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The Pre-Travel Medical Evaluation: The Traveler with Chronic Illness and the Geriatric Traveler

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The pre-travel medical evaluation of elderly patients and patients with chronic illness requires special assessment and advice. Screening and special precautions are reviewed for traveling patients with respiratory disease, cardiac disease, sinusitis, diabetes mellitus, HIV infection, and other chronic medical conditions. Current guidelines for empiric therapy and prophylaxis of travelers' diarrhea are reviewed, with emphasis on concerns in geriatric or chronically ill travelers. Special considerations such as potential drug-drug interactions and insurance coverage are also discussed.

An increasing number of patients with chronic illness and elderly patients are becoming world travelers. Safe and healthy travel for such patients involves special considerations and advice by their health care practitioners. This review will address some issues that arise during the pre-travel evaluation for patients with illnesses such as pulmonary or cardiovascular disease, diabetes mellitus, HIV infection, and the geriatric traveler.

RESPIRATORY DISEASE

A review of altitude considerations is important for advising the patient with respiratory illness considering air travel. Aircraft cruising altitudes range between 10,000 feet (3,048 meters) to 60,000 feet (18,288 meters) [1]. Aircraft cabins are pressurized with compressed air but can only maintain a maximum gradient of 445 mm Hg above the outside atmospheric pressure; thus a simulated sea level cabin pressure cannot be maintained at altitudes higher than 25,500 feet (7,772 meters) (Table 1) [2]. Cottrell has studied in-flight cabin altitudes and showed that the simulated altitude in the cabin was significantly higher on newer aircraft (7,411 feet, 2,259 meters) as compared to older aircraft (6,056 feet, 1,846 meters) [3]. The effect of these cabin altitudes has been shown to decrease arterial oxygen pressures in healthy volunteers without any associated symptoms [2]. The clinical significance of cabin altitude-related hypoxemia in patients with chronic lung disease is not fully known. Several studies have shown that temporary hypoxemia in this setting has not been associated with any severe symptoms [4,5,6]; however, these studies were done in stable patients for short exposures.

The pre-travel evaluation for a patient with chronic pulmonary disease who wants to fly should include a routine history and physical with attention to whether the

Abbreviations: DVT: deep venous thrombosis FEV_1: forced expiratory volume in one second PaO_2: arterial PO_2 TMP/SMX: trimethoprim/sulfamethoxazole

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TABLE 1
Altitude Simulation During Air Travel

Aircraft Altitude [feet (meters)]	Simulated Altitude in Cabin [feet (meters)]
40,000 (12,191)	7,500 (2,286)
35,000 (10,667)	5,000 (1,524)
25,500 (7,772)	Sea level
15,100 (4,602)	Sea level
10,000 (3,048)	Sea level
5,000 (1,524)	Sea level
Sea level	Sea level

Modified from [1]

patient is stable clinically and can exercise adequately without significant dyspnea [1,7,8]. Jong and Benson have summarized a consensus regarding contraindications to air travel for those with certain respiratory conditions; however, these are relative contraindications and may improve with appropriate therapy and supplemental oxygen (Table 2) [9].

The arterial PO_2 (PaO_2) at cabin altitude is thought to be most important in considering the need for in-flight supplemental oxygen. Several studies have suggested that the ground-level PaO_2 is the most useful predictor of altitude PaO_2 in patients with normocapnic, stable chronic obstructive pulmonary disease [1,10,4,5,6]. Dillard et al. have shown that including the forced expiratory volume in one second (FEV_1) as a factor improved prediction of the altitude PaO_2 significantly [11]. Current recommendations suggest measuring the FEV_1 and PaO_2 within two weeks before the flight to predict in-flight PaO_2 for patients with normocapnic chronic obstructive pulmonary disease [1]. Lung function should be maximized by broncho-

TABLE 2
Contraindications to Air Travel[a]

Acute bronchospasm
Cyanosis
Dyspnea at rest
Pneumonia
Pulmonary hypertension
Severe anemia (hemoglobin ≤ 8.5 gm/dl or sickling hemoglobinopathy
Unstable cardiac disease
Thoracic surgery within three weeks
Otitis media, sinusitis, or recent middle ear surgery
Noncommunicating lung cysts
Pneumothorax or pneumomediastinum
Inadequate pulmonary function, including
Hypercapnia ($PaCO_2 > 50$ mm Hg)
Hypoxemia ($PaCO_2 < 50$ mm Hg on room air)
Diffusing capacity < 50 percent predicted

[a]Contraindications should be considered relative, since conditions may improve with therapy and supplemental oxygen.
Modified from [9]

dilator and steroid therapy as needed. For patients with "borderline" ground-level PaO_2 values of 60 to 70 mm Hg, or patients with co-existing illnesses such as interstitial lung disease, anemia, cardiac disorders, or other complicating medical illnesses, evaluation should include an "altitude stress test" in a pulmonary function laboratory [1,4,6]. The minimal desired in-flight PaO_2 for patients with normocapnic chronic pulmonary disease or these other illnesses is 50 mm Hg, especially when other medical factors contribute or when the flight lasts longer than two hours [1]. Arrangements for in-flight oxygen must be made with the airline at least 48 hours prior to departure. Unfortunately, procedures for requesting or administering oxygen in flight are not currently standardized. Planning non-stop flights and/or oxygen at destination or stopovers must be considered when making arrangements [1].

Remind travelers to request a non-smoking seat (as far away as possible from the smoking section) on international flights in order to avoid elevated carboxyhemoglobin levels. Encourage hydration, since most cabins are maintained at only 8 to 12 percent humidity and thick secretions may cause problems for patients with tracheostomies or chronic bronchitis [9]. Patients with chronic obstructive pulmonary disease should carry an extra supply of medications needed for treatment of exacerbations and keep that supply on their persons rather than in checked baggage.

The above guidelines for decreased oxygenation at high altitudes should also be considered for those wanting to trek. Those with chronic pulmonary or cardiac disease should be advised of the remoteness of trekking areas and the lack of accessible medical care. In general, such patients should avoid treks above intermediate (2,000 meters, 6,562 feet) or high (4,500 meters, 14,763 feet) altitudes.

CARDIOVASCULAR DISEASE

A study of international air travel from 1977 to 1984 showed that the major cause (56 percent) of in-flight deaths was unexpected cardiac events [12]. Pre-travel evaluation of the patient with cardiac or vascular disease also begins with a routine history and physical. Cardiovascular contraindications to flying include: recent (within six weeks) myocardial infarction, decompensated congestive heart failure, uncontrolled arrhythmias, recent cerebrovascular accident (within two weeks), uncontrolled hypertension, active thrombophlebitis, and recent deep vein thrombosis (within four weeks) [8]. Patients with a history of heart disease should have on their persons, not in checked baggage, a summarized medical history, current electrocardiogram, and a supply of medications. The American Medical Association Commission on Emergency Medical Services suggests supplemental oxygen for patients with chronic cardiovascular disease during flights above 22,500 feet, where potentially significant hypoxemia can occur [2].

Automatic implantable cardiac devices and pacemakers are not considered contraindications to flight and are not affected by metal detectors used in airport security [9]. Those with pacemakers should carry the model number and electrocardiogram with and without pacemaker activation. The international traveler should consider that telemetry telephone checks are not relayed by satellite.

Deep venous thrombosis (DVT) and pulmonary embolism are of particular concern in the long-distance traveler, even without a history of cardiovascular disease [13]. One three-year study at London's Heathrow airport showed that pulmonary embolism was responsible for 18 percent of sudden deaths in 61 long-

TABLE 3
Insulin Adjustment for the Diabetic Traveler

Eastbound
Day of departure: Usual dose
First morning of destination (local time):
Use ⅔ usual dose
Test glucose level ten hours after A.M. dose:
Give remaining ⅓ dose if glucose >240 mg/dl
Westbound
Day of departure: Usual dose
Test glucose level 18 hours after A.M. dose:
Give ⅓ usual A.M. dose if glucose >240 mg/dl, followed by snack or meal
Morning of destination (local time):
Usual dose

Modified from [16]

distance travelers [14]. Those at increased risk include the geriatric traveler with venous disease, venous stasis, or dehydration, and women over age 40 with a previous history of DVT [13,14].

Travelers who are predisposed to DVT should avoid the inside or middle seats and obtain bulkhead seats if possible in order to maximize leg room. They should use support hose, do isometric calf exercises, and ambulate occasionally. Smoking should be avoided, as should dehydration and excess alcohol. Low-dose aspirin or subcutaneous heparin may be considered for high-risk patients who are traveling long distances [15]. All travelers should maximize hydration with frequent, non-alcoholic beverages.

DIABETES MELLITUS

Although diabetic patients must take special precautions, there are simple formulas to adjust insulin schedules to changes in time zones. Insulin adjustment is not needed for north-south travel and is only needed for east-west travel if the traveler crosses more than six time zones. Frequent monitoring by blood testing every six hours should be advised in the insulin-dependent traveler. For eastbound travel, adjustment should be made for the shortened day (Table 3). An algorithm by Benson and Metz [16] suggests decreasing the regular insulin dose to two-thirds on the first morning of destination at local time, then testing and readjusting ten hours later if the blood glucose is elevated. Similarly, when the westbound traveler crosses six or more time zones an adjustment must be made for the longer day. If the blood glucose is elevated 18 hours after the A.M. injection, an extra dose of insulin is given (Table 3).

SINUSITIS, OTITIS

A middle ear infection or sinus infection is potentially harmful for the air traveler. Boyle's law (pressure × volume = constant) predicts that, as atmospheric pressure decreases on ascent, the volume of air in body cavities increases by the same amount; the opposite occurs during descent. As a result, air space in the middle ear and sinuses will expand during ascent and collapse during descent. When otitis or upper

respiratory infection is present, the middle ear is especially prone to barotrauma. As atmospheric pressure increases during descent, the eustachian tube may collapse, causing rapid accumulation of fluid in the middle ear or "aero-otitis media" [17].

Prophylactic topical or systemic decongestants and instruction concerning ventilation of the middle ear are the best aids in avoiding barotrauma. The Toynbee maneuver (pinch nostrils closed and swallow) and a modified Valsalva (hold mouth and nose closed while increasing nasopharyngeal pressure) can be tried on descent [17]. Patients with acute sinusitis or otitis media should be discouraged from flying [2,17].

Early empiric antibiotic treatment of upper respiratory infections may be advised, particularly in the patient with chronic pulmonary disease. Empiric antibiotics which should be on hand for travelers' diarrhea (see below) might also be used for bronchitis.

HIV INFECTION

More and more patients with HIV infection, whether they have a clinical diagnosis of AIDS or not, are traveling. There are several important considerations in advising these patients about travel. In the pre-travel medical history, it is appropriate to inquire regarding HIV-positivity or risk factors for it, since HIV infection is considered a contraindication to live immunizations, except for measles vaccine. Patients should receive inactivated rather than live vaccines when these can be substituted, i.e., enhanced potency inactivated polio vaccine versus live oral polio vaccine. HIV-positive patients should review their itinerary and travel plans in detail with the practitioner because some vaccines are contraindicated. For instance, if travel involves heavy exposure to mosquitoes in a yellow fever-endemic or -epidemic area and the patient cannot receive yellow fever (live) vaccine, the traveler should consider this risk. If travel plans cannot be changed, at least personal protective measures against mosquitoes can be emphasized. Since patients may inquire, practitioners should inform travelers that, at present, over 50 countries have some sort of travel restriction for migrants or travelers with HIV infection or AIDS [18,19]. Inform the traveler of the need to check with the embassy of the country or countries in question, prior to traveling, regarding current policy. In addition to a routine history and physical to assess the patient's general state of health, immune status should be evaluated by a CD4 cell count [19]. Special considerations regarding these patients' susceptibility to enteric pathogens are discussed below (see section on Travelers' Diarrhea).

Considerations for continuing the patient's medical management should be considered, such as identifying a knowledgeable physician or clinic in the area and arranging aerosolized pentamidine prophylaxis if needed. A physician letter, stating that the traveler has a chronic illness which may require emergent medical therapy, may help the traveler to expedite a return home on an airline, should this action be necessary.

OTHER MEDICAL CONDITIONS

Patients should be questioned about immunosuppression from other conditions, such as hematologic malignancies or long-term steroid therapy, since live vaccines are contraindicated in such conditions. Patients over 65 years of age or those with

chronic illnesses should be up to date on influenza and pneumococcal immunizations.

The gas expansion that may occur in body cavities makes air travel a risk within three weeks of intrathoracic surgery [8,20]. Flying should be delayed for one week after air is introduced into a body cavity for therapeutic or diagnostic reasons [20]. Likewise, a known pneumothorax is a contraindication to air travel [8,17]. Patients with colostomy bags should be advised about gas expansion during ascent [2] and wear a larger bag during the flight to allow for this problem.

Nephrologists interviewed at our institution do not report problems related to gas expansion in the peritoneum in patients on chronic ambulatory peritoneal dialysis [unpublished observations]. For chronic renal failure patients on hemodialysis, arrangements for hemodialysis at another unit while traveling can often be arranged, but consideration must be given to the possibility that units may not accept patients positive for hepatitis B surface antigen. Units may also request hepatitis C or HIV screening.

Anemic patients with a hemoglobin level less than 8.5 g/dL or sickle-cell disease should use supplemental oxygen for flights over 22,500 feet [2]. Supplemental oxygen may be considered in the patient with severe cerebrovascular disease, and travel should be postponed until at least two weeks after an acute cerebrovascular accident [20].

Patients with a history of kidney stones, elderly patients, and patients taking diuretics should be advised about avoiding dehydration when traveling to the tropics. Elderly patients in particular should be informed of the early signs of heat exhaustion such as fatigue, weakness, fainting, nausea, vomiting, and headache.

Terminally ill or bedridden patients who want to travel will need to make special arrangements. The airline carrier with whom travel arrangements are being made should be contacted for specific and current guidelines.

TRAVELERS' DIARRHEA

Travelers' diarrhea afflicts more than one-third of travelers to the tropics, and 80–85 percent of cases are caused by bacterial pathogens [23]. Enterotoxigenic *Escherichia coli* are still the most commonly identified cause of this disease in travelers to developing countries, accounting for 20–40 percent of cases [21]. *Shigella* sp. accounts for about 8 percent of cases in Latin American countries, and 0–15 percent in Asia and Africa [21]. The rates of isolation of non-typhi *Salmonella* range from 0–16 percent in Latin America and 0–33 percent in Asia [21]. *S. typhi* infections can also occur, with the highest rates reported from certain countries such as Peru, India, and Mexico [24]. *Campylobacter jejuni* infections have been documented in 15–17 percent of cases in studies in Asia; however, it appears to be uncommon as a cause of "turista" in Mexico [21]. Parasitic infections, such as *Giardia lamblia* and *Entamoeba histolytica* are also important etiologies.

Many patients with chronic illness or elderly patients have special risks for contracting or developing complications from travelers' diarrhea. Post-gastrectomy patients or patients taking histamine-blockers may be at increased risk for travelers' diarrhea, since the host defense of gastric acidity is reduced [25]. Patients taking diuretics may become rapidly dehydrated and electrolyte-depleted. Gastric secretory failure and decreased intestinal immunity may impair the AIDS patient's host defense against this disease [26,27]. In addition, *Shigella* and especially *Salmonella*

infections in AIDS patients may be prolonged, severe, and associated with bacteremia [28,29,30,31,32]. *Campylobacter* infections may be persistent and associated with cholecystitis or bacteremia in AIDS patients as well [33,34,35]. *Cryptosporidium* sp. is a relatively uncommon cause of travelers' diarrhea and not a significant one in healthy travelers, since most infections are self-limited; however, it can cause a chronic, wasting diarrhea in AIDS patients. For these patients, preventive measures to avoid travelers' diarrhea and empiric therapy directed at the most common causes, should the traveler develop symptoms, are especially important.

The best way to prevent travelers' diarrhea is to avoid contaminated food and water. Food served steaming hot or food that can be peeled is considered safe. Bottled water or beverages, particularly if carbonated, are probably safe from contamination. Ice is not safe and should be avoided. Water purification is difficult. Boiling water for ten minutes kills bacteria, viruses, and protozoa and is considered the best method. Iodide tablets, when used according to directions, eliminate bacteria and viruses, but these tablets do not reliably inactivate protozoa such as *G. lamblia* [36]. Filtration systems can eliminate both bacteria and protozoa, but they do not usually filter viruses that may be pathogenic for travelers, such as hepatitis A or rotavirus. Good filtration systems are also expensive and may not be practical for the traveler who is not planning a number of exotic sojourns. Avoiding contaminated food and water is difficult at best. One study documents that travelers do not or cannot comply with the adage, "Boil it, cook it, peel it, or forget it" [37].

Agents used for empiric therapy include trimethoprim/sulfamethoxazole, fluoroquinolones (ciprofloxacin, norfloxacin, ofloxacin), doxycycline, and bismuth subsalicylate. Trimethoprim/sulfamethoxazole (TMP/SMX) (800/160 mg orally twice daily for three days) has been effective empiric therapy for travelers' diarrhea and, when combined with the anti-motility agent loperamide, can limit symptoms to one hour's duration [38]. In that study of travelers to Mexico, the combination of TMP/SMX plus loperamide was more effective than either drug alone, although both drugs alone were more effective than a placebo. Increasing antibiotic resistance to TMP/SMX among enteric pathogens in developing countries [39,19] has raised a concern about using TMP/SMX as empiric therapy, now that fluoroquinolone agents are available. Another potential advantage of the fluoroquinolones is their activity against TMP/SMX-resistant *Salmonella* sp. and activity against *Campylobacter jejuni,* which TMP/SMX does not have. For AIDS patients at a greater risk from these infections or for travelers going to areas where these are more prevalent causes of diarrhea, one of the fluoroquinolones may be the best choice for empiric therapy. Ciprofloxacin (500 mg twice daily for three days) or norfloxacin (400 mg twice daily for three days) are effective therapy. When ciprofloxacin plus loperamide was compared with ciprofloxacin alone in a study of travelers' diarrhea in Egypt, there was a trend for those using combination therapy to have shorter duration of symptoms, although this trend did not achieve statistical significance except in patients with enterotoxigenic *E. coli* [40]. Loperamide alone is not usually recommended because of the high failure rate (13 percent) in a study of travelers to Mexico [38], and because of adverse effects reported when another antimotility agent, diphenoxylate hydrochloride, has been used alone to treat shigellosis [41]. Doxycycline hydrochloride may also be used as empiric therapy (100 mg twice daily for five days), but the antimicrobial resistance to tetracyclines in developing countries and

TABLE 4
Travelers' Diarrhea Empiric Therapy

Agent	Considerations	Contraindications
Quinolones Ciprofloxacin Norfloxacin Ofloxacin	Broad-spectrum Theophyllines (Ciprofloxacin)	Pregnancy Children
Trimethoprim/ Sulfamethoxazole	Bacterial resistance in many areas Photosensitivity Hypersensitivity (especially HIV-positive)	Pregnancy HIV-positive
Doxycycline	Photosensitivity (15 percent) Vaginitis	Pregnancy Children
Loperamide	Should be used in combination with empiric antibiotic	Fever Severe abdominal pain
Bismuth Subsalicylate	Large doses required Tinnitus Black stools	Pregnancy

the photosensitivity that occurs in 15 percent of patients make this choice an undesirable agent when visiting a tropical country.

Bismuth subsalicylate has also been shown to be effective empiric therapy. The advantages of this agent are that it is safe and well-tolerated. Patients should be advised about black stools and potential tinnitus. The disadvantage of this agent is that large doses (in tablet or liquid form) must be given (525 mg in eight half-hourly doses for the first 24 hours, continuing for 48 hours or until symptoms are gone), and that antimicrobials are more effective for dysenteric cases of diarrhea [42].

Drug interactions and contraindications should be considered when choosing empiric therapy. Patients on oral hypoglycemic agents should avoid taking TMP/SMX, since it can potentiate these agents to cause profound hypoglycemia [43,44]. Patients on theophyllines should avoid ciprofloxacin and norfloxacin, which prolong the half-life of theophyllines and xanthines. If a fluoroquinolone is still desirable, ofloxacin, another fluoroquinolone with a similar spectrum of activity but without theophylline interaction, may be considered. Oral rehydration is an important aspect of therapy. Oral electrolyte and glucose packets can be taken along and reconstituted when necessary.

Prophylactic antibiotics are not currently recommended for routine travelers due to toxicity from drug-related side effects, the availability of rapidly effective empiric therapies, a false sense of security in the traveler, and difficulty in identifying agents for empiric therapy should the travelers on antibiotics become ill [23,45]. There are also concerns about the development of antibiotic resistance in fecal flora while on TMP/SMX or doxycycline [39]. One study has shown that development of resistance did not occur when norfloxacin was used as prophylaxis for a two-week period in Mexico [46]. Undesirable side effects include skin rashes, photosensitivity, vaginal candidiasis, and antibiotic-associated colitis. Chemoprophylaxis has been shown to be effective, however [47,48], and, in certain situations, it may be more cost-effective than empiric therapy [49]. Agents currently used include TMP/SMX (160 mg/800 mg), norfloxacin (400 mg), ciprofloxacin (500 mg), ofloxacin (100 mg), doxycycline

(100 mg) once daily while in the high-risk area [23]. Bismuth subsalicylate may also be effective in doses of two 525 mg tablets four times daily [23]. Chemoprophylaxis may be considered in the patient in whom diarrhea would be disastrous even for a few hours [23,50]. No traveler should take prophylaxis for a visit to a high-risk area that lasts longer than three weeks because of the chance of development of antibiotic-resistant flora or adverse side effects [23].

ADVERSE DRUG EFFECTS

Since chronically ill and geriatric patients are often on numerous medications, it is important to consider potential drug interactions that may occur on the trip. Interactions of antibiotics used for empiric therapy of travelers' diarrhea are discussed above. Other interactions to consider are those that may occur with antimalarials used for prophylaxis. For example, mefloquine can decrease cardiac conduction and is contraindicated in patients taking beta-blockers or quinidine. Anticholinergic drugs such as scopolamine, used for prevention of motion sickness, should be given with care to the elderly, who are more susceptible to the potential side effects of confusion and disorientation. Anticholinergic drugs also decrease the ability to sweat and may further predispose this group to heat syndromes.

OTHER CONSIDERATIONS

Patients should review their medical insurance to see if coverage extends overseas. Except for some cruises in U.S. territorial waters and certain inpatient services in Canada and Mexico, Medicare does not usually cover services in other countries [51]. The traveler should check Medicare coverage for the specific destination before departure. There are a number of travel insurance plans available which include medical coverage and air evacuation for emergency departure; travelers with health problems should consider these. Some countries require a physician letter for a visa application if the traveler is over age 65. The U.S. embassy should be consulted for up-to-date information.

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