Aeromedical Evacuation of Patients with Highly Infectious Disease in Italy: Lessons Learned

Évacuation aéromédique des patients avec une maladie hautement infectieuse en Italie: leçons apprises

Italian Air Force. Logistic Command – Medical Service
Overview

• Background
• Principle of isolation on aircraft
  – Aircraft Transit Isolator System
• Aeromedical Isolation Unit
• Operational challenges
• Operational experience
• Lessons learned
The outbreak of Ebola Virus Disease (EVD) in West Africa has highlighted questions related to the evacuation of patients with highly infectious diseases (HIDs).

Medical evacuations from EVD-affected countries:
- Total: 65
- Europe: 38
- USA: 27
AE of patients with highly infectious disease

• Usually an absolute contraindication for AE
  – AAMedP-1.1 (STANAG 3204)

• Risks
  – Spreading the disease
  – In flight transmission
AE of patients with highly infectious disease

DECISION MAKING

• Treatment in place
  – Policy most frequently in use

• Dedicated flight
  – Low risk of transmission, window of non-communicability

• Isolation systems
  – Exceptional circumstances (VHF)
  – Absence of local medical support
  – Limited number of patients
  – Proper mode of isolation: **closed** vs **open** isolation
**Isolation on aircraft**

**Open Isolation**
- The patient and medical staff inside a mobile isolation unit (e.g. tent, container, ambulance), HEPA and negative pressure
- Medical staff protected by PPE
- Enhanced monitoring and treatment interventions
- Highly complex logistics

**Closed Isolation**
- The patient is placed inside a physical containment: an isolation stretcher (HEPA + negative pressure)
- Medical staff outside without PPE
- Integrated gloves allow some basic patient handling from outside
- Easy to implement
The Aircraft Transit Isolator System

- The Italian Air Force employs the ATI System. Developed by Vickers in the U.K. in the 1970s
- Program development began in 2005
- Two isolators (modular system):
  - STI - Stretcher Transit Isolator: for ambulance
  - ATI - Aircraft Transit Isolator: for aircraft
- Sealed containers in PVC under negative pressure maintained by a battery-powered HEPA-filtered ventilation system
The Aircraft Transit Isolator System

• Already in use
  – Aeromedical Isolation Team (US Army), Deployable Aeromedical Response Teams (RAF)

• Easy to implement

• Many monitoring and treatment interventions allowed (i.e. intubation, ventilation, fluids)

• Suitable for different aircraft (C-130J, C-27J, KC-767)

• Modular system: implemented with isolation tent for stand-by care (continuity of care)
Isolation Systems

Aircraft Transit Isolator (ATI)

Stretcher Transit Isolator (STI)

Isoark N-36

Isoark Tent
The Aircraft Transit Isolator System Procedures

- Patient reception and isolation (ATI or STI)
- Patient transferring (ATI ↔ STI)
- In-flight patient care (monitoring and treatment)
### Patient reception and isolation (ATI or STI)

<table>
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<tr>
<th>Personnel with PPE</th>
<th>![Image of personnel with PPE]</th>
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<td>Patient assessment and stabilization</td>
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<td>Staff decontamination and PPE doffing</td>
<td>![Image of staff decontamination and PPE doffing]</td>
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Patient transferring (ATI ↔ STI)

Personnel with or without PPE
Connection with a transfer sleeve
Panel removed from the inside

Transfer of the patient

Clamping and cutting
Without breaking the microbiological barrier
Transferring the isolated patient
Patient care – Nursing facilities

- Half suit for patient intubation and airways management to be placed at the entry port

- Two half suits for use if the freedom of movement within the sleeves is insufficient

- Four pairs of gloved sleeves

Materials required for patient care stored inside: absorbent pads, emesis basins, portable toilet, etc.
Patient care – Nursing facilities

- A supply port to bring supplies into the isolators using the double bag system
- Two long closed sleeves which are available for storage of waste material
- Various sealed cones which may be utilized to pass tubing and wires
Patient with suspect CC-HF intubated and ventilated during an AE in 2007
ATI Flight Certification Issues

- Whenever a certain modification is needed
  - Military Operational Certification

- Examples of certification issues:
  - ATI boarding (high loader on KC-767)
  - Restraint device and fastening
  - Power supply, EMC interference
  - Vibration, weight
  - Emergency egress procedures
C-130 J set-up
The Aeromedical Isolation Unit
The Aeromedical Isolation Unit

- Pratica di Mare AFB Medical Wing
  - Provides Aeromedical Evacuation Support
  - Rapid response within 8 hrs

- Isolation devices
  - ATI (2 operational), STI, Isoark N-36, Isoark tent

- Operators
  - Medical Doctors (Flight Surgeons, Anesthetist, Infectious Disease specialist)
  - Flight nurses
  - Technicians (ATI Maintenance)

- Aircraft certified
  - FW: KC-767, C-130 J, C-27 J
  - RW: HH-139, HH-212
• **Training requirements**
  – Initial course on medical management of HID patients in flight
  – Periodical Training (at least twice a year)
  – Other courses
    • Joint Forces CBRN Defence School (Italy)
    • MMCBC Course at USAMRIID (US)

• **Joint activity with Ministry of Health**
  – Reference HIU Spallanzani Hospital (Rome), Sacco Hospital (Milan)

• **Topics**
  – Patient care during transport, infection control practices, PPE (selection, donning, doffing, use), decontamination
OPERATIONAL CHALLENGES
MEDEVAC vs Bio-MEDEVAC

MEDICAL
- Personnel
- Training
- Medical equipment
- Patient management

AVIATION
- Flight plan
- Equipment Certification
- Disinfection of aircraft

ORGANIZATIONAL
- Responsibilities
- Coordination
Operational Challenges

• Coordination
  – With sending/receiving facilities

• Flight planning according to IHR
  – Diplomatic clearance, diversion, in-flight emergency procedures

• Patient assessment (pre-mission)
  – Medical → contraindication to flight
  – Infectious risk (mode of transmission) → isolation precautions, PPE

• Equipment
  – Medical: electrical devices, drugs
  – Isolation: isolator + spare parts, PPE, decontamination systems etc
  – Waste disposal
Operational Challenges

- **Field operations**
  - Area set-up (clean / dirty area)
  - Patient evaluation and stabilization
  - Isolation procedures (onload, offload)
  - Decontamination and waste disposal

- **In-flight care**

- **Patient hand-off**

- **Post mission**
  - Modules sealed and transported for decon, disassembly, disposal
  - Disposable contents removed and incinerated
  - Usually aircraft decontamination not required
Operational experience
Operational experience

• **2006**
  - 1. AE TBC Sardinia

• **2007**
  - 2. AE suspect CCHF Torino
  - 3. AE TBC Sardinia

• **2009**
  - 4. AE dengue Torino

• **2010**
  - 5. AE TBC Sicily

• **2011**
  - 6. AE TBC Sicily

• **2014**
  - 7. AE suspect monkeypox Sicily
  - 8. AE EVD Sierra Leone

• **2015**
  - 9. AE EVD Sardinia
  - 10. AE TBC Sardinia
  - 11. AE Suspect VHF Pantelleria
Operational experience

- Missions: 11
- Isolator: ATI (11)
- Range: 10 in Italy (8 from islands), 1 from Sierra Leone
- Aircraft: C-130 J (10), KC-767 (1)
- Receiving facilities: Spallanzani Hospital (Rome)
- Disease: EVD (2), TBC-MDR (5), suspect HF (3), suspect monkeypox (1)
- All missions successful, no incidents
Lessons learned - 1

• AE of patients with HIDs in an effective and safe manner is a challenge requiring a strong background in preparedness, including logistics, procedures and skills

• BIO-MEDEVAC vs AEROMEDDEVAC more complex for infection control procedures (isolation, people involved, use of PPE & decontamination)

• AE capability achieved on short (helicopter, C-27) medium (C-130 J) and long range (KC-767)

• ATI in our experience was effective for in-flight patient management

• Easy aircraft recovery, no need for decontamination procedures
Lessons learned - 2

• Transport must be coordinated with public health and civil aviation authorities

• Value of collaboration with Ministry of Health already employed in the past with joint training and evacuation of other patients

• Limitations
  • Elevated number of patients
  • High level of care to critical patient for long flight

• Our ten years experience showed the added value of long-lasting preparedness for the management of a patient with high risk infectious diseases
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Grazie!
References

• North Atlantic Treaty Organization (NATO) STANAG 3204. Aeromedical Evacuation