure adequate oxygenation and ventilation
- Pre-flight surgical stabilization versus vacuum spine board
- Consider DVT prophylaxis (5-20% risk of clinically apparent DVT/PE)

Spine Injuries

Vacuum Spine Board



Aspen Collar



Review

- Maintain the same level of care as there is on ground (ICU in the Sky)
- CCATT care is door to door
- Understand and adjust for stressors in flight
- Preparation prior to flight will improve overall patient care

Literature

- American Society of Anesthesiologists. Dr. T. Carter in ASA March 2006.
- “Blunt Abdominal Trauma”. Joint Theater Trauma System Clinical Practice Guidelines. 30 June 2010.
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- “Spine Injury Surgical Management and Transport”. Joint Theater Trauma System Clinical Practice Guidelines. 30 June 2010.

Any Questions?

Thank you for your time and attention!