REVIEW

CME CREDIT ***LEARNING OBJECTIVE:*** Readers will feel confident in assisting in in-flight medical emergencies

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Is there a doctor on board? In-flight medical emergencies

ABSTRACT

Although not legally required to render assistance in the event of a medical emergency aboard an airplane, physicians have an ethical obligation to do so and should be prepared.

KEY POINTS

The exact incidence of medical emergencies aboard airplanes is unknown, but they occurred in 1 in 604 flights in 1 study, which is likely an underestimate.

The relatively low air pressure in the cabin can contribute to the development of acute medical issues.

In the United States, the Federal Aviation Administration mandates that airlines carry a limited set of medical resources.

The Aviation Medical Assistance Act protects responding providers against liability except in cases of "gross negligence."

You the physician can recommend that the flight be diverted to the closest airport, but only the captain can make the actual decision.

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It could happen. You are on a plane, perhaps on your way to a medical conference or a well-deserved vacation, when the flight attendant asks you to help a passenger experiencing an in-flight medical emergency. What is your role in this situation?

FLIGHT ATTENDANTS USED TO BE NURSES

Before World War II, nearly all American flight attendants were nurses, who could address most medical issues that arose during flights.[1] Airlines eliminated this preferential hiring practice to support the war effort. Traveling healthcare providers thereafter often volunteered to assist when in-flight medical issues arose, but aircraft carried minimal medical equipment and volunteers' liability was uncertain.

In 1998, Congress passed the Aviation Medical Assistance Act (AMAA), which provides liability protection for on-board healthcare providers who render medical assistance. It also required the Federal Aviation Administration (FAA) to improve its standards for in-flight medical equipment.[2,3]

HOW OFTEN DO EMERGENCIES ARISE?

How often medical events occur during flight is difficult to estimate because airlines are not mandated to report such issues.[4] Based on data from a ground-based communications center that provides medical consultation service to airlines, medical events occur in approximately 1 in every 604 flights.[5] This is likely an underestimate, as many medical events may be handled on board without involving a ground-based consultation center.

TABLE 1

Contents of on-board emergency medical kits mandated by the US Federal Aviation Administration

Assessment supplies

Blood pressure cuff

Stethoscope

Acute interventional equipment

Oropharyngeal airways

Bag-valve and cardiopulmonary resuscitation masks

Intravenous administration set

Saline solution

Needles

Syringes

Medications

Acetaminophen

Albuterol, metered-dose inhaler

Aspirin

Atropine

Dextrose 50%

Diphenhydramine, tablet and injectable

Epinephrine 1:1000

Epinephrine 1:10,000

Lidocaine

Nitroglycerin tablets

Information from Federal Aviation Administration (FAA), US Department of Transportation. Emergency medical equipment. Final rule. Fed Regist 2001; 66:19028–19046.

Aircraft cabins are pressurized to an equivalent of the air pressure at 6,000 to 8,000 feet

The most common emergencies are syncope or presyncope, representing 37.4% of consultations, followed by respiratory symptoms (12.1%), nausea or vomiting (9.5%), cardiac symptoms (7.7%), seizures (5.8%), and abdominal pain (4.1%).[5] Very few in-flight medical emergencies progress to death; the reported mortality rate is 0.3%.[5]

CABIN PRESSURES ARE RELATIVELY LOW

The cabins of commercial airliners are pressurized, but the pressure is still lower than on the ground. The cabin pressure in flight is equivalent to that at an altitude of 6,000 to 8,000 feet,[6,7] ie, about 23 or 24 mm Hg, compared with about 30 mm Hg at sea level. At this pressure, passengers have a partial pressure of arterial oxygen (Pao_2) of 60 mm Hg (normal at sea level is > 80).[8]

This reduced oxygen pressure is typically not clinically meaningful in healthy people. However, people with underlying pulmonary or cardiac illness may be starting further to the left on the oxygen dissociation curve before gaining altitude, putting them at risk for acute exacerbations of underlying medical conditions. Many patients who rely on supplemental oxygen, such as those with chronic obstructive pulmonary disease, are advised to increase their oxygen support during flight.[9]

Boyle's law says that the volume of a gas is inversely proportional to its pressure. As the pressure drops in the cabin after takeoff, air trapped in an enclosed space—eg, in some patient's bodies—can increase in volume up to 30%,[10] which can have medical ramifications. Clinically significant pneumothorax during flight has been reported.[11–13] Partially because of these volumetric changes, patients who have undergone abdominal surgery are advised to avoid flying for at least 2 weeks after their procedure.[10,14] Patients who have had recent ocular or intracranial surgery may also be at risk of in-flight complications.[15]

IN-FLIGHT MEDICAL RESOURCES

The limited medical supplies available on aircraft often challenge healthcare providers who offer to respond to in-flight medical events. However, several important medical resources are available.

Medical kits and defibrillators

FAA regulations require airlines based in the United States to carry basic first aid supplies such as bandages and splints.[3] Airlines are also required to carry a medical kit containing the items listed in **Table 1**.

The FAA-mandated kit does not cover every circumstance that may arise. Although in-flight pediatric events occasionally occur,[16] many of the available medications are inappropriate for young children. The FAA does not require sedative or antipsychotic agents, which could be useful for passengers who have acute psychiatric episodes. Obstetric supplies

are absent. On international carriers, the contents of medical kits are highly variable,[17] as are the names used for some medications.

The FAA requires at least 1 automated external defibrillator (AED) to be available on each commercial aircraft.[3] The timely use of AEDs greatly improves survivability after out-of-hospital cardiac arrest.[18,19] One study involving a major US airline found a 40% survival rate to hospital discharge in patients who received in-flight defibrillation.[20] Without this intervention, very few of the patients would have been expected to survive. In addition to being clinically effective, placing AEDs aboard commercial aircraft is a cost-effective public health intervention.[21]

Consultation services

Most major airlines can contact ground-based medical consultation services during flight.[10] These centers are staffed with healthcare providers who can provide flight crews with advice on how to handle medical events in real time. Healthcare providers can likewise discuss specific medical issues with these services if they respond to an in-flight medical event. Ground-based call centers can also communicate with prehospital providers should a flight need to be diverted.

Other on-board providers

Some medical events require the involvement of more than one medical provider. Other physicians, nurses, and prehospital providers are often also on board.[22] Responding physicians can also request the assistance of these other healthcare providers. Flight attendants in the United States are required to be trained in cardiopulmonary resuscitation (CPR).[23]

Flight diversion

Critically ill patients or those with time-sensitive medical emergencies may require the aircraft to divert from its intended destination. As may be expected, medical emergencies suspected to involve the cardiovascular, neurologic, or respiratory system have been shown to most likely result in aircraft diversion.[5,24] Approximately 7% of in-flight medical events in which a ground-based medical consultation service is contacted result in diversion.[5]

While an on-board responding physician can make a recommendation to divert based on the patient's acute medical status, only the captain can make the ultimate decision.[4] On-board healthcare providers should clearly state that a patient might benefit from an unscheduled landing if that is truly their assessment. In addition to communicating their clinical concerns with the flight crew, the responding physician may also be able to discuss the situation with the airline's ground-based consultation service. On-board physicians can make important contributions to the assessment of illness severity and triage decisions.

MEDICOLEGAL ISSUES

No legal duty to assist

US healthcare providers are not legally required to respond to on-board medical emergencies on US-based airlines. Canada and the United Kingdom also do not require providers to render assistance. But the General Medical Council (the regulatory body for UK doctors) states that doctors have an ethical duty to respond in the event of a medical emergency, including one on board an aircraft. Other countries, notably Australia and some in the European Union, require healthcare professionals to respond to on-board medical emergencies.[10]

Regardless of potential legal duties to assist, healthcare providers are arguably ethically obliged to render assistance if they can.

Mandated aboard commercial aircraft: first aid supplies, an AED, a basic medical kit

Aviation Medical Assistance Act

The extent of an American healthcare provider's liability risk for assisting in a medical emergency on a plane registered in the United States is limited by statute. The 1998 AMAA provides liability protection for on-board medical providers who are asked to assist during an in-flight medical emergency. This statute covers all US-certified air carriers on domestic flights and would likely be held to apply to US aircraft in foreign airspace because of the general rule that the law of the country where the air carrier is registered applies to in-flight events.

Under the AMAA, providers asked to assist with in-flight medical emergencies are not liable for malpractice as long as their actions are not "grossly" negligent or intended to cause the patient harm.[25] This is distinguishable from a standard malpractice liability scenar-

io, in which the plaintiff only needs to show ordinary negligence. In a traditional healthcare setting, a provider has to act within the "standard of care" when assessing and treating a patient. If the provider deviates from the standard of care, such as by making an error in judgment or diagnosis, the provider is legally negligent. Under traditional malpractice law, even if a provider is minimally negligent, he or she is liable for any damages resulting from that negligence. Under a gross negligence standard, providers are protected from liability unless they demonstrate flagrant disregard for the patient's health and safety.

Postflight issues

A provider who undertakes care should continue to provide care until it is no longer necessary, either because the patient recovers or the responsibility has been transferred to another provider. At the point of transfer, the healthcare provider's relationship with the patient terminates.

The provider should document the encounter, typically using airline-specific documentation. The responding physician needs to be mindful of the patient's privacy, refraining from discussing the event with others without the patient's authorization.[26]

Volunteers should perform only the treatments they are qualified to provide, within their scope of training

SUGGESTED RESPONSE

Healthcare providers who wish to respond to in-flight medical emergencies must first determine if they are sufficiently capable of providing care. During a flight, providers do not expect to be on duty and so may have consumed alcoholic beverages to an extent that would potentially render them unsuitable to respond. When it is appropriate to become involved in a medical emergency during flight, the healthcare provider should state his or her qualifications to the passenger and to flight personnel.

If circumstances allow, the volunteer provider should obtain the patient's consent for evaluation and treatment.[10] Additionally, with the multilingual nature of commercial air travel, especially on international flights, the provider may need to enlist a translator's assistance.

Providers may find it preferable to treat passengers in their seats.[27] Given the confined space in an aircraft, keeping ill passengers out of the aisle allows others to move about the cabin. If it becomes necessary to move the patient, a location should be sought that minimally interferes with other passengers' needs.

If a passenger has critical medical needs, in-flight medical volunteers can recommend flight diversion, which should also be discussed with ground-based medical staff. However, as emphasized earlier, the captain makes the ultimate decision to divert, taking into account other operational factors that affect the safety of the aircraft and its occupants. In-flight medical care providers should perform only the treatments they are qualified to provide and should operate within their scope of training.

After the aircraft lands, if the passenger must be transported to a hospital, providers should supply prehospital personnel with a requisite transfer-of-care communication. In-flight medical providers who have performed a significant medical intervention might find it appropriate to accompany the patient to the hospital.

SPECIFIC CONDITIONS

The list of possible acute medical issues that occur aboard aircraft is extensive. Here are a few of them.

Trauma

Passengers may experience injuries during flight, for example during periods of heavy air turbulence. Responding physicians should assess for potential life-threatening injuries, keeping in mind that some passengers may be at higher risk. For example, if a passenger on anticoagulation experiences a blunt head injury, this would raise suspicion for possible intracranial hemorrhage, and frequent reassessment of neurologic status may be necessary. If an extremity fracture is suspected, the physician should splint the affected limb. Analgesia may be provided from the medical kit, if appropriate.

Gastrointestinal issues

Acute gastrointestinal issues such as nausea and vomiting are often reported to ground-based medical consultation services.[5] Responding on-board providers must consider if

the passenger is simply experiencing gastrointestinal upset from a benign condition such as gastroenteritis or has a more serious condition. For some patients, vomiting may be a symptom of a myocardial infarction.[28] Bilious emesis with abdominal distention may be associated with small-bowel obstruction. While antiemetics are not included in the FAA-mandated medical kit, providers can initiate intravenous fluid therapy for passengers who show signs of hypovolemia.

Cardiac arrest

Although cardiac arrest during flight is rare,[5] medical providers should nonetheless be prepared to handle it. Upon recognition of cardiac arrest, the provider should immediately begin cardiopulmonary resuscitation and use the on-board AED to defibrillate a potentially shockable rhythm. Flight attendants are trained in cardiopulmonary resuscitation and therefore may assist with resuscitation efforts. If the patient is resuscitated, the responding physician should recommend diversion of the flight.

Anaphylaxis

In the event of a severe life-threatening allergic reaction, the FAA-mandated emergency medical kit contains both diphenhydramine and epinephrine. For an adult experiencing anaphylaxis, a responding on-board physician can administer diphenhydramine 50 mg and epinephrine 0.3 mg (using the 1:1000 formulation), both intramuscularly. For patients with bronchospasm, a metered-dose inhaler of albuterol can be given. As anaphylaxis is an acute and potentially lethal condition, diversion of the aircraft would also be appropriate.[29]

Myocardial infarction

When acute myocardial infarction is suspected, it is appropriate for the provider to give aspirin, with important exceptions for patients who are experiencing an acute hemorrhage or who have an aspirin allergy.[30] Supplemental oxygen should likewise be provided if the responding physician suspects compromised oxygenation. As acute myocardial infarction is also a time-sensitive condition, the clinician who suspects this diagnosis should recommend diversion of the aircraft.

Acute psychiatric issues

While approximately 2.4% of on-board medical events are attributed to psychiatric issues,[5] there are few tools at the clinician's disposal in the FAA-mandated emergency medical kit. Antipsychotics and sedatives are not included. The responding physician may need to attempt verbal de-escalation of aggressive behavior. If the safety of the flight is compromised, the application of improvised physical restraints may be appropriate.

Altered mental status

The differential diagnosis for altered mental status is extensive. The on-board physician should try to identify reversible and potentially lethal conditions and determine the potential need for aircraft diversion.

If possible, a blood sugar level should be measured (although the FAA-mandated kit does not contain a glucometer). It may be appropriate to empirically give intravenous dextrose to patients strongly suspected of having hypoglycemia.

If respiratory or cerebrovascular compromise is suspected, supplemental oxygen should be provided.

Unless a reversible cause of altered mental status is identified and treated successfully, it will likely be appropriate to recommend diversion of the aircraft. ■

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