Responding to In-flight Emergencies

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Disclosures

• None
Objectives

1. Discuss equipment readily available on commercial airlines

2. Understand the rules and laws governing medical emergency aboard aircraft including the decision to divert a flight

3. Recognize the common medical emergencies that arise during air travel.
Case Presentation

- No “Shockable Rhythm” identified by AED
- CPR Continued
- Oropharyngeal airway placed and oxygen applied*
Case Presentation

• Pilot makes decision to divert
• Peripheral IV attempted- failed
• Right External Jugular IV placed
  • Epinephrine and Atropine given
Case Presentation

• After Medications given- AED alerted “Shockable Rhythm”- 1 shock delivered

• No pulse or signs of life, CPR resumed

• Second Epinephrine given

• Endotracheal intubation attempted
Case Presentation

• ETT placed but no breath sounds heard

• ETT removed and smaller caliber tube placed with B/L breath sounds heard

• Both ETT tube and REJ IV unstable, both lost
Airline emergencies

- Most are minor and never reported
  - Flight attendants handle ~ $\frac{3}{4}$ medical situations

- Major events are rare.
  - 1:10,000 passengers to 1:40,000 passengers
  - 3% fatal (approximately 1:1,000,000 passengers)
  - International flights 1.5-2x incidence

- More frequent in the future
  - Lower cost of air travel
  - Rising life expectancy
  - Medical Tourism
# Medical Events Aboard Aircraft

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>20%</td>
<td>10%</td>
<td>13%</td>
<td>5%</td>
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<tr>
<td>GI</td>
<td>8%</td>
<td>28%</td>
<td>21%</td>
<td>9%</td>
</tr>
<tr>
<td>Syncope/near syncope</td>
<td>22%</td>
<td>8%</td>
<td>&lt;1%/19%</td>
<td>53%</td>
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<tr>
<td>Neurologic</td>
<td>12%</td>
<td>9%</td>
<td>31%</td>
<td>2%</td>
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<tr>
<td>Respiratory</td>
<td>8%</td>
<td>5%</td>
<td>9%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>OB</td>
<td></td>
<td></td>
<td>2%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Trauma</td>
<td>5%</td>
<td>3%</td>
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</table>
Aircraft – difficult environment

- Cruising altitude 30,000-40,000 ft
- Cabin is pressurized to 6,000-8,000 ft
- Cramped conditions
- Lack of access to patient
- Lack of privacy
- Language barriers
- Noise
- Aircraft vibration
- Unfamiliar supplies/environment
Physiologic effects

- Decrease in partial pressure of arterial oxygen from 95 mmHg to 55 mmHg
- Air and gas expansion in body cavities
  - Includes casts and feeding tubes
- Increase pulmonary artery pressures
- Drying of mucous membranes
Hemoglobin Physiology

Barometric pressure decreases exponentially with altitude. At sea level, $P_{O_2}=160$ mmHg. At 2400m $P_{O_2}=120$ mmHg.
## Contraindications to Air Flight

### General
- Any contagious disease
- Unstable behavior problems
- Hemoglobin <8.5g/dl

### Cardiovascular
- MI within previous 3 weeks or CABG within 2 weeks
- Unstable Angina
- Decompensated heart failure

### Respiratory
- Baseline pO2 <70 mm Hg at sea level without oxygen
- Exacerbation of COPD or Asthma
- Large effusion/ Pneumothorax within 3 weeks

### Neurologic
- CVA within 2 weeks
- Uncontrolled seizures

### Surgical
- GI, Thoracic, ENT, or Neurologic surgery within 2 weeks

### Pregnancy related
- >35 weeks gestation

### Pediatric
- <7 days after birth

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**ASMA and AMA Recommendations**

*NEJM. 2002*
Resources

• Yourself
  • Role of passenger-provider is to assist, not to take control
• Passengers and crew
• Supplies
• Medications
• Technology
Flight Crew Training

- Flight attendants
  - 5 days course ending with practical and written test
    - CPR/ACLS, altitude physiology, details of their “crash cart”
  - 1-day annual refresher course with practical and written test

- Flight deck
  - 1 day initial and ½ day annual refresher including decision to divert
Passengers

Aviation, Space, and Environmental Medicine. 2004
Supplies

• Since 1986 all aircraft >30 passengers require a emergency medical kit
  • Wide variation in kit beyond basic requirements

• AED required since 2004 on all US flights

• Not designed for prolonged code
  • 1-2 doses
### Contents

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphygmomanometer</td>
<td>1</td>
</tr>
<tr>
<td>Stethoscope</td>
<td>1</td>
</tr>
<tr>
<td>Airways (oropharyngeal)</td>
<td>3</td>
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<tr>
<td>CPR Mask- 3 sizes</td>
<td>3</td>
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<tr>
<td>IV Administration set: tubing with 2 Y connectors</td>
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</tr>
<tr>
<td>Alcohol sponges</td>
<td>2</td>
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<tr>
<td>Adhesive tape, 1 inch standard roll</td>
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<tr>
<td>Tape Scissors</td>
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<tr>
<td>Tourniquet</td>
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<tr>
<td>Saline Solution (500ml)</td>
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<tr>
<td>Protective gloves</td>
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<td>Needles (18 ga, 20ga, 22ga)</td>
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<tr>
<td>Syringes (5ml, 10ml)</td>
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<td>Acetaminophen 325 mg tab</td>
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<tr>
<td>Antihistamine tablet 25mg</td>
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<tr>
<td>Antihistamine Injectable 50mg</td>
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<tr>
<td>Atropine 0.5mg</td>
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<tr>
<td>Aspirin 325mg</td>
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<tr>
<td>Bronchodilator</td>
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<td>Dextrose 50%/50ml</td>
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<tr>
<td>Epinephrine 1:1000</td>
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<tr>
<td>Epinephrine 1:10,000</td>
<td>2 amp</td>
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<tr>
<td>Lidocaine 20mg/ml</td>
<td>2 amp</td>
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<tr>
<td>Nitroglycerine tablets 0.4mg</td>
<td>10 tabs</td>
</tr>
</tbody>
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**Required emergency equipment for aircraft >7500 lbs. and with at least one flight attendant**

FAA. 2006
• Diazepam
• Saline
• IM/IV antiemetic
In flight surgical equipment
What passengers may carry
Technology

• Handheld devices

• In-flight Internet

• Ground based teams
Ground based medical teams

• Ground based medical teams may reduce flight diversion by 70%

• In case of disagreement captain will follow ground advice over any onboard provider

• Examples
  • MedLink and MedAire
  • Mayo Clinic Emergency Communications center
No litigation has been brought against a provider who has rendered assistance during an in-flight medical event
Governance

- Tokyo Convention Act of 1963
- Good Samaritan Act
  - Can’t accept ANY compensation
  - Can’t abandon patient once provide care
- Medical Assistance Act of 1998
  - Specific protections for airlines and providers
- Federal Aviation Administration
- Airline insurance policies
  - Indemnify providers in emergency service
Medical Assistance Act of 1998

• “Good Samaritan” protection to a medically qualified passenger who provides medical assistance
  • Volunteer
  • Render in good faith
  • Receive no compensation

(b) LIABILITY OF INDIVIDUALS- An individual shall not be liable for damages in any action brought in a Federal or State court arising out of the acts or omissions of the individual in providing or attempting to provide assistance in the case of an in-flight medical emergency unless the individual, while rendering such assistance, is guilty of gross negligence or willful misconduct
Do you have a duty to assist?

• US, Canada, and UK: no legal duty to render assistance
  *unless there is a pre-existing provider/patient relationship*

• Australia and Europe: there is such a legal obligation
Who has jurisdiction?

The country where the aircraft is registered

The country where the incident occurs

The country of citizenship of the plaintiff or defendant can also have jurisdiction
Medicolegal Recommendations for Providers Volunteering During In-Flight Medical Event

- Properly identify yourself and your qualifications
- Obtain complete history (Interpreter if needed)
- Obtain consent and carry out appropriate physical exam
- Inform crew of clinical impression
- Establish communication with ground medical support staff
- Discuss with crew the need to divert or treat
  - Informed consent
- Document your findings in writing
Diverting a flight

• Rare: 13% of all in-flight emergencies get diverted
• Significant cost and ecological concerns
  • Fuel dumping
    • $3,000- $100,000 per diversion
• Logistically challenging

• Pilot has the final say
What to do in an emergency

• Don’t Panic
• ABCD
• Take stock
  • People
  • Supplies
• Common things are common
• Take notes
• Discuss options with patient and crew
What to do when….

Collapse

• Simple faint is MOST common cause
• Vaso-vagal, dehydration, seizure, arrhythmia
• Oxygen, Glucometer, Airway

Shortness of breath

• Pneumothorax, CHF, Angina
• Tension- contralateral tracheal deviation, JV distention, SOB, anxiety, absent breath sounds, tachycardia and hypotension

Allergic reactions

• Antihistamines, epinephrine

Chest Pain

• Unstable Angina, GERD, Pneumothorax Oxygen, Nitroglycerine, Aspirin
What to do when….

Nausea

- GERD, Motion sickness, alcohol, Gastric distention
- Carbonated beverage, diphenhydramine, H2 blocker, Antacid

Tachycardia

- SVT, Atrial fibrillation
- Valsalva, Vagal Maneuvers*

Head injury

- Neuro assessment, frequent monitoring

Altered Mental Status/Unresponsive

- Intoxication, Stroke, Hypoglycemia, Arrest
- Glucometer, Ingestion history, Neuro exam, Toxidromes
What to do when....

Psychiatric Problems
- Rising frequency
- Anxiety, phobias, intoxication, psychiatric disease
- Anxiolytics
  - Caution if alcohol involved
  - Caution with restraints

Decompression Sickness
- Recent Diving
- Oxygen
Back to our case...
Case Presentation Recap

Minutes elapsed

• 00 Call for unresponsive patient

• 03 AED Applied

• 10 Plane began emergency landing

• 11 Shock delivered

• 25 (approx) Airway and IV lost
Case Presentation

• Plane landed 37 minutes after resuscitation started

• 7 Paramedics to remove patient from seat/plane

• IO started, monitor applied (asystole), Blood glucose 157

• Paramedics were patched to their medical director

• Patient pronounced dead 1 hour from flight attendant call
Case Presentation

- Police/Paramedics opened the passenger's briefcase
- 14 bottles of medications found including:
  - 2 Morphine formulations
  - Diazepam
  - (Ziprasidone) Geodon
  - Several NSAID formulations
  - Statin
  - (Naloxone) Narcan given by paramedics - No response
Cause of Death

• Myocardial Infarction

• Drug overdose

• Venous thromboembolism

• Arrhythmia

• Other?????
Final thoughts

79% agreement between in-flight and hospital diagnosis

60% of cases demonstrated improvement with in-flight treatment provided
Take Home Points

• Airline emergencies (where provider- passengers are solicited to assist) are rare

• Aircraft are a difficult environment
  • For both patient and provider

• You are not alone

• Be prepared!
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