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Health Risks to Air Travelers

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According to the Aerospace Medical Association, one billion people travel by air each year on domestic and international flights and this number is expected to double in the coming two decades [1,2]. It is estimated that in the United States alone, over 1,700,000 passengers board aircraft every day [3]. Beyond the hassles of an occasional late arrival or lost luggage, most travelers experience neither inconvenience nor adverse health consequence related to air travel. There are, however, some health risks to air travelers. Using real-life cases, concerns, and situations, this article discusses those risks and how savvy travelers can minimize air travel-associated health problems.

Do I need to wear a face mask during my trip?

During a pretravel consultation before a trip to China in spring of 2004, a business traveler wants to know if he should wear a face mask during his return flight from Beijing to New York. “There may be [severe acute respiratory syndrome] SARS-infected patients on the flight, you know!” he explains. Are passengers at risk of acquiring respiratory infections onboard aircraft and should a face mask be recommended to help prevent such infections?

Travelers can acquire infection on commercial aircrafts in a variety of ways. Infection can be transmitted by contaminated food (*Salmonella*, *Staphylococcus*, *Vibrio* spp.); from insects that may enter the aircraft during layover at airports in endemic area (malaria); or more commonly through person-to-person transmission of respiratory infections [4]. Respiratory pathogens can spread by large droplets (which quickly fall down to the

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ground if they fail to reach the mucous membranes) or by tiny droplet nuclei (<10 μm in diameter), which disperse widely and remain airborne for hours (measles, influenza, tuberculosis, and SARS spread by these droplet nuclei) [5,6]. Close proximity onboard commercial aircrafts can help spread these infections to fellow passengers [2]. Approximately 26% of international travelers report respiratory illness associated with their travel [7], but it is not known how much of this is caused by exposure on planes as opposed to during activities on the ground.

Cabin air in commercial aircraft is remarkably clean. Air is recycled on average 20 to 30 times an hour and recirculated air is passed through high-efficiency particulate air filters, which remove microorganisms of 0.3 to 1 μm in size including mycobacteria, fungi, and some viruses [4,8]. As a result, the concentration of microorganisms in cabin air is much lower than most city locations including shopping malls and airport terminals [9]. Despite these measures, however, in-flight transmission of respiratory infections, such as measles, influenza, tuberculosis, and more recently SARS, has been reported [4,10–12].

Severe acute respiratory syndrome

SARS is a novel respiratory illness, characterized by acute onset of fever, malaise, cough, and shortness of breath, which emerged in the spring of 2003. Rapid global spread of SARS-corona virus in 2003 was facilitated by international travel as illustrated by initial dissemination of the SARS outbreak from Hong Kong [13]. Although concern of transmission to fellow passengers on aircraft was raised from early on, the first documented transmission of SARS-corona virus on airplane was reported in December of 2003 [10]. In their study, three flights that carried passengers with laboratory-confirmed SARS-corona virus infection were investigated. There was strong evidence to suggest transmission of SARS-corona virus to 22 fellow passengers and crew members in one flight from Hong Kong to Beijing, which carried a symptomatic passenger. Travelers who became infected were sitting in the same row as the index case or within three rows directly in front of him (suggesting spread by aerosol and small droplets). None of the passengers in other sections of the plane acquired infection pointing against the possibility of transmission by the aircraft ventilation system. There was no evidence of transmission on flights that carried SARS-corona virus-infected passengers who were asymptomatic at the time of travel. These data suggest that the primary preventive strategy to minimize risk of in-flight transmission of SARS is to prevent symptomatic SARS patients from traveling [13].

The Centers for Disease Control and Prevention (CDC) recommends hand washing to reduce risk of transmission. Routine use of face masks or other personal protective equipment in public areas is not recommended [13]. Travelers to areas where SARS is being reported should avoid high-risk settings, such as health care facilities and live animal markets [14].

Tuberculosis

Increasing global travel and immigration to United States from parts of the world where tuberculosis is highly endemic increases potential for exposure and transmission of tuberculosis on commercial aircraft [12]. Although screening for tuberculosis is required for immigrants and refugees, it is not required for tourists, business travelers, and students coming to the United States [15]. Patients with active pulmonary tuberculosis may travel on commercial aircrafts without being aware of their diagnosis. The cough of a patient with tuberculosis releases droplet nuclei, which become airborne and are carried by air currents to neighboring passengers until they are cleared by the aircraft ventilation system. According to some estimates, 1 of every 26,000 airline passengers may be exposed to tuberculosis [12]. Risk is still low, however, to passengers and crew on commercial aircrafts in United States [11,12,16].

From 1992 to 1994, seven different flights that carried tuberculosis-infected passengers were investigated [11,12,16–19]. Index patients on all seven flights were highly infectious (symptomatic, sputum smear positive for acid-fast bacilli, and evidence of cavitory disease on chest radiograph). There was strong evidence of tuberculosis transmission on three flights [11,12,16]. Infection was transmitted from one flight attendant to two other crew members on one flight [16], whereas transmission from the index case to fellow passengers and flight crew was documented in another two flights [11,12]. Risk of transmission was associated with proximity to the index cases (sitting in same section of plane) and a long duration of flight (>12 hours). There was no evidence of transmission on the other four flights despite highly infectious passengers on board, suggesting that although in-flight transmission is possible, the risk is still very low.

The CDC recommends that patients should have at least three negative sputum smears for acid-fast bacilli before travel to minimize risk of transmission on aircraft [11]. If travel is essential while the patient is still infectious, a private mode of transportation should be arranged.

So what of the business traveler? He should be counseled that the risk of acquiring SARS on board is extremely low. The CDC recommends good hand washing for prevention of infection. Routine use of face masks, however, is not recommended [13].

Do I need to arrange oxygen for my trip?

One of your patients with chronic obstructive pulmonary disease is planning to take a trip to Hawaii. He is medically stable and does not use oxygen at home. He has read in his travel book that passengers on aircrafts may be exposed to hypoxic conditions. “Do you think I should arrange for oxygen on board, just in case?” he inquires.

Commercial jets maintain a relative cabin pressure equivalent to the atmospheric pressure at 5000 to 8000 ft during routine flights [1,6]. At

this altitude, the partial pressure of inspired oxygen (PiO_2) drops from 150 mm Hg (sea level) to 109 mm Hg [20]. This fall in PiO_2 results in a drop of arterial oxygen saturation (SaO_2). In one study of healthy flight-crew members during 22 scheduled flights, mean nadir SaO_2 fell from 97% (preflight) to 88.6% at cruising altitude [21]. Most healthy travelers can compensate for this level of hypoxemia. Patients with pre-existing cardiac and respiratory conditions, however, who are hypoxemic at sea level, can develop respiratory distress with such a drop in SaO_2 at high altitude. Up to 10% of radio calls to ground medical staff for in-flight medical emergencies is related to respiratory problems [22]. To ensure a safe and comfortable flight for these patients, they should be evaluated for need of in-flight oxygen therapy. Recommended tests for this evaluation are summarized in Box 1.

Box 1. Recommended tests to evaluate need for in-flight oxygen therapy

1. Ability to walk 50 yards at a normal pace or climb one flight of stairs without becoming severely short of breath.
Most practical test to evaluate fitness for commercial air travel.
2. Pulse oximetry at rest and during exertion (adequate in most cases). Patients with $SaO_2 > 95\%$ in room air on sea-level do not require oxygen on board, whereas those with $SaO_2 < 92\%$ require it. Individual in intermediate range requires some hypoxic exposure test to determine need for oxygen.
3. Arterial blood gas: single most helpful blood test because PaO_2 at sea-level is considered the best predictor of altitude PaO_2 and tolerance. $PaO_2 < 70$ in room air at sea level is an indication for in-flight oxygen therapy.
4. Hypoxia altitude simulation test: sophisticated method. PaO_2 is determined while patient breathes mixed gases simulating the aircraft cabin environment at 8000 ft altitude (85% nitrogen and 15% oxygen). If PaO_2 is < 50 mm Hg, medical oxygen should be considered.
5. Exposure to hypoxia in an altitude chamber. Ideal preflight test. Also detects potential adverse effects of gas expansion. Only available in a few centers.
6. Consider departing altitude, length of flight, destination altitude, and prior history of air travel when making decision for in-flight oxygen requirement.

Data from Refs. [1,2,20,23–25].

Travelers with chronic obstructive pulmonary disease are the best studied group for flight-related problems. They are susceptible to significant in-flight hypoxemia depending on baseline PaO_2 . Measurement of preflight forced expiratory volume in first second improves prediction of PaO_2 at altitude in patients with severe chronic obstructive pulmonary disease [26]. Most patients with interstitial lung disease (sarcoidosis and idiopathic pulmonary fibrosis) generally well tolerate air travel. Travel guidelines for patients with specific respiratory conditions are summarized in Table 1 [1,24,27].

What advice should you give to your patient? Certainly, he should be evaluated for a possible in-flight oxygen requirement. He should also be advised to contact the airline at least 48 to 72 hours in advance to arrange

Table 1
Travel guidelines for patients with specific respiratory conditions

Disease	Recommendations
COPD: chronic bronchitis and emphysema	Arrange inflight oxygen if indicated; carry bronchodilators in hand luggage; consider PFT (FEV_1) in patients with severe COPD
Asthma	Hand carry short-acting inhalers; advise to take a course of oral steroid with them for any emergencies during trip; delay travel if labile condition
Interstitial lung disease (idiopathic pulmonary fibrosis and sarcoidosis)	Evaluate need for in-flight oxygen therapy
Bronchiectasis and cystic fibrosis	Control of lung infection with appropriate antibiotics; measures to loosen and clear secretions; adequate hydration; consider aerosolized rhDNAse to reduce sputum viscosity; medical oxygen if indicated
Pneumothorax	Diagnose and correct underlying etiology; delay travel until resolved
Pulmonary hypertension	Anticoagulation, evaluation for in-flight oxygen; restrict exercise during flight
Pleural effusion	Large effusion should be drained 10–14 days before flight for diagnostic and therapeutic purposes; consider repeating chest radiograph before trip
Neuromuscular disease (spinal cord injury, obesity hypoventilation syndrome, muscular dystrophy)	Arrange manual suctioning equipment, medical oxygen, and ventilator capabilities; some patients may require tracheostomy before trip
Tracheostomy	Humidification of inspired air; adequate hydration; suctioning
Patients on long-term home oxygen therapy	May need to increase flow rate from 1 to $2 \text{ L}\cdot\text{min}^{-1}$ to $4 \text{ L}\cdot\text{min}^{-1}$
Recent exacerbation of any chronic respiratory disease	Delay travel until stabilized

Abbreviations: COPD, chronic obstructive pulmonary disease; FEV_1 , forced expiratory volume in 1 second; PFT, pulmonary function tests.

Data from Refs. [1,24,27].

oxygen onboard aircraft [25] because airlines do not allow passengers to carry their own oxygen on aircrafts out of concerns of safety and security. The patient should be provided with a prescription for in-flight oxygen and a “fitness to fly” certificate from a physician. The delivery method (face-mask versus nasal-cannula, intermittent versus continuous flow) should also be specified [28]. Airlines are not responsible for providing oxygen during airport layovers and at destination airports and travelers need to make their own arrangements.

How long do I have to wait before I can fly?

Patients with cardiac problems represent a major group at risk for flight-related complications. Most patients with stable angina pectoris can travel safely. Individuals with acute myocardial infarction may need to delay their travel plan (Table 2) [2,25]. Previously, a delay of several weeks was recommended for patients who suffered an acute myocardial infarction. In a review of 196 adults carried on commercial aircrafts post-myocardial infarction, however, 95% were transported without incident when traveling

Table 2
Recommended travel delay for specific conditions

Condition	Recommended travel delay
Cardiac (CABG, valve replacement) surgery	10–14 d
Uncomplicated myocardial infarction	2–3 wk
Complicated myocardial infarction ^a	6 wk
Uncomplicated PCI	3–5 d
Complicated PCI	1–2 wk
Thoracic surgery	10–14 d
Pneumothorax	2–3 wk after resolution
Any unstable cardiopulmonary condition	Delay until stabilized
Stroke (CVA)	2 wk
Postspinal anesthesia	10–14 d
Open abdominal surgery	1–2 wk
Laparoscopic abdominal surgery	24 h (1–2 wk if intestinal lumen has been opened)
Colonoscopy with polypectomy	24 h
Skull fracture or postneurosurgery	1–2 wk
Scuba diving (one dive per day)	12–24 h
Communicable diseases (including TB, SARS, measles, influenza)	Delay travel until period of communicability is over (clinical improvement, negative cultures, and so forth)

Travel is by commercial airline flight. These are only guidelines and must be individualized based on clinical judgment and length of trip.

Abbreviations: CABG, coronary artery bypass grafting; CVA, cerebrovascular accident; PCI, percutaneous coronary intervention; SARS, severe acute respiratory syndrome; TB, tuberculosis.

^a Complicated by arrhythmia, postinfarct angina, or left ventricular dysfunction.

Data from Refs. [1,2,29,31–33].

at least 2 weeks after the event [29]. A symptom-limited treadmill test at 10 to 14 days after myocardial infarction is a better way to assess fitness for flying than arbitrary travel restrictions [30]. Patients with an old myocardial infarction should not have any problem during air travel. Patients should be evaluated for need of in-flight oxygen. Unstable angina, decompensated heart failure, uncontrolled hypertension, uncontrolled ventricular or supraventricular tachycardia, Eisenmenger's syndrome, and severe symptomatic valvular heart disease are considered contraindications to travel by commercial air flights [1].

Postoperative patients are another group who may need to delay their travel plans after surgery. General anesthesia itself is not a contraindication for flying because cardiac depressant effects and changes in vascular systems secondary to anesthesia are rapidly reversible. Surgical procedures that result in entrapment of air in various body cavities (abdominal, chest, head, eye) can result in problems associated with expansion of gases at reduced cabin pressure at altitude (gases expand 25% at an altitude of 8000 ft). Recommended travel delay for specific surgical conditions is listed in Table 2 [1,2,29,31–33].

Travelers with permanent pacemakers and implanted cardioverter defibrillators are at low risk for flying once medically stable. Interaction with airline electronics or airport security devices is highly unlikely for the most common bipolar devices [34]. Hand-held security devices may interfere with implanted cardioverter defibrillators and travelers should carry a physician's letter specifying this hazard [33,35]. Questions about particular models should be directed to representatives of the pacemaker company. Patients should be advised to carry copies of their electrocardiogram with and without activation of their pacemaker during travel [25].

To shock or not to shock!

Cardiovascular problems are the most common cause of air travel-related medical emergencies and deaths [6,33,36]. Almost 1000 lives are lost annually from cardiac arrest in commercial aircrafts and airline terminals in International Airlines Transport Association carriers [37]. Most of the victims do not have prior history of heart disease. Ventricular fibrillation is the most common rhythm recorded in victims of sudden cardiac arrest [38,39]. Early defibrillation is the most important predictor of success and long-term survival [40]. Chances of survival decrease by 10% for each minute defibrillation is delayed. Previously, the common practice of airlines was to continue cardiopulmonary resuscitation and divert the plane to the nearest airport. This may take 20 minutes or longer, however, even in best of circumstances. This is an unacceptable delay in view of current standards of care for sudden cardiac arrest [41]. A more logical approach is to place automated external defibrillators on board and train flight crew in their use

[42]. Onboard automated external defibrillators improve chances of survival in cardiac arrest and avoid unnecessary and futile diversions for idioventricular rhythm and asystole [6,43,44].

In the United States, American Airlines was the first to install automated external defibrillators on commercial aircrafts. In their experience from June 1997 to July 1999 [45], automated external defibrillators were used on 200 occasions. Sensitivity (ability correctly to diagnose ventricular fibrillation) and success rate (ability successfully to defibrillate) of automated external defibrillators was 100%. No inappropriate shocks were given. Rate of survival after defibrillation to discharge from hospital was 40%. Based on these data, it was estimated that use of automated external defibrillators will save 93 lives each year. Similar encouraging experience has been reported by other international carriers [41].

In June 2001, the Federal Aviation Administration mandated that all commercial air carriers with at least one flight attendant on board must carry automated external defibrillators on each aircraft by April, 2004 [6,46]. Physicians and other medical personnel who volunteer to assist during in-flight emergencies are protected from liability by the “Good Samaritan” provision of the “Airline Passenger Safety Act” of 1997 [47].

Should I take an aspirin before traveling on airplane?

A 35-year-old anxious woman presents for pretraveling counseling. She does not smoke but uses oral contraceptives. Her mother died with pulmonary embolism last year at age 65. She wants to know if she should take aspirin before her flight to minimize her risk of pulmonary embolism.

Air travel is now considered a well-recognized risk factor for venous thromboembolism [48–50]. The reported incidence of travel-related venous thrombosis ranges between 5% and 10% [22,31,48,51]. In a case control study of 160 patients, history of recent travel was four times more common in patients with venous thromboembolism compared with controls [49]. Most cases of travel-related deep venous thrombosis are asymptomatic and result in no clinical consequences. Pulmonary embolism is the most dreaded complication of travel-related deep venous thrombosis presenting with chest pain, dyspnea, or even sudden death. In a study of 61 cases of sudden death in passengers arriving at Heathrow airport between 1979 and 1982, pulmonary embolism was identified as the cause of death on autopsy in 18% of cases [52]. Travel-related arterial and cerebral venous thrombi have also been reported in the literature [53,54].

The term “economy class syndrome” has been used widely in the past to describe air travel-related venous thromboembolism [55]. This term, however, is misleading because the risk of venous thrombosis is not limited to travel on “economy class” of aircrafts but indeed may occur on “first class” or during travel on buses or trains [56]. Instead, use of the term “traveler’s thrombosis” is probably more appropriate.

Prolonged immobility and venous stasis associated with long-haul flights are the major promoting factor for venous thromboembolism [57,58]. Risk increases with duration of flight (more common in flight of >12 hours duration, whereas rarely occurring in flights of <4 hours duration) [49,59]. Compression of the popliteal vein at the edge of a seat [60] and hemoconcentration associated with diminished fluid intake and increased insensible water loss may serve as additional risk factors [61]. Sitting at window or central seats is another potentially avoidable risk factor for air-travel-related venous thrombosis [25].

The risk of venous thrombosis is very low in travelers without pre-existing additional risk factors [60,62]. These additional risk factors include age above 50 years, clotting disorders, cardiovascular disease, malignancy, recent major surgery or trauma, history of deep venous thrombosis or pulmonary embolism, pregnancy, and use of oral contraceptives [1,22,63]. Smoking, obesity, and varicose vein may serve as additional risk factors.

Traveler's thrombosis is a potentially preventable hazard of air travel. Preventive efforts are largely focused on stimulation of circulation to prevent venous stasis. Most travelers are at low risk and only need to follow nonpharmacologic measures listed in Box 2 [1,2,33,51,64–76]. Patients with additional risk factors should seek medical advice before traveling. Physicians may recommend delaying travel plans after orthopedic surgery or trauma to lower extremities. The role of pharmacologic measures (aspirin, low-molecular-weight heparin) is controversial and their use should be limited to individuals at highest risk (malignancy, personal history of venous thromboembolism, recent major orthopedic surgery) [22,65]. Single dose of low-molecular-weight heparin 2 to 4 hours before long-haul flights (>10 hours) was associated with a significant reduction in risk of traveler's thrombosis in a randomized case-control study of 300 subjects [51,67]. Although aspirin prophylaxis has been shown to be helpful in reducing incidence of venous thrombosis and pulmonary embolism in high-risk medical and surgical patients, its role in reducing travel-related deep venous thrombosis has not yet been evaluated in prospective studies [68,69]. Travelers should be cautioned against indiscriminate use of aspirin because of potential side effects of allergic reactions and gastrointestinal bleeding [2,65].

So what should we advise to the patient? She is at low risk because her only identifiable risk factor is use of oral contraceptives. She should be counseled about nonpharmacologic measures listed in Box 2. Aspirin should not be prescribed in this case.

Peanuts or pretzels?

Approximately 15% of people have significant allergic disease, and about 1% of individuals have a potentially life-threatening allergy to peanuts. During travel, peanut-sensitive individuals should be reminded to be careful

Box 2. Measures to minimize risk of traveler's thrombosis*Nonpharmacologic*

1. Bulkhead seating if available.
2. Wear properly fitted graduated-compression stockings especially designed for air travel. Stockings are available over-the-counter and are reusable. Wear these correctly to avoid compression in popliteal area. Stockings are contraindicated in patients with peripheral arterial disease because these may provoke ischemia in this patient population.
3. Avoid constrictive clothing.
4. Take periodic walks during the flight.
5. Simple, frequent, isometric calf exercises, such as flexion and extension of foot and ankle rotation exercises.
6. Change positions periodically while seated.
7. Avoid leg crossing.
8. Maintain adequate hydration.
9. Avoid excess alcohol and caffeine-containing drinks because they may cause dehydration.
10. Do not place hand-luggage where it may restrict movement of legs and feet.
11. Get off plane and walk around in air terminal at refueling stops.

Pharmacologic (may be considered for high-risk individuals)

1. Aspirin: caution in patients with peptic ulcer disease or history of gastrointestinal bleeding.
2. Low-molecular-weight heparin.

Data from Refs. [1,2,33,51,64–76].

to avoid either obvious exposure (eating free peanuts during flights) or inadvertent exposure (eating foods that might have been prepared in peanut oil). Is there, however, a risk of inadvertent exposure and a severe reaction because of “peanut dust” being circulated and recirculated in ventilated aircraft?

Peanut allergen has been identified in filters removed from aircraft [70]. This implies that significant allergen had been circulating in the aircraft air during flight. And, the filters in aircraft ventilation systems are usually changed only after 5000 hours of in-flight use. In addition, peanut reactions can occur after exposure to very small amounts of allergen [71], even by an inhalational or transcutaneous route.

Anaphylaxis is possible following a first-known peanut exposure (presumably following intrauterine or inadvertent sensitization), but most people with life-threatening reactions were already aware of their allergy and exposed themselves anyway. In addition, fatal peanut reactions are associated with both known exposure and a delay of more than 25 minutes between the onset of the reaction and the administration of epinephrine [72–74].

Travelers concerned about anaphylaxis to peanuts should be careful to avoid ingestion or handling of peanuts on airplanes (and elsewhere). They should avoid foods that might have been prepared using peanut products. They should also carry epinephrine. The epinephrine should be administered immediately on recognition of symptoms of possible anaphylaxis, and further medical care should also be sought. As new therapeutic modalities, such as those involving monoclonal IgE antibody become available, peanut-allergic individuals might also be candidates for desensitization treatment [75].

Child safety seats

A flustered family tries to make sure they have not forgotten anything as they prepare for their flight. Packing a preschool-sized load of paraphernalia, they ask if they really need to use a car seat on the plane. “Isn’t a lap adequate for our baby?” they ask.

It is estimated in America that a plane crash–associated death of a child could be prevented once every 2 years by the use of appropriate safety restraints. Some organizations, such as the American Academy of Pediatrics, advise that all infants have a ticketed seat on airplanes and that they be securely fastened in a child restraint seat [76].

Analysis of the costs and effectiveness of requiring infant seats on aircraft, however, suggests that the added inconvenience and cost of using safety seats in planes would stimulate enough children to travel by road rather than by air that there would actually be an increase in travel-related deaths [77].

What should be suggested for the flustered family? A safety restraint in an individual seat might save the life of the child in the rare event of a survivable plane crash, but the restraint should be approved by the Federal Aviation Administration because not all car seats provide appropriate protection for the sorts of forces that occur during air turbulence or plane crashes. For additional in-flight safety, infants should avoid aisle seats where hot drinks might spill when being passed over them. Restrained in a safety seat or not, families should also be advised to provide games or reading material and snacks for children during flights; this can help make the flight safer and more enjoyable for the whole family and for others sharing the aircraft cabin.

Does air travel cause crib death?

A parent who works as a medical professional comes in with her family for a pretravel consultation. You have covered all the usual safety, diarrhea, malaria, and immunization information. The parent then asks, “Didn’t the British prove that intercontinental travel causes crib death?”

Crib death (also called cot death or sudden infant death syndrome) is the unexplained death of a young child (usually between 2 and 6 months of age). Although some apparent sudden infant death syndrome deaths have been retrospectively identified as caused by trauma, suffocation, fatty acid oxidation defect, or cardiac dysrhythmia, true sudden infant death syndrome refers to a death for which no cause is identified, even after extensive evaluation.

Anecdotally, some infants have happened to die of apparent sudden infant death syndrome shortly after completing a transcontinental air flight [78]. This prompted British investigators to study the effect of a low-oxygen environment (15% ambient oxygen at sea level, approximating the oxygen content of a commercial aircraft during flight with the cabin pressurized to the equivalent of about 6500 ft elevation) [78]. Thirty-four young infants (mean age 3 months), 13 of who were siblings of sudden infant death syndrome victims, were exposed overnight to environments of 15% oxygen. Oxygen saturations were variable (85%–100%) but of lower mean (93%) in 15% oxygen as compared with 98% in room air. In low oxygen environments, irregular breathing (with respiratory pauses of less than 20 seconds) was more common.

This study stimulated ethical concern and clinical controversy. Nonetheless, how can one respond to the parent-professional concerned about air travel with an infant? First, there is no proof that international travel causes sudden infant death syndrome, and any association noted is only anecdotal and likely coincidental at this point. Second, hypoxic environments similar to those of commercial aircraft do stimulate infants to have lower oxygen saturations and irregular breathing. The studied infants did not drop to dangerously low oxygen levels or have true apnea, and neither the decreased oxygenation nor the respiratory irregularity were associated with any sign of clinical compromise. There has been concern about prolonged air travel for infants, and there are physiologic changes associated with air travel–like environments, but there is no clear evidence of prolonged air travel being dangerous for infants.

It seems safe to give cautious reassurance to parents traveling with infants. At the same time, they can be reminded to implement other interventions that have clearly been linked to decreased risk of sudden infant death syndrome. Parents, traveling or not, should avoid passive smoke exposure for infants, and infants should routinely sleep in a supine, rather than a prone, position [79].

I get sick on planes!

A family expresses concern before a long-anticipated vacation. “What,” they ask, “can we do to prevent motion sickness?”

Although approximately one third of the population is susceptible to motion sickness [80], most people are not bothered by the conditions of routine commercial air flights. Those with most susceptibility to motion sickness are children, pregnant women, and individuals with a personal or family history of migraine headaches.

Studies of nonpharmacologic measures to prevent motion sickness have yielded either negative or conflicting results. There is no clear evidence to support the use of biofeedback, acupressure, and ingestion of ginger [80]. Anecdotally, seating over the center (wing area) of the plane might be associated with less movement during times of turbulence, but location on a ship was not associated with any change in seasickness [81]. Lying down and avoiding reading are, as anecdotally reported, also useful for many travelers.

A variety of medications can help reduce the risk of symptomatic motion sickness. Dimenhydrinate is readily available and can be used at a dose of 1 mg/kg (50 mg for adults) approximately 1 hour before the expected risk of motion sickness; drowsiness can be a side effect. Scopolamine is effective [82] and is available in tablet form to be taken as 0.4 mg 1 hour before anticipated risk setting and repeated 8-hourly as needed for recurrent exposures. Scopolamine is also available in a patch form to be applied 6 to 8 hours before beginning a prolonged period of motion sickness risk (1.5 mg, gradual release over 72 hours). Transdermal scopolamine, however, is not approved in young children and carries a potential risk of adverse central nervous system effects including hallucinations and seizures. Another option is promethazine, taken as a 25-mg dose for adults with onset of activity approximately 2 hours after administration and continuing for 6 or more hours.

Can I fly during pregnancy?

Other than the risks of venous stasis and thrombosis and the potential exposure to a minimal amount of cosmic radiation, is there any other reason why a pregnant woman should not travel by air? Although there is a little evidence that even commuter travel and its associated physical (and perhaps emotional) stresses is linked to earlier deliveries [83], there does not seem to be medical contraindications to air travel during an otherwise healthy pregnancy. If the woman has a history of preterm labor or of placental abnormalities, however, she should probably avoid air travel during pregnancy.

Why, then, do some airlines prohibit travel during the late stages of pregnancy? Although the trip will not likely change the chance of an unexpected delivery, an in-flight delivery adds significant inconvenience to the woman, the newborn, the other passengers, and the flight crew. For the sake of others, it seems wise to avoid a long flight near term when an airborne delivery could lead to a diversion of the flight.

The other risk of travel during pregnancy relates more to situations at the destination than to the actual flight. It seems that the costs and social stresses of a premature delivery away from home have negative impacts on the child, mother, and family [84].

Should a pregnant woman travel by air? For the sake of other passengers, she should probably refrain from travel during the final month of pregnancy when there is some chance of spontaneous labor and delivery. For her own sake, a pregnant woman is usually advised to avoid a trip during pregnancy that takes her away from the supportive network and medical care of her home setting. If she does choose to travel while pregnant, she should be advised to avoid tight-fitting clothes that might impede venous blood flow, to drink plenty of fluids during flight, to walk every hour or two during long flights, and to have contingency plans should urgent obstetric care be needed. In addition, she should be advised to carry a copy of her medical records and prenatal test results to share with any other providers who might become unexpectedly involved in her care.

Summary

With focused pretravel counseling and intervention, travelers can be prepared to avoid many risks of in-flight problems. Travel medicine practitioners can include appropriate guidance for in-flight health and safety in discussions during pretravel visits.

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