Chapter 4

Aeromedical Evacuation

Introduction

Evacuation of injured personnel using aircraft, fixed or rotary wing, has revolutionized the rapid transport of casualties from areas where there is either inadequate or no care available to medical treatment facilities (MTFs) where essential and/or definitive care can be rendered. While an aircraft can decrease transport time, the aeromedical environment creates unique stresses on the injured patient. The following are terms that describe evacuation of patients using aircraft.

- Casualty evacuation (CASEVAC): The movement of a casualty from the point of injury to medical treatment by nonmedical personnel. Casualties transported under these circumstances do not receive en route medical care; if the casualty's medical condition deteriorates during transport, an adverse impact on the casualty's prognosis and long-term disability may result. Traditionally, this situation involves a helicopter mission returning from the battlefield.
- Medical evacuation (MEDEVAC): The timely, efficient movement and en route care provided by medical personnel to the wounded being evacuated from the battlefield to MTFs, using medically equipped vehicles or aircraft. Examples include civilian aeromedical helicopter services and Army air ambulances. This term also covers the transfer of patients from the battlefield to an MTF or from one MTF to another by medical personnel, such as from a ship to shore.
- Aeromedical evacuation (AE): Providing USAF fixed-wing **intra**theater (Tactical Evacuation [TACEVAC]: from the combat zone to points outside the combat zone, and between points within the communications zone) and **inter**theater (Strategic Evacuation [STRATEVAC]: from out of the theater

of operations to a main support area) movement of sick or injured personnel, with enroute care provided by AE crewmembers and critical care air transport teams (CCATTs), to locations offering appropriate levels of medical care.

- Enroute care: Maintenance of treatment initiated prior to evacuation and sustainment of the patient's medical condition during evacuation.

Medical Considerations for Patients Entering the Medical Evacuation System

Medical Considerations/Requirements

- Medical evacuation request includes requirement for surgical equipment and/or providers.
- Patient is sufficiently stabilized for the anticipated mode and duration of travel.
- Patient's airway and breathing is adequate for movement.
- Patient's IV lines, drainage devices, and tubes are fully secured and patent.
- Patient at high risk for barotrauma should be considered for prophylactic chest tube placement before prolonged aeromedical evacuation.
- Heimlich valves on chest tubes are functioning.
- Foley catheters and nasogastric (NG) tubes are placed and allowed to drain.
- Patient is securely covered with both a woolen and aluminized blanket for air transport, cold environment, or postoperative hypothermia.
- 3 litter straps are used to secure the patient to the litter.
- Personal effects and all medical records accompany the patient.

- The evacuation of a patient is initiated by the surgeon according to established procedures. The support patient administration personnel normally provide the administrative details and coordination required to accomplish the evacuation. Due to differences in the type of evacuation assets used and their effect on the patient's medical condition (such

as flying in the pressurized cabin of an aircraft), patients entering the USAF AE system must also be validated for evacuation by the supporting flight surgeon.

- For patients evacuated from Level II MTFs or forward surgical teams (FST), the brigade surgeon (or designee) determines the evacuation precedence for all patients requiring evacuation from that facility. This is done in consultation with the forward surgical team's chief surgeon and/or senior nurse. When a patient is readied for evacuation from the forward surgical team by USAF assets, the supporting patient movement requirements center (PMRC) should be established at the earliest possible time. This allows the PMRC sufficient time to coordinate airlift and patient movement items requirements.

Implications of Aviation Environment

- General Considerations Prior to Transport.
  - o Due to altitude effects, limited mobility, decreased staffing enroute, and unpredictable evacuation times, the referring physician should tailor vital signs (VS) monitoring requirements, and frequency of wound and neurovascular checks.
  - o Some therapies that might not be used in a fixed MTF are appropriate for AE.
    - ♦ For example, patients with significant medical or surgical conditions should have Foley catheters, NG tubes, provisions for IV pain medications, extended duration IV antibiotics.
  - o Consider liberal use of fasciotomies/escharotomies.
  - o Consider securing airway with prophylactic endotracheal (ETT) tube.
  - o Wounds dressed for delayed primary closure. Unless directed otherwise, AE crew should not routinely re-dress wounds. If a patient develops fever or sepsis enroute, wounds must be inspected.
  - o Casts must be bivalved. If the cast is over a surgical wound site, "window" the cast to allow for tissue expansion and emergency access. Document neurovascular checks prior to and frequently during flight.

- Decreased Barometric Pressure.
  - The diameter of a gas bubble in liquid doubles at 5,000 ft above sea level, doubles again at 8,000 ft, and doubles again at 18,000 ft. Cabin pressures in most military aircraft are maintained at altitudes between 8,000 and 10,000 feet. If an aircraft has the capability, the cabin altitude can be maintained at lower levels, with increased flight time and fuel.
- Consider a Cabin Altitude Restriction (CAR) for the following:
  - Penetrating eye injuries with intraocular air.
  - Free air in any body cavity.
  - Severe pulmonary disease.
  - Decompression sickness and arterial gas embolism require CAR at origination field altitude. Destination altitude should not be higher than origination altitude. Transport on 100% oxygen (by aviator's mask if available).
- Pneumothorax: Chest tube required, even for small, asymptomatic lesions. A Heimlich valve or collection system must be in place prior to patient transfer to the flight line.
- Air Splints: Should not be used if alternate devices are available. Because air expands at altitude, air splints require close observation and adjustments during flight.
- Ostomy Patients: Vent collection bags to avoid excess gas dislodging the bag from the stoma wafer. Use a straight pin to put two holes in the bag above the wafer ring.
- Decreased Partial Pressure of Oxygen: Ambient partial pressure of oxygen decreases with increasing altitude. At sea level, a healthy person has an oxygen saturation of 98%–100 %. At a cabin altitude of 8,000 ft, this drops to 90%, which corrects to 98%–100% with 2 L/min of oxygen.
- Neurosurgical Patients: Hypoxia may worsen neurological injury. Adjust ventilator settings to meet increased oxygen demands at altitude.
- Gravitational Stress: Traumatic brain injury patients can experience transient marked increases in intracranial pressure during takeoff or landing. Patient positioning onboard the aircraft helps minimize this risk (head forward on takeoff, head rearward on landing).

- Thermal Stress: Plan for cabin temperature changes from 15°C (59°F) to 25°C (77°F) on winter missions, and from 20°C (68°F) to 35°C (95°F) on summer missions.
- Noise: Exposure to noise can produce problems with communication and patient evaluation (auscultation is impossible — use noninvasive blood pressure [NIBP] and an arterial line). Provide hearing protection. Audible medical equipment alarms are useless.
  - o Decreased Humidity: Airplanes have very low cabin humidity at altitude. Evaporative losses will increase; therefore, patients will require additional fluids, especially those with large burns, and those at risk for mucous plugging.
- Patient movement in nuclear, biological and chemical (NBC) environments.
  - o Nuclear and chemical casualties must be externally decontaminated, and time allowed for off-gassing of residual chemical agent.
  - o Movement of biological casualties varies by the nature of the agent, its mechanism of transmission, and the period of communicability during the course of illness.
  - o Any NBC AE movement may be delayed due to the following:
    - ♦ Aircraft decontamination time.
    - ♦ Availability of noncontaminated aircrew.
    - ♦ Cohorting of similarly exposed patients.
    - ♦ Quarantinable diseases (eg, plague and smallpox) require special approval (command and diplomatic) before AE.

Medical Evacuation Precedences

- Depending on the Service and the type of evacuation assets used, the timeframes for affecting evacuation differ. Refer to Table 4-1.

Table 4-1. Evacuation Precedences.

Movement Precedence	Army, Navy, Marine (MEDEVAC)	Air Force (AE)	Description
Urgent	Within 2 h.	ASAP	Immediate AE to save life, limb, or eyesight.
Priority	Within 4 h.	Within 24 h.	Prompt medical care not available locally. Medical condition could deteriorate and patient cannot wait for routine AE.
Routine	Within 24 h.	Within 72 h or next available mission.	Condition is not expected to deteriorate significantly while awaiting flight.

- **Concept of Operations. The USAF AE system.**
  - o Command and control (C2) of casualty movement by air transport.
  - o AE personnel and equipment for inflight supportive patient care and flight line support operations.
  - o Organic communication network for medical facilities and airlift C2 agencies.
    - ♦ Aeromedical Evacuation Liaison Team (AELT): 4–6 person communication team, usually collocated with an MTF, to coordinate requests with the AE system.
  - o Facilities and personnel at airheads for the administrative processing, staging, and limited medical care of casualties entering or transiting the AE system. Patients are normally held only for 2–6 hours prior to evacuation.
    - ♦ USAF units provide aeromedical staging support through incrementally sized elements ranging in size/capability from forward deployed special operations forces (SOF) to 100-bed facilities.
- Reporting a Patient for AE. Originating physician consults with local FS to determine the en route care plan and timing of evacuation.

Due to the complexity of the AE system, physicians must identity points of contact (POCs) (local Flight Surgeons [FSs], AELT, aeromedical staging elements, PMRC); verify and test lines of communication; and rehearse patient evacuation drills and procedures, **before** the actual need arises.

- Patient Stability. Patients validated for transport by AE must be stabilized as well as possible (secure airway, controlled hemorrhage, treated shock, and immobilized fractures).
  - o Communicate the condition, AE category (ambulatory or litter), and movement precedence (Table 4-1) of the patient to the PMRC, as communications assets allow. See PMRC contact information below.

PMRC	Commercial telephone number	Military telephone number
Global-Scott AFB, IL	1-800-303-9301 or 1-800-874-8966	DSN 779-4200 or 8184
EUCOM Theater-Ramstein Air Force Base, Germany	011-49-6371-47-2264 or 2235	DSN 314-480-2264 or 2235
PACOM (Hickam AFB Hawaii)	808-448-8734	DSN 448-8734

  - o To ensure optimum care, communicate with the accepting physician, and provide diagnosis, care rendered, and subsequent medical care plan (next 24–48 h).
  - o Ensure the patient has adequate quantities of supplies and medications for duration of transfer (at least 72 h).
- **Local Flight Surgeon Responsibilities.**
  - o Authority for determining whether patients are physiologically ready for air transport.
  - o Resource for AE system information, communication, and coordination.

AE Process

Activity	Location at Which the Activity Occurs
Request for AE mission (see end of chapter for format).	Originating physician.
Validation for Aeromedical Evacuation.	PMRC (establishes AE requirement).
Clearance to move by air.	MTF (referring physician and local FS).

- Request versus Requirement. AE **requests** and patient movement **requirements** are different. Physicians at originating MTFs submit requests for movement, timing, destination, suggested support therapies, and so forth. Only the validating Flight Surgeon (usually located at PMRC; not the local FS) and the PMRC can validate those requests, which then become AE requirements.
- Validation versus Clearance for USAF AE.
  - o Aeromedical evacuation **clearance** is a medical care event; **validation** is a logistical event.
  - o **Clearance** is a decision between the referring physician and the local FS, addressing
    - ♦ Description of the medical condition of the patient.
    - ♦ Probability that patient can survive transit through an aviation environment.
    - ♦ What the patient needs to make the trip safely.
    - ♦ Enroute medical capability requirements.
- Key Steps for USAF AE Patient Request.
  - o Contact local FS and AE liaison for clearance consultation.
  - o Determine the patient's AE category, based on diagnosis and ability to self-help in an emergency during flight.
  - o Determine need for CCATT (see below). The CCATT adds an additional level of support to the AE system for movement of stabilized patients who require a higher level of medical therapy or have the potential to experience significant deterioration during movement. The CCATT physician is the clinical authority and, with the other team members, is responsible for documenting and providing

care. CCATT members may be called on to consult and/or assist in the care of other patients.

- o A four-person burn transport team can augment a CCATT team as required for inhalation injury and/or severe burns.
- o Determine if special requirements exist for transport; eg, CAR, and splinting.
- o Determine patient movement items (PMI) required (eg, ventilators, pulse oximeters, among others). Flight surgeon must verify that all items accompanying the patient are cleared for in-flight use.
- o Determine the patient's movement precedence.
- o Submit request.

Critical Care Air Transport Teams

Intensivist physician.

- Capable of providing short term life-support, including advanced airway management, ventilator management, and limited invasive (nonoperative) procedures.
- Trained in critical care medicine, anesthesiology, or emergency medicine.

Critical care or emergency medicine nurse.

- Experienced in managing patients requiring mechanical ventilation, invasive monitoring, and hemodynamic support.

Cardiopulmonary technician.

- Experienced in management of patients requiring mechanical ventilation, and invasive monitoring.
- Experienced in troubleshooting ventilatory support and monitoring systems.