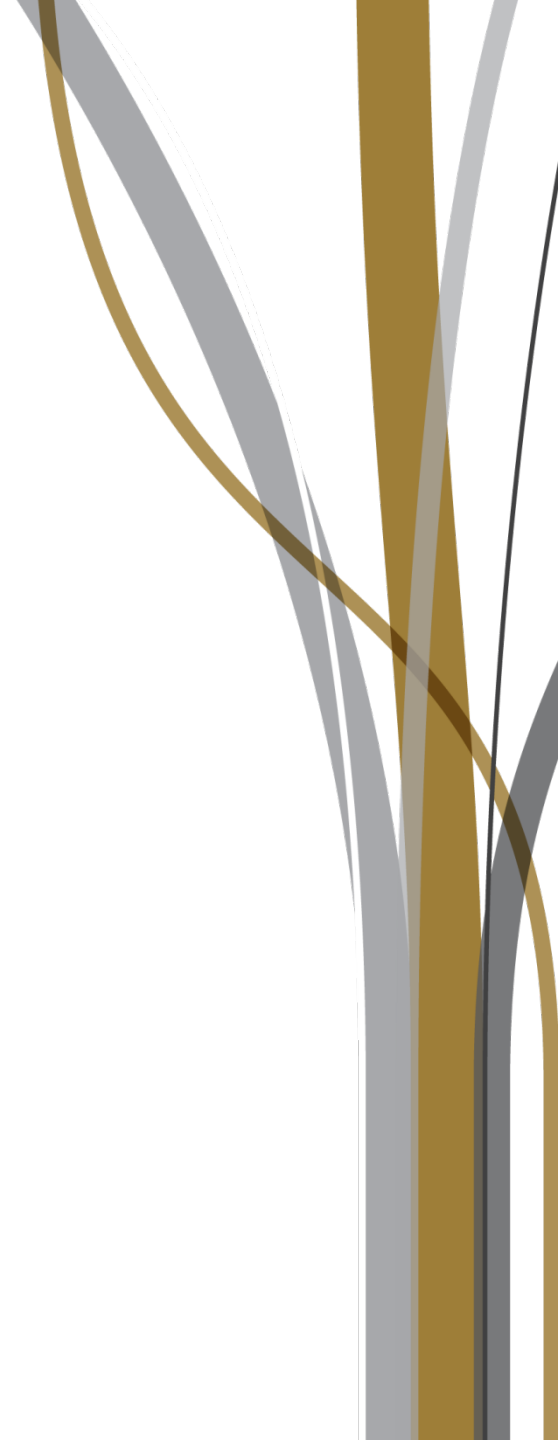


Managing In-flight Emergencies

Zachary Hartsell, DHA, PA-C



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.

The speaker has no relevant disclosures

Audience Response

1. Have you ever been on a flight where there was an in-flight medical emergency?
2. Have you ever responded to an in-flight medical emergency?







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
 - 44% of physicians have responded in career
- 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

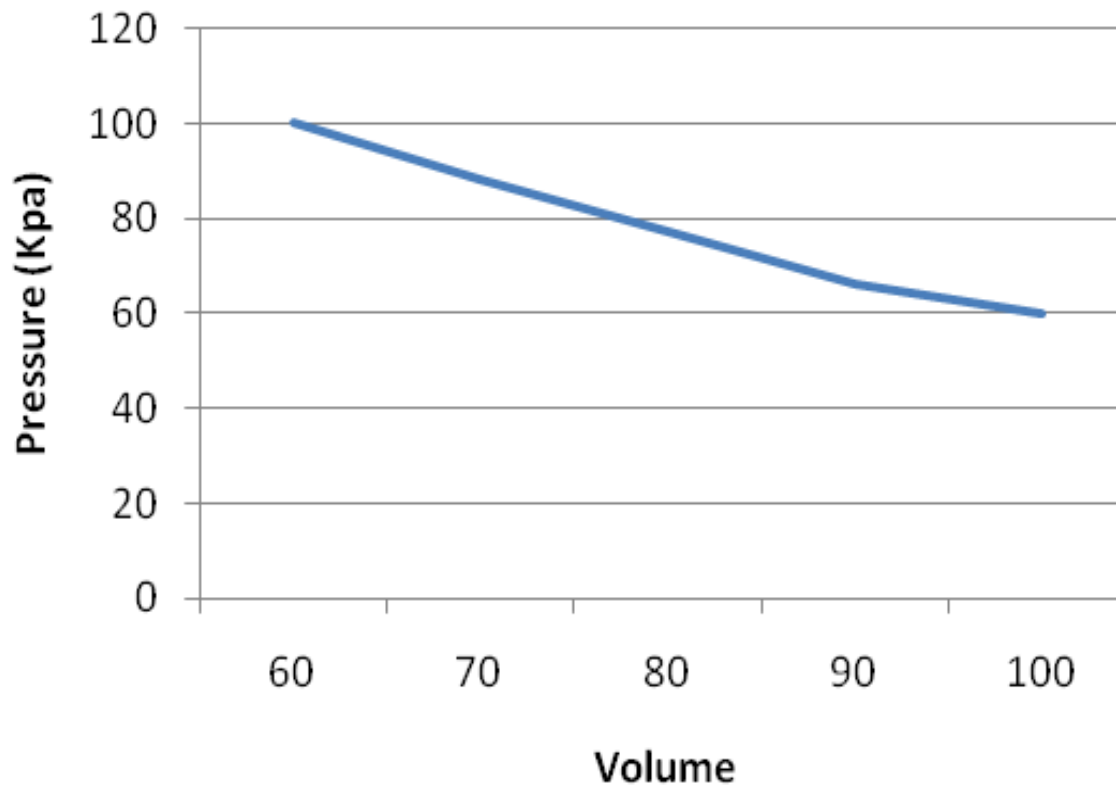
Event	DeJohn 2000	Dowdall 2000	NEJM 2013	Martin 2018*	Borges do Nascimento 2021
Cardiac	20%	10%	7.7%	7%	5.7%
GI	8%	28%	13.6%	14.8%	14.9%
Syncope/ Near syncope	22%	8%	37.4	32.7%	32.7%
Neurologic	12%	9%	11.2%	5.5%	7.1%
Respiratory	8%	5%	12.1%	10.1%	8.5%
OB			0.5%	0.7%	
Trauma	5%	3%	3%	4.8%	
Cardiac Arrest	0.3%		0.3%	0.2%	

Aircraft – difficult environment

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

Physiologic effects

Boyle's Law

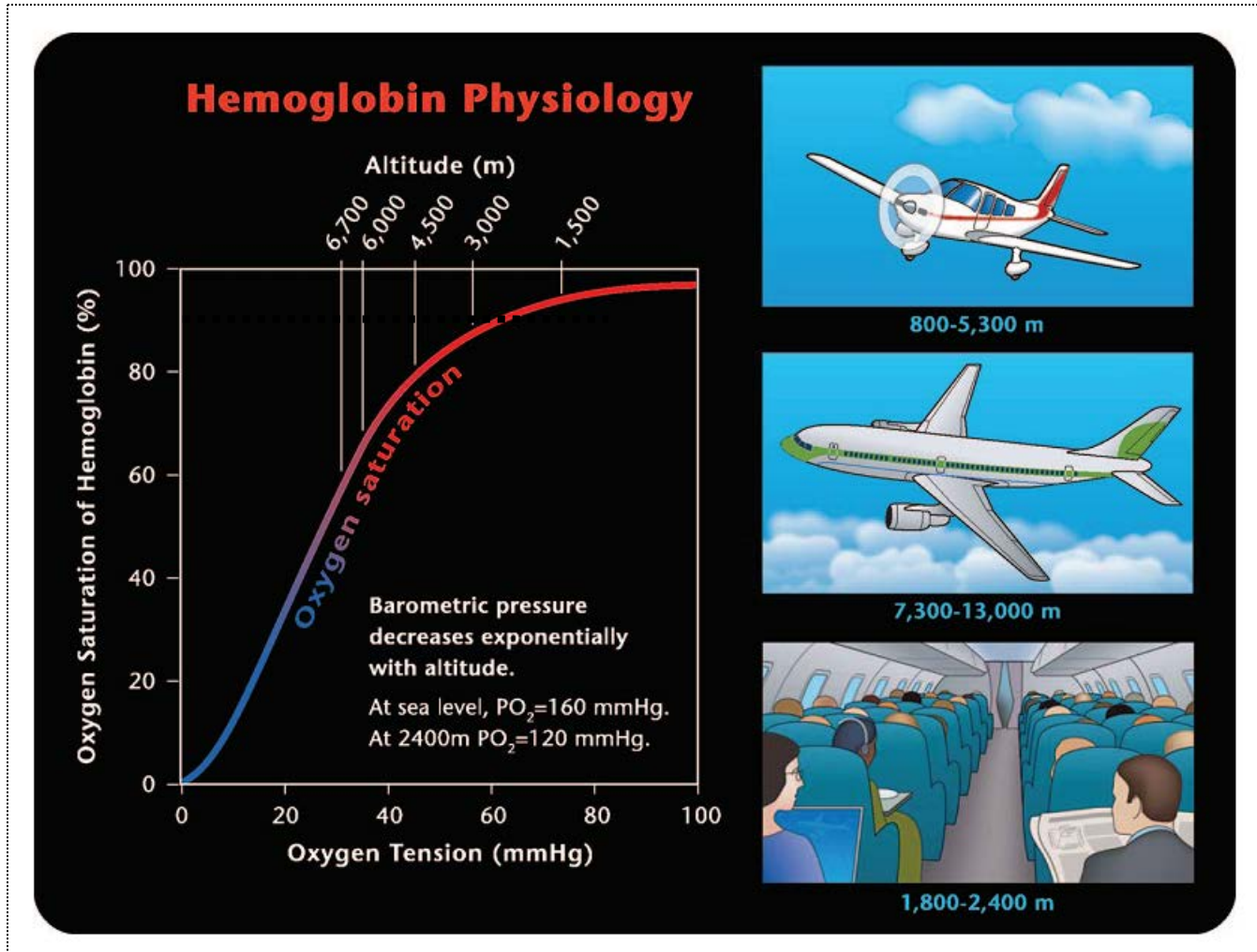


Physiologic effects

- 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 PA pressures
- Drying of mucous membranes

Remember, these effects can also impact physiologic response to medication

Hemoglobin Physiology



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 pO ₂ <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

Resources



Resources

- Yourself
 - Role of passenger-provider is to *assist*, not to take control
- Passengers and crew
- Supplies
- Medications
- Technology

Flight Crew Training

- Regulation:
 - *“An [aircraft] operator shall establish and maintain a training program, approved by the State of the Operator, to be completed by all persons before being assigned as a cabin crew member. Cabin crew members shall complete a recurrent training program annually.”*
- 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 focus on decision to divert

Passengers



Aviation, Space, and Environmental Medicine. 2004

Supplies

- Since 1986 all aircraft >30 passengers require an 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
- Can be prone to drug shortages



Required emergency
equipment for
aircraft >7500 lbs.
and with at least one
flight attendant

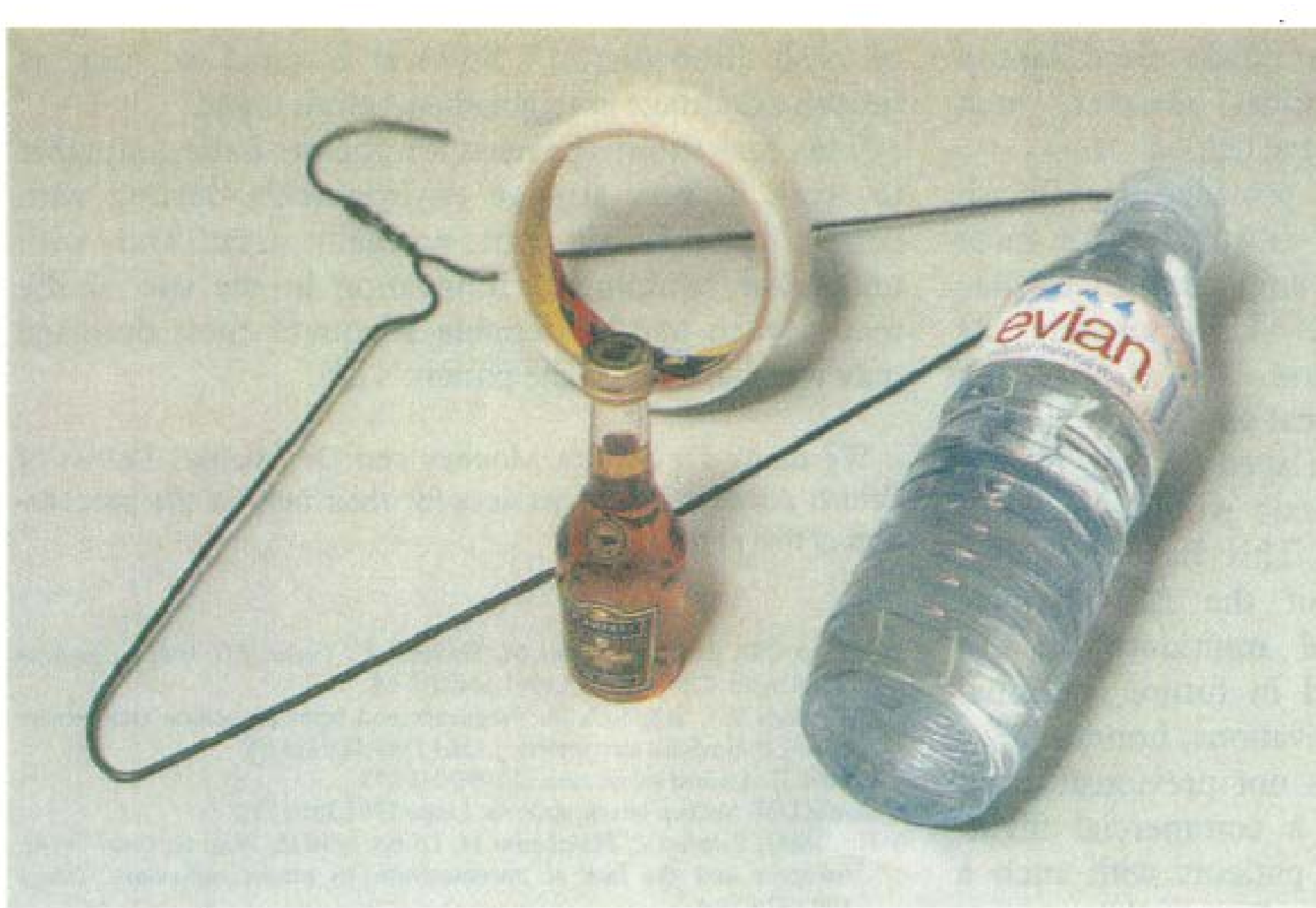
Contents	Quantity
Sphygmomanometer	1
Stethoscope	1
Airways (oropharyngeal)	3
CPR Mask- 3 sizes	3
IV Administration set: tubing with 2 Y connectors	1
Alcohol sponges	2
Adhesive tape, 1 inch standard roll	1
Tape Scissors	1 pair
Tourniquet	1
Saline Solution (500ml)	1
Protective gloves	1 pair
Needles (18 ga, 20ga, 22ga)	6
Syringes (5ml, 10ml)	4
Acetaminophen 325 mg tab	4 tabs
Antihistamine tablet 25mg	4 tabs
Antihistamine Injectable 50mg	2 amps
Atropine 0.5mg	2 amps
Aspirin 325mg	4 tabs
Bronchodilator	1 inh.
Dextrose 50%/50ml	1 amp
Epinephrine 1:1000	2 amp
Epinephrine 1:10,000	2 amp
Lidocaine 20mg/ml	2 amp
Nitroglycerine tablets 0.4mg	10 tabs

- Diazepam
- Saline
- IM/IV antiemetic









In flight surgical equipment

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

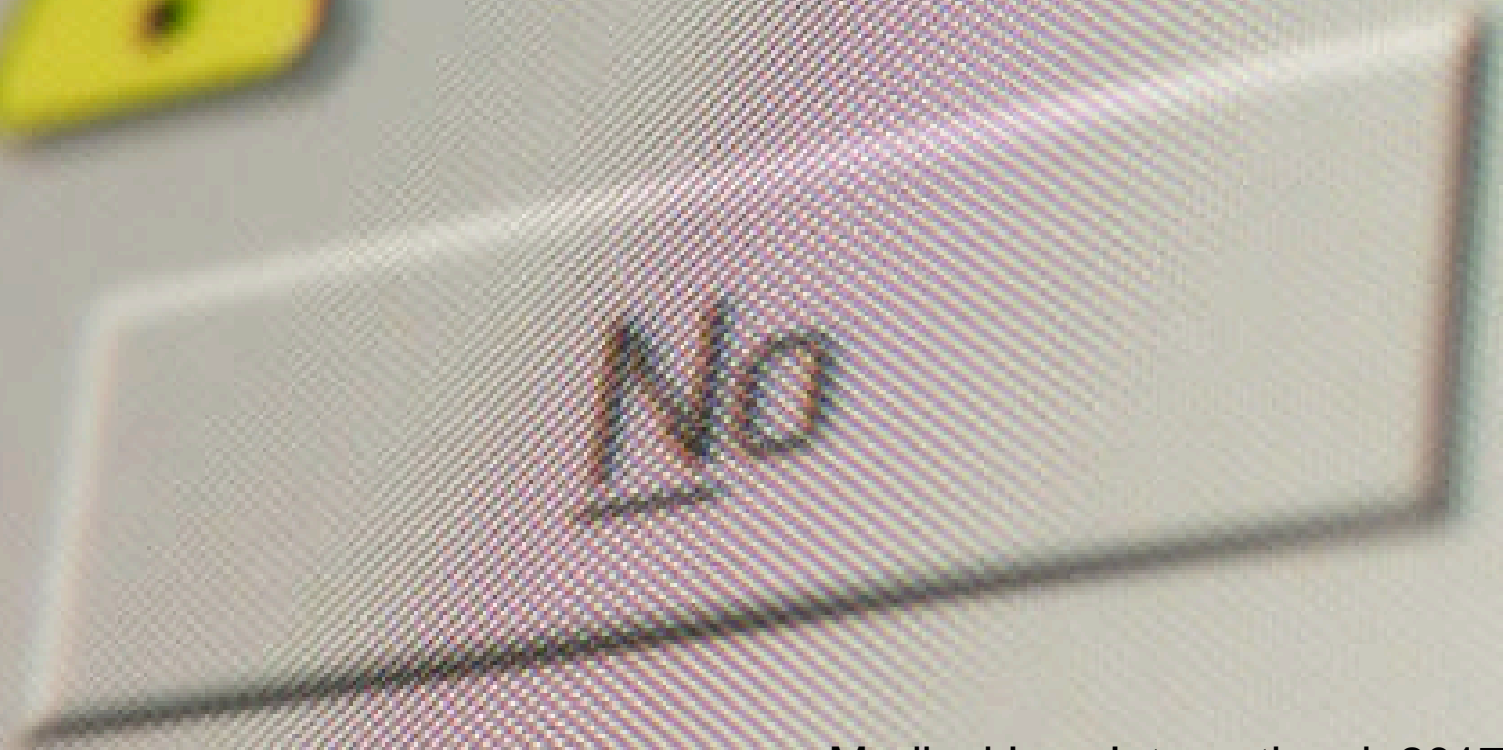
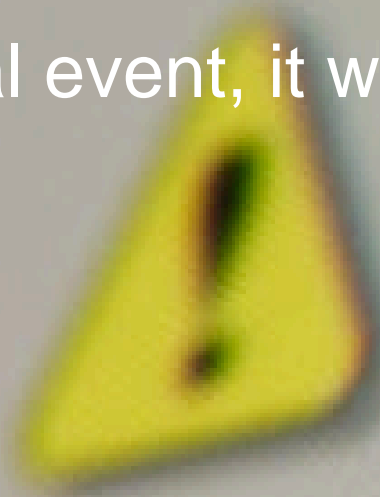


EQUAL JUSTICE UNDER LAW

Legalities

- General principles
- Level of training

1 case was brought against a provider
who has rendered assistance during an in-flight
medical event, it was dismissed without hearing



Governance

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

Aviation 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.....

Syncope/near syncope

- Simple faint is the *MOST* common cause
- Vaso-vagal, dehydration, seizure, arrhythmia
- Oxygen, Glucometer, ABC's

Shortness of breath

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

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

Allergic reactions

- Antihistamines, epinephrine

A black and white image featuring a silhouette of a person in a suit on the right, standing with one hand on their hip and the other behind their head, appearing to be in deep thought. To the left is a blurred signpost with a vertical pole and several horizontal arrows pointing in various directions (up, down, left, right, and diagonally).

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 passengers 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!
- Don't Panic

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