IN-FLIGHT MEDICAL EMERGENCIES by Nick Mark MD

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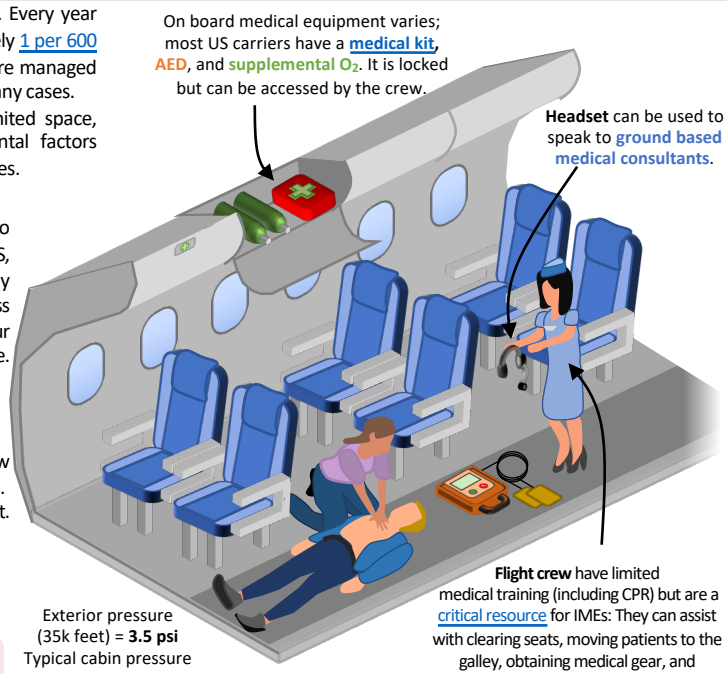
· Worldwide over 2 billion people fly on commercial aircraft annually. Every year there are over 40,000 **in-flight medical emergencies** (**IME**) (approximately 1 per 600 flights), most related to underlying medical conditions. ~25% of IMEs are managed by the cabin crew alone, however medical volunteers are essential in many cases.
· Commercial aircraft are a medically austere environment, with limited space, equipment, and trained personnel to assist. Additional environmental factors (hypobaric hypoxemia, pressure changes, noise) add additional challenges.

VOLUNTEERING TO ASSIST

If crewmembers request assistance, consider if you are able to assist (no sleep aides/alcohol, not fatigued). There is no legal duty to act in the US, though it is ethically appropriate to help if able. Volunteers are generally protected from liability under the Aviation Medical Assistance Act unless there is gross negligence or willful misconduct. Do not practice beyond your level of expertise & remember that ground-based consultation is available. Do not accept compensation (points, miles) for services provided.

GENERAL APPROACH

· Identify yourself to crew; be prepared to provide proof of qualifications.
· Obtain a history, vital signs, and exam as able. Having the crew clear a row or help move the patient to the galley may be helpful (and provide privacy).
· Request the **medical equipment** from the crew & provide treatment. Request **supplemental O2** and **AED** if necessary.
· Confer with **ground-based medical direction** if necessary
· Inform the crew about recommendations, need for diversion
· Document presentation & care provided (there may be specific forms)



EQUIPMENT AVAILABLE IN FLIGHT

Supplemental oxygen is available, but flow rates may be limited (2-4 lpm).
Aircraft w ≥30 passengers are ***required*** by the FAA to have an **AED** & basic medical kit including:
· **Airway**: BVM, CPR mask, OPAs
· **Assessment**: stethoscope, sphygmomanometer
· **IV start kit**: syringes, needles, tourniquet, dressing/tape
· **Medications**: epinephrine, lidocaine, atropine, antihistamine, aspirin, bronchodilator (albuterol), dextrose (D50W), nitroglycerin, non-opioid analgesics (acetaminophen, ketorolac)
· **Note:** Epinephrine is usually **not** supplied in auto-injectors.
  · For anaphylaxis → 0.3 mL SQ/IM = 0.3 mg of 1:1,000 (e.g. 1 mg in 1 mL)
  · For ACLS → 10 ml IV = 1 mg of 1:10,000 epi (e.g. 1 mg in 10 mL)

Some aircraft voluntarily carry enhanced medical kits, which ***may*** contain:
· **Advanced airway**: laryngoscope, ET tubes, Magill forceps
· **Assessment:** Thermometer/glucometer/pulse oximeter
· Additional **medications**: (highly variable depending on country/airline)
  · Antidotes: naloxone
  · CV meds: amiodarone, digoxin, furosemide, metoprolol
  · GI meds: ondansetron, metoclopramide, loperamide, antacids
  · Motion sickness: meclizine, scopolamine
  · Corticosteroids: dexamethasone, prednisone
  · Neuro/psych: diazepam, midazolam, haloperidol

DIVERSION

IME's give aircraft priority ("lifeguard") status.Diversion of the flight to the closest available airport, can incur significant costs ($15k to $893k) but may be necessary in certain cases. ~5% of in-flight medical emergencies require diversion, most commonly for cardiac arrest, cardiac or neurological symptoms, or obstetric emergencies. The decision to divert depends on fuel, weather, location, and medical neccesity. It is made by the pilot in conjunction with crew, medical volunteers, and ground medical support.

GROUND BASED MEDICAL RESOURCES

Physicians on the ground are available 24/7 to assist with medical decision making. They can provide checklist support and can help with decision making about diversion.

COMMON IN-FLIGHT MEDICAL EMERGENCIES (IME)

*JAMA has an excellent **set of checklist cards for common IME**.*

Syncope/presyncope most common IME (30%). Place in Trendelenburg (potentially in aisle). Provide supplemental O2 if hypoxic. Check blood glucose & administer oral or IV dextrose if hyopglycemic. Consider naloxone if evidence of overdose. If not improving after 15 min, consider etiologies (ACS, arrythmia, PE, stroke, seizure) that may require **diversion**.

GI Illness – (15% of IME) obtain history and abdominal exam, treat symptoms: ant-acids, anti-emetics, anti-diarrheals. Though usually symptoms can be managed, if severe pain or an exam concerning for surgical abdomen, **diversion** may be necessary.

Respiratory symptoms (10%) – obtain history (asthma, COPD, diving, recent PTX, etc. if hypoxic give O2. if bronchospasm give albuterol, consider steroids. If not improving, consider **diversion**.

Cardiovascular symptoms – (7%) if ACS symptoms give O2, chewable Aspirin. If and SBP > 100 give nitroglycerin. Can use Apple Watch or other devices for basic ECG rhythm interpretation. Consider **diversion**.

Allergy/Anaphylaxis (2%) – if localized give PO antihistamine, if anaphylaxis give SQ/IM epinephrine, IM antihistamine, steroid. If airway swelling or hypotensive **divert**. Can mix epi infusion if hypoTN.

Neurological deficits (5%) – obtained focused history, including time of onset, as well as detailed neurological exam. Administer O2. Contact ground control & consider diversion.

Psychiatric emergencies (3%) – obtain history and establish rapport to try to verbally de-escalate. Consider haloperidol or benzodiazepine if available. If violent/agitated, defer to crew and airline protocols about management & diversion.

Seizure (5%) - if ongoing seizure, administer benzodiazepines IV or PR (if available), if postical place in lateral position. Check blood glucose & give D50W if hypoglycemic. Confer with ground based medical direction. May require supplemental O2 and airway management.

Trauma (5%) – falling luggage & ground level falls are the most common mechanisms. Control hemorrhage with direct pressure. Can improvise splint. Usually does not require diversion.

Obstetric emergencies (1%) – if bleeding <1 pad/hr expectant management. If more bleeding or >20 weeks consider diversion.

Cardiac arrest (0.2%) – check pulse/breathing and prompty initiate CPR. Obtain AED and deliver shock if indicated. If additional rescuers are available to perform high quality CPR, consider taking charge of airway management and obtaining IV access. Give epinephrine. Consider reversible causes (see cardiac arrest OnePager). Divert promptly unless clearly futile.

PHYSIOLOGIC CHALLENGES OF THE AEROSPACE ENVIRONMENT

Hypobaric hypoxemia – commercial aircraft fly up to 42,000 feet (12,800m); commercial aircraft are typically pressurized to 8,000 feet (4,500m), this corresponds to ~11 psi. (This is about 25% less than the 14.7 psi at sea level). People with pre-existing lung disease can develop hypoxemia at altitude, which can precipitate neurological or cardiovascular events. Patients with underlying disease (particularly if on home O2) should have pre-flight clearance.

Barotrauma – the change in pressure causes gas in an enclosed space to expand by ~30%, which can be painful for people with otitis media. It can also cause pneumothorax to worsen.

Decompression sickness (DCS) – divers should avoid flying for at least 12-24 hours after diving, as ascent to altitude can cause inert gas (nitrogen) to come out of solution, potentially causing DCS.

Venous stasis – long duration or multiple flights increases the risk for VTE.

Ambient noise – aircraft are typically 75-85 dBA during flight, which makes auscultation and use of a stethoscope to check blood pressure challenging. (Measure blood pressure by palpation instead; determine systolic pressure by feeling for return of radial pulse while deflating the sphygmomanometer cuff)