

Winging It!

The Prevention and Management of In-flight Emergencies

Ever been on a flight when the PA system announces, “Is there a doctor on board?” With an aging population that travels despite health problems, it is likely that sometime in the future that call may be for you.

It can be unnerving to manage medical emergencies in the air without the usual support systems. *The New England Journal of Medicine* recently published a useful review on determining fitness for air travel and the provision of medical assistance on commercial airline flights. Here is some information you may find helpful for preventing and managing in-flight emergencies.

On the ground

Most medical emergencies on airplanes happen unexpectedly, but some emergencies may be avoided by screening persons with pre-existing medical conditions who plan air trips. Most people don't know the effects that air travel can have on their health. Some may believe that airplanes are traveling emergency rooms, when, in fact, basic first aid may be all that is available.

Increasingly, family physicians are being asked to determine who can and cannot fly. See the table right for a partial list of contraindications to flying. Legislation prohibits airlines from discriminating against passengers with disabilities, but

(Cont'd page 3)



“is there a **DOCTOR** on board?!”

Partial List of Contraindications to Commercial Air Travel

Category	Contraindication				
General	• Low probability of surviving	• Any contagious disease	• Unstable behaviour problems		
Cardiovascular	• Myocardial infarction within previous 3 weeks	• Unstable angina	• CABG within previous 2 weeks	• Decompensated heart failure	• Uncontrolled arrhythmias
Pulmonary	• Contagious pulmonary infection	• Base-line partial pressure of arterial oxygen <70 mmHg at sea level without supplemental oxygen	• Exacerbation of obstructive or restrictive lung disease	• Large pleural effusion	• Pneumothorax within previous 3 weeks
Neurologic	• Cerebrovascular accident within previous 2 weeks or uncontrolled seizures				
Surgical	• Gastrointestinal, thoracic, otorhinolaryngologic or neurologic surgery within previous 2 weeks				
Pregnancy-related	• ≥35 weeks pregnancy or complicated pregnancy				
Pediatric	• First week after birth				
Other	• Severe anemia (Hgb <8.5 g/dL)*, sickle cell crisis or decompression sickness				

Adapted from: *NEJM* 2002; 346;14:1067–1073. *Contraindicated without supplemental oxygen.

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they do have the right to refuse passengers who look visibly ill. Airlines vary as to the stringency of screening potential passengers for fitness to fly. A medical certificate from a physician stating that a person is stable medically for flight and will not require extraordinary medical assistance may be required.

Individual arrangements must be made with the airline for passengers who require intensive nursing, specialized equipment or medical care while in flight. Each airline has its own policies regarding the provision of air transport for seriously ill passengers. Air ambulances generally provide this level of care.



Is your patient fit to fly?

Your patient may be fit to fly if he/she can:

- Walk 50 metres, or
- Climb one flight of stairs without angina or severe dyspnea.

Some patients may require more extensive testing, such as pulmonary function tests or treadmill testing.

In the air

Flying is generally safe, but there are environmental and physiologic stresses that can be encountered, including lowered barometric pressure and partial pressure of oxygen, environmental temperature changes, low humidity, sustained periods of postural immobility, as well as the stresses of pre-flight activities.

Cabin pressure

The *relative* cabin altitude maintained in commercial jet aircraft is between 1,500 to 2,500 metres. Barometric pressure decreases from the “normal” sea level value of 760 mm Hg to 560 mm Hg, which has two main effects on the body—reducing the partial pressure of arterial oxygen (PaO_2) and causing expansion of air and gas in body cavities.

■ **Oxygenation:** PaO_2 decreases from about 95 mm Hg to about 56 mm Hg in normal individuals (about a 90% O_2 saturation) when in the air. Below this point, there is a relatively steep gradient for the pressure/saturation relationship. Since 50–55 mm Hg is a minimum acceptable PaO_2 level for a healthy person, travelers with cardiovascular, circulatory or pulmonary problems may experience symptoms of hypoxia at normal cabin pressure. See box left for a simple screening test.

Oxygen supplementation may be required for some patients. It is suggested that a minimum pre-flight PaO_2 measurement of **68–70 mm Hg** be used to ensure adequate oxygenation without supplementation. In particular, supplemental oxygen is advised for persons with a hemoglobin <8.5 g/dL and for those with sickle cell disease. See the box right.

■ **Expansion of air/gas:** In healthy travelers, expansion of gas in body cavities (up to 25% by volume at a cabin altitude of approximately 2,450 metres) may result in mild abdominal cramps or ear discomfort. In those with Eustachian tube or sinus conditions, recent surgery or air-filled medical devices, more serious complications can occur.

• **Surgery:** Persons who have had recent abdominal (including laparoscopy), ophthalmologic, thoracic or neurologic surgeries can run into difficulties with expansion of trapped gas. For example, torn sutures, hemorrhaging and even bowel perforation can occur in patients with recent abdominal surgery. Recommendations vary, but a waiting period of around two weeks is reasonable after laparoscopic surgery or any procedure that involves the introduction of gas into the body, providing there are no other complications.

- **Medical devices:** Feeding tubes, urinary catheters, cuffed endotracheal or tracheostomy tubes can be affected by expansion of air. Water rather than air should be installed into the devices prior to take-off. Most airlines do not permit pneumatic splints. Plaster casts applied within 48 hours of flight should be bivalved.

Supplemental Oxygen

Supplemental oxygen is available on an emergency basis when in the air, but can also be arranged in advance for those with stable medical conditions who pre-book. Oxygen is generally available with adjustable 2–8 L/min flow or fixed flow of 2 L/min. This service is based on a fee: passengers are charged per unit of oxygen used or per ticket.

Patients must book this service well in advance, and have a medical certificate from their physician certifying that the person is medically cleared to fly, as well as an oxygen prescription which specifies flow rate, intermittent or continuous use and delivery device (e.g. mask or cannula). Patients are generally not permitted to use their own equipment during the flight and must make their own arrangements for oxygen at departure and arrival terminals.

- **Eustachian tube/sinus conditions:** As the aircraft cabin changes pressure, ear and sinus conditions such as otitis media, effusions, acute/chronic sinusitis, allergies or nasal congestion can lead to in-flight problems. Negative pressure in the middle ear created by blockage creates a vacuum, which in turn causes pain, tinnitus, vertigo, hearing loss or even tympanic membrane rupture. When the pressures aren't equilibrated, barotitis media or barosinusitis can occur on descent. Patients with ear or sinus problems should consider using decongestants 30 minutes before landing. They should also be instructed in the use of the Valsalva manoeuvre. Frequent swallowing and chewing gum can be helpful. Those who have undergone recent surgical procedures to the inner or middle ear should not fly.



Cabin air quality

Studies show that the air in commercial cabins is safe. There are about 20 to 30 air exchanges per hour, with approximately 50% of the air being recirculated after filtration. 50% of the air is drawn from the outside.

- **Humidity:** At high altitudes, the air contains very little moisture. As a consequence, cabin humidity is low (usually 10–20%), which can exacerbate reactive airways disease and cause dry mouth and eyes (particularly in those with contact lenses). Dehydration is unusual if regular oral fluid intake is maintained. Alcohol can potentiate dehydration.
- **Transmission of disease:** There is very little data available on transmission of disease in commercial aircraft, but transmission of tuberculosis, influenza, measles, smallpox, cholera and enteritis has been reported. The risk of cross-infection is increased by flight duration of greater than eight hours and close proximity of the index patient (within two rows).

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Immobility

Although there have not been any conclusive prospective studies, many experts think that there is an increased risk of developing deep venous thrombosis (DVT) during air travel. Immobility, edema of the lower leg, dehydration (compounded by alcohol) and popliteal vein compression on the seat edge are all thought to contribute to the development of DVT, although it may not manifest itself until several hours or even days after the journey.

Preventive measures for all passengers include walking in the aisle when possible, drinking plenty of water, isometric exercise and requesting bulkhead seating. Additional measures, such as low dose

acetylsalicylic acid, compression stockings or low molecular weight heparin, may be considered for persons at increased risk (e.g. history of DVT, malignancy, hormone therapy, major surgery, leg surgery). It should be noted that there have been no prospective studies on the efficacy of these preventive measures.

General Measures

All patients with medical conditions who will be flying should bring their medication (including additional supplies in case of delay) in their onboard luggage. A prescription or doctor's note validating the use of these medications may be required. Patients should also bring pertinent medical information, which may include a medical problem/drug list and a recent electrocardiogram.

For more information on flying and specific conditions, including pregnancy, scuba diving and diabetes mellitus, see *informed plus* #8410.

In-flight Emergencies

It is difficult to determine the incidence of in-flight medical events on commercial airlines because there is no regulatory requirement to report. A recent estimate was one event per 14,000 passengers worldwide.

Most of these events are not serious and can be handled by cabin crew. Common events include episodes of ear pain, dizziness, fainting and hyperventilation. Traumatic injuries can also occur, particularly when overhead bins are opened after take-off or landing. Scalds from hot beverages are quite common. Interestingly, three-quarters of medical emergencies on planes take place while travelers are still on the ground.

A General Approach

Each airline has its own policies and procedures for in-flight medical events, but there are no federal regulations or guidelines for the management of these emergencies. It is the responsibility of the *crew*, who are all trained in first aid, to respond to a passenger who becomes ill. If medical assistance is requested, a health care professional who volunteers to help is not required to take "control" of the situation, but to work *with* the crew



AEDs

The Working Group on Medical Emergencies for Transport Canada does not favour inclusion of automated external defibrillators (AEDs) on board commercial aircraft for several reasons, including a lack of standard training, airworthiness standards and battery requirements of the devices. There is also concern that mandating AEDs may create a false expectation by passengers that flight attendants are trained emergency medical personnel.

However, many airlines, including some Canadian companies, already carry AEDs. By 2004, all American airlines will be required to carry AEDs and train cabin crews to use the devices.

to offer assistance to the ill passenger. On most flights, more than half the time when a call is made for medical assistance, the first responder is a physician, followed by nurses.

There are a number of options for basic management of the patient. The goal is to stabilize the patient until the aircraft has landed. The physician may:

- ✓ **Administer oxygen.** Canadian regulations require that there be enough first aid oxygen available to provide at least one person with oxygen for one hour or the entire duration of the flight at a cabin pressure altitude above 8,000 feet (whichever is longer).
- ✓ **Use supplies and medications from the medical emergency kit.** Kit contents are limited and are intended for basic emergency care only, not to sustain or treat those who become critically ill during flights. At present, Canadian aircraft (with over 100 seats and at least one flight attendant) are required to

carry a medical kit containing diphenhydramine, epinephrine and 50% dextrose for injection, along with nitroglycerin tablets or spray. Required equipment includes a blood pressure cuff, stethoscope, latex gloves and syringes and needles of appropriate sizes (including a safe disposal method). There is also one or more first aid kit(s) available which include antiseptics, various bandages, a splint, an eye pad and tweezers.

A Working Group on Medical Emergencies was tasked by Transport Canada to reassess the contents of the medical emergency kit. They recommended expanding the kits to include bronchodilators, IV saline and atropine, along with various sizes of airways, a CPR mask and an IV kit. It should be noted that most airlines provide expanded kits, which may include automated external defibrillators (AEDs)—see box left. For details of Canadian and American kits, see [informed plus #8411](#).

- ✓ **Ask the flight crew to lower the altitude** of the plane to increase cabin pressure, which can alleviate altitude-related chest pain, shortness of breath and abdominal pain (increases PAO₂ and decreases gas expansion)
- ✓ **Consult with the ground-based medical support personnel**, if available. Some airlines are staffing their headquarters with consulting physicians available 24 hours/day, or are contracting with commercial companies to provide physician consults through telemedicine links—right to the passenger’s seatback phone.
- ✓ **Suggest diversion** of the aircraft if deemed necessary (see box right). The captain is the ultimate decision-maker regarding the decision to divert. The costs associated with aircraft diversion can run as high as \$100 000 (US dollars) depending on whether or not fuel needs to be dumped before landing and overnight accommodations for passengers are necessary. Diversion of aircraft depends entirely on routes operated and the location of appropriate airports for landing, including the availability of appropriate medical assistance.



Diversion

Recommendation to the flight crew to divert the plane should be considered if a passenger:

- Has chest pain, shortness of breath (SOB) or severe abdominal pain that does not improve with treatment
- Is unresponsive, suffers cardiac arrest, an acute coronary syndrome, severe SOB, stroke, seizures or severe agitation.

In a recent American study, the most common reasons for diversion were cardiac incidents (28%), neurological problems (20%) and food poisoning (20%). Fifteen per cent of patients were admitted to hospital; 1.3% died. Other reasons for diversion include severe/uncontrollable pain, bleeding, injury with shock, impending birth, uncontrollable mental disturbance, and air rage (often caused by excessive alcohol use or smoking restriction). See [informed plus #8412](#) for information on managing the top ten in-flight medical emergencies.

Liability

In Canada, as in the United States and the United Kingdom, physicians do not have a legal duty to offer assistance, unless there is a prior physician-patient relationship. However, many other countries do impose a legal obligation, and the country in which the aircraft is registered has legal jurisdiction.

There is no known case in which a physician has been sued after helping aboard an aircraft. However, when a physician is asked to assist in a medical emergency in Canadian airspace, the

major airlines indemnify the physician using the emergency medical kit. The doctor becomes an “agent” of the airline and is thus protected by the airline’s liability insurance. In addition, “Good Samaritan” provisions in Canada and the United States, as well as in other countries, limit the liability of non-employee passengers unless the assistance is grossly negligent or wilful misconduct is evident. For more information on medical liability, see [informed plus #8413](#).

Probably the best advice anyone can give to a physician who responds to the request for medical assistance for a fellow passenger is to remember your limitations, including possible impaired judgement due to alcohol intake. Working in isolation with limited resources is difficult; you can only supply care commensurate with your skill set and the tools/equipment/medication at hand. Recent medical kit changes should help, as should the increased ground medical support available through improved telecommunications technology. ■

The Bottom Line

- **Patients with pre-existing medical problems should be screened for fitness to fly prior to the flight.**
- **Some patients may require special precautions (e.g. supplemental oxygen, decongestants) due to changes in environmental and physiologic factors during flight.**
- **Physicians who volunteer in an in-flight emergency are not required to take control, but to assist the crew.**

informed plus ▼

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 - 8411 • Emergency medical kits
 - 8412 • Top 10 in-flight emergencies
 - 8413 • Medico-legal liability
 - 8414 • Web site resources for patients and physicians
- ▶ These supplementary tools and information materials are available online at www.ices.on.ca



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