“Is there a neurologist on this flight?”

An update

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Abstract

Purpose of review

Neurologists are being asked to offer their services in response to in-flight medical conditions. This review updates the latest understanding of how neurologists should manage in-flight neurologic emergencies should they be called upon to serve. A review of the existing literature was conducted for sharing of best practices in this unique scenario.

Recent findings

In-flight neurologic emergencies are on the rise. This article provides a synthesis of current best practices for in-flight emergencies including epidemiology, airline responsibility, available health care equipment on jetliners, legal ramifications of helping, and pathophysiology of why in-flight neurologic emergencies are so common.

Summary

In-flight neurologic emergencies are common and all physicians are increasingly being asked to respond to in-flight emergencies. Understanding one's responsibility, available equipment, and how to best prevent these scenarios with one's own patients may help to make this complex situation more manageable.

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“Is there a doctor on this flight?” is increasingly heard on many commercial flights around the world. For most physicians, assessing whether or not to respond is the most common question that arises following such a request. Anecdotally, the number of neurologists who experience this in-flight scenario continues to increase. However, despite the relative commonplace nature of this occurrence, the discomfort associated with this encounter has not dissipated.

According to the International Air Transport Association, the number of commercial airline passengers has grown exponentially.¹ Between 2004 and 2008, worldwide commercial airlines have carried just over 4 billion passengers on scheduled flights. Moreover, that same organization expects that 7.8 billion passengers will travel by air in 2036, a near doubling of the 4 billion air travelers expected to fly this year.¹ With the confluence of a near doubling of airline passengers coupled with the graying of the global population as a whole, there are now many more people who are acutely ill and have a chronic medical problem managed with prescription medications flying on airlines throughout the world. Therefore it stands to reason that the number of in-flight medical conditions—defined as events that arise to the level that the flight crew is alerted—will have concomitantly risen simply by the increased number of individuals who are flying in the traveling public.

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Emergency landings are becoming less frequent than they have been due to the benefits of air-to-ground medical consultation services.

Epidemiology

The exact number of in-flight conditions is unknown. Airlines do not track these data. Instead, they outsource triaging of in-flight medical conditions to private independent air-to-ground telemedicine companies that can be activated at the discretion of the flight crew. It is the telemedicine companies that keep all data regarding their consultations to airline flights. Given that there is no mandatory public reporting of such data, publications based on these proprietary databases are the only glimpse of the epidemiology of these clinical scenarios.

In 2002, Sirven et al.² published an analysis of in-flight medical emergencies based on Northwest Airlines (now part of Delta airlines) and Mayo Clinic air-to-ground consultations, which represented 10% of the US airline market at that time. The analysis of real-time in-flight encounters from 1995 to 2000 revealed 2,042 medical incidents that led to 312 diversions. A diversion is defined by the airline industry as an emergency landing at a location that is not the intended destination of the flight. More importantly, neurologic symptoms were the single largest category of medical incidents, prompting nearly 626 air-to-ground medical calls, almost 31% of the entire cohort.² These same neurologic symptoms were responsible for 34% of all emergency landings of the plane.²

More recently, Peterson et al.³ published an analysis of in-flight medical emergency calls from 5 domestic and international airlines that represented nearly 10% of the world's airline coverage based on a similar proprietary database analysis. Records of in-flight medical emergency calls from January 2008 to October 2010 were reviewed and the inciting medical symptom catalogued. A total of 11,920 in-flight medical emergencies were identified that led to calls to the center, approximately 1 medical emergency per 604 flights,³ which translates to 1 or 2 phone calls per hour for a medical condition. Similar to the Sirven analysis, the most common complaints requiring intervention were syncope or loss of consciousness (37.4%), respiratory symptoms (12%), and nausea/vomiting (9.5%).³ In almost 48% of all in-flight emergencies, physician passengers provided medical assistance. Aircraft diversions occurred in 7.3%.³ Of the 10,914 patients for whom post-flight follow-up data were available, emergency medical service personnel transported almost 25.8% to a hospital, 8.6% were admitted, and 0.3% died.³ The most common triggers for admission to a hospital were stroke, followed by respiratory symptoms and cardiac

symptoms. In that analysis, stroke symptoms were the most common rationale for admission to a hospital from an in-flight medical problem.

Who exactly is in charge of a passenger's health on a passenger flight?

The captain of a plane is in charge of the health, well-being, and flight of all passengers on that plane. Therefore the ultimate responsibility of a passenger's health on any given flight is up to the captain of the flight. This responsibility includes whether to accept the advice of any person who self-identifies as a physician or a health care worker in response to a medical condition. Thus, it is up to the captain to decide whether to activate air-to-ground medical services, whose advice to accept should there be varying medical opinions in management between on board vs telemedicine physicians, and whether an emergency landing is recommended.

Emergency landings are becoming less frequent than they have been due to the benefits of air-to-ground medical consultation services. In 2002, Sirven et al.² found 312 total diversions, roughly 7% of the cohort. Similarly, in the Peterson et al.³ analysis, they found diversions of 875 for 12,000 flights (7.3%). There was virtually no difference in the number of diversions based on the Sirven analysis done nearly 2 decades prior. Emergency landings are not an easy solution for in-flight medical emergencies because a number of factors have to be considered. First, there has to be a location to land. If on a long transoceanic flight, an emergency landing may not be feasible. Depending at what point the diversion occurs, fuel has to be released for a safe landing if the diversion occurs at the beginning of the flight. Second, just because a landing is possible does not mean that the location has appropriate medical resources to care for an individual with acute symptoms while in flight. Finally, air in-flight diversions are costly to airlines. The expenditure of operating an airline flight is calculated on a minute to minute basis, so any diversion from the intended destination is expensive, with an estimated expense of almost \$50,000 in 2002 per diversion, which would rise substantially based on 2018 US dollars.² Therefore emergency landings are not encouraged and are often a last resort option.

Are flight crews trained in handling neurologic emergencies?

Up to the 1930s, only nurses could serve as flight attendants on airlines. Safety and comfort of all passengers was always the sole purpose of flight attendants when the role was created, and this philosophy continues to underpin current practice today. Typically, flight attendants when hired are trained in basic first aid and cardiopulmonary resuscitation (CPR) rigorously. Moreover, the training is refreshed annually, especially in emergency response. Pilots and ground crew are also trained in emergency responses, with an

emphasis on obtaining important medical information that may need to be conveyed to available telemedical consultation services.

Flight crews are given a considerable amount of training in CPR, operating automated external defibrillation machines, and awareness of potential medical emergencies that may occur. However, they also have numerous other responsibilities, which include assessing cabin security risks such as disbanding the formation of lines for the forward lavatories post 2011, handling onboard passenger complaints, and customer service, which can dilute a flight crew's focus on passenger safety and comfort. Despite their professionalism, flight crews are human and subject to the same delays and hassles characteristic of the modern flying experience, which can contribute to short tempers and anxiety when an in-flight emergency occurs. Nevertheless, they are trained to respond in those situations with clear codified policies in terms of how to intervene. But one should not expect an emergency department experience on every flight because that is not the way the airline system is designed.

Available equipment in emergency medical kits

According to the Federal Aviation Administration Title 14 Code of Federal Regulations, emergency medical kits (EMK)

and an automated external defibrillator (AED) are required on all air carriers with at least one flight attendant, which typically translates to planes with capacities for 30 passengers or more. The regulations stipulate that lack of either the EMK or AED onboard planes meeting the above requirements are considered not able to fly. It is up to the airline to inspect its planes to make certain the kit is present, usable, and not damaged. As detailed in tables 1 and 2,⁴ several items are legally required to be contained within an onboard EMK. Most EMKs are packaged and sold commercially to the airline by vendors.

Medical equipment includes both basic and advanced life-saving tools such as oropharyngeal airways. Basic required medications are itemized in table 2. Airlines are free to exceed these minimum requirements and include medications not codified in regulations. Note the absence of medications for seizures or sedation. European and Asian aviation authorities have even broader requirements and airlines governed by those groups provide extensive equipment and programs for in-flight medical emergencies. Their EMKs includes agents such as diazepam for emergent seizures or sedation, steroids, bronchodilators, and obstetrical medications that can be utilized for emergencies. Impressively, some national flagship carriers, such as Lufthansa, Emirates, Singapore Air, Air France, and Qantas Airways, that operate ultra-long-haul flights on Airbus 380, A350, or B787 jets (flights longer than 12 hours), provide sick bays where ill passengers can be brought on the plane

Table 1 Federal Aviation Administration–required equipment in emergency medical kits on US airlines

Equipment	Quantity	Neurologically pertinent as deemed by the author (+ least pertinent to +++ most neurologically pertinent)
Sphygmomanometer	1	+++
Stethoscope	1	++
Oropharyngeal airways	3	++
Resuscitation devices	1 (3 masks: pediatric, small adult, large adult)	+++
CPR mask	3 sizes	+++
IV administration set	1	++
Alcohol sponges	2	+
Adhesive tape	1	+
Tape scissors	1	+
Tourniquet	1	+
Protective gloves	1	+
Automated external defibrillator	1	+++
Needles (18-, 20-, and 22-G)	6	+
Syringes (5 and 10 mL)	4	+

Adapted from reference 4.
Abbreviation: CPR = cardiopulmonary resuscitation.

Table 2 Federal Aviation Administration–required medications in emergency medical kits on US airlines

Medication	Quantity	Neurologically pertinent as deemed by the author (+ least pertinent to +++ most neurologically pertinent)
Non-narcotic analgesic	325 mg (4)	+++
Antihistamine	25 mg (4)	++
Antihistamine injection	50 mg (2)	++
Atropine	0.5 mg/5 mL (2)	+++
Aspirin	325 mg (4)	+++
Inhaled bronchodilator	1	+
Dextrose 50%/50 mL	1	++
Epinephrine 1:1000–1 mL	2	+
Epinephrine 1:10,000–2 mL	2	+
Lidocaine 5 mL, 20 mg/mL injectable	2	+
Nitroglycerin 0.4 mg	10	+

Adapted from reference 4.

in urgent medical situations to be tended and monitored by in-flight help.

Telemedical air-to-ground support

Every US airline or world airline operating in the United States has a contract with an air-to-ground medical service. Emergency department or internal medicine physicians who handle consultations via radio when the captain has deemed an emergency typically staff these air-to-ground medical services because an onboard provider needs to get medical advice. These physicians are trained to provide useful information and guide whoever is the medical professional on board in order to best stabilize the situation, help decide whether the EMK should be opened, and help guide the captain as to whether an emergency landing is needed.

Curiously, the increase in these services has led to fewer diversions or no change over the years because of this help. However, controversy has ensued as a number of legal cases have arisen that pertain to stroke care, regarding whether a plane should have been landed at an emergency location for emergent stroke care, as opposed to continuing on to its destination.⁵ Given the dramatic shifts in urgent stroke intervention, this issue will undoubtedly be examined in the future by both airlines and legal professionals.

Neurologic in-flight medical emergencies

In 2002, Sirven et al.² documented that neurologic issues accounted for the largest number of symptoms that prompt

medical attention. In a reanalysis of the Peterson et al.³ data recategorized similar to the methodology employed by Sirven et al.,² neurologic symptoms continue to account for nearly half of all in-flight medical emergencies (49.3%). This is calculated by redefining neurologic symptoms to include syncope/presyncope (37.4%), seizures (6%), psychiatric or agitation (2.5%), possible stroke (2%), headache (1%), and ear pain (0.4%).³ Although syncope and presyncope can have numerous etiologies (cardiac, neurologic, psychiatric, or pulmonary), this condition presents with loss of consciousness, an arguable neurologic symptom neurologists are often asked to assess. More importantly, these same neurologic symptoms account for 54.1% of all in-flight diversions based on that analysis. Moreover, for all patients who were ultimately admitted to the hospital for which the authors had data, nearly 59.5% were due to neurologic symptoms.³ Stroke led the way as the most common trigger for hospital admission due to an in-flight medical emergency. Overall, neurologic issues account for a majority of in-flight medical consultations. Therefore, neurologic issues are of considerable consequence to the flying public and continue to be so based on that analysis.

Ethical and legal issues

The most common question that neurologists and other physicians pose from in-flight medical emergencies is “Am I legally required to respond?” Legally, there is no formal requirement that a physician must respond to an in-flight medical emergency. Clearly, however, many physicians willingly help, based on the fact that they provided medical assistance in 48.1% of reported in-flight medical emergencies.³ A Federal law encourages physicians to step up

and assist airline crews in managing in-flight medical emergencies. The US Congress passed the Aviation Medical Assistance act in 1998, which protects providers who respond to in-flight medical emergencies from liability.⁶ This law applies to in-flight medical situations that arise on both domestic and international flights involving US airlines or American citizens and residents. This law does not protect physicians if the treated patient can establish that the provider who responded was grossly negligent or intentionally caused alleged harm. An example of this would be an intoxicated physician treating a patient. Whether it is considered unethical not to respond to an in-flight emergency depends on the country where one is licensed to practice. In Europe and Australia, responding to such a call is part of the professional code of ethics in terms of making certain that a patient is helped. In The United States, where all graduate medical students swear to the Hippocratic Oath, the answer should be to respond, but not all physicians agree on this point.

Why are in-flight neurologic issues so common?

Neurologic issues occur due to the unusual environment specific to airplanes. Planes fly at around 35,000–36,000 feet of altitude. The ambient temperature at that level is very cold and barometric pressure is low. Thus to make air travel viable, safe, and comfortable at that altitude, airplanes are pressurized to mimic being on the ground at an altitude of 8,000 feet. Simply following the basic laws of the chemistry of gases, specifically Dalton's Law, which underpins our understanding of aviation physiology, cabin pressurization used on most jet travel is simulated to resemble that on the ground at 8,000 feet elevation. At 8,000 feet elevation, there is relative hypoxemia because the barometric pressure is lower at 8,000 feet altitude than at sea level, and thus the partial pressure of oxygen according to Dalton's Law should also be lower. For a large majority of the public, this causes minimal issues. However, for those who are ill, have difficulty oxygenating, or are taking prescription medications for a chronic condition, this relative hypoxemia can have real consequences. Add in the stress of flying secondary to security issues, packed flights with minimal personal space, and anxiety-laden sleep deprivation, and douse it all with alcohol, then one has the perfect environment for in-flight medical emergencies to occur.

Prevention

How can we as physicians help to prevent an in-flight emergency in our patients? Delay significant medication changes for chronic neurologic or medical conditions until after travel is completed as opposed to increasing the risk of adverse effects; make certain your patients have ample or extra medication on their person, and advise them to not pack medication into checked baggage where they do not have

Advocating for better passenger laws and for aviation safety is key to the future prevention and management of in-flight emergencies.

access to it; and advise patients to get adequate sleep, avoid alcohol, and stay hydrated. The simple aspects of healthy flying need to be emphasized even if at times the advice seems self-evident.

What should I do if I hear the words “Is there a doctor on this flight?”

You can decide whether to respond, but should you do so, have some form of identification to show that you are a physician. This is important because multiple people may respond. If multiple people respond, some issues may be more pertinent to a neurologist, as opposed to another type of physician. Sometimes more than one physician or nurse can help. Make sure you provide all the information to the flight attendant and if there is an emergency ask for air-to-ground medical consultation services. Know what is on board in the plane's EMK. If a medication that you need is not in the EMK, such as in the situation of a seizure, it is OK to have the flight attendant ask on the overhead whether someone has spare medication to use. This has been done on numerous occasions when there is an emergency. Practice within the scope of your specialty. Assuming you are a neurologist, an in-flight emergency is not the place to hone one's nascent surgical skills. Remember that the captain is ultimately responsible for all decisions and regardless of any objections you may voice on any given management issue. You can document your objections should you feel the need to in a letter to the airline. When you arrive on the ground, you may be asked to go to the hospital or you may not, depending on whether the patient is stable. You will provide any information you have to the medical personnel awaiting the flight at the destination, regardless whether it is the diverted or scheduled destination of that flight.

Air travel in 2018 and future years looks to be crowded and challenging. Sometimes scanning the departure gate may give you a sense of whether you may be working on that particular flight and may even help to identify people who are in distress and should not fly medically. Advocating for better passenger laws and for aviation safety is key to the future prevention and management of in-flight emergencies. Understanding our roles as physicians and neurologists, familiarity with the laws, as well as what equipment and tools are available on board will help ensure everyone reaches their destination in as safe and healthy a manner as possible.

TAKE-HOME POINTS

- In-flight neurologic symptoms are common and have increased over the last several years.
- The captain of a commercial flight is ultimately responsible for management decisions of an in-flight medical emergency.
- Air-to-ground medical consultation services are available to support neurologists or other health care providers who step up to help an ailing passenger. However, it is up to the captain to decide whether an emergency landing is needed and to choose which medical advice to follow should there be a difference of opinion between the in-flight medical provider and the air-to-ground medical service.
- All commercial flights with a flight attendant have an EMK available to help manage acute symptoms.
- There are federal Good Samaritan laws in place that help to protect physicians who offer to assist in managing an in-flight medical emergency. However, physicians must practice within the scope of their medical license and expertise and must not be impaired.

Author contributions

J. I. Sirven: Drafting/revising the manuscript; Data acquisition; Study concept or design; Analysis or interpretation of data; Acquisition of data.

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Disclosure

J.I. Sirven has done clinical and policy consulting and is certified as an Aviation Medical Examiner for the Federal Aviation Administration; serves on scientific advisory boards for Eisai, Upsher-Smith, Epilepsy Foundation, American Academy of Neurology, and Federal Aviation Administration; has received funding for travel from Epilepsy Foundation; serves on the editorial board of Epilepsy.com; receives publishing royalties for *Up-to-Date 2010 Clinical Neurology of the Older Adult* (LWW, 2008); serves as a consultant for Acorda Therapeutics, UCB Inc., NeuroPace, and Eisai; has completed projects for Medscape; is on the Board of Directors of the American Brain Foundation; and receives research support from NIH/NINDS and Epilepsy Foundation. Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

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