The coronavirus-induced severe acute respiratory syndrome (SARS) has focused attention on severe respiratory tract infections among returning travelers. Pneumonia is a rare cause of health care-seeking among travelers. In a study of 838 sick French tourists in Nepal, the prevalence of respiratory tract infections was 17.55%, but pneumonia only accounted for 0.46% of consultations.¹ Nevertheless, pneumonia is a frequent cause of fever among returning travelers. In an Australian study of 232 febrile travelers, lower respiratory tract infection was the second most common cause of fever after trips to tropical zones (24%), just after malaria (27%).² In a study of 195 febrile British travelers, respiratory tract infections represented the fourth most common cause of fever, after malaria, viral infections and gastrointestinal disorders.³ Mortality from pneumonia among travelers is far from negligible; for example, it was estimated at 1% (3/309 deaths) of global mortality in a Canadian study.⁴

No previous studies have focused specifically on pneumonia among returning travelers, and the etiologic spectrum is thus unknown in this setting. The purpose of this study was to evaluate causes of pneumonia in a short series of hospitalized travelers returning from abroad and to discuss these etiologies.

**Patients and Methods**

We reviewed the medical files of all patients who had pneumonia on returning from abroad and who were admitted to the Infectious and Tropical Diseases Unit of Groupe Hospitalier Pitié-Salpêtrière, Paris, France, over a 12-month period, from August 2001 to July 2002. Patients were included if they were admitted for pneumonia less than 1 month after returning to France, whatever the purpose of the trip. The diagnosis of pneumonia was established if at least two of the following clinical criteria were present: fever >38.5°C, cough, expectoration and/or auscultatory abnormalities, together with compatible chest radiographic...
findings (alveolar condensation, interstitial syndrome or miliary abnormalities).

The following data were recorded for each patient: age, gender, country of birth, country of residence, co-morbidity (splenectomy, underlying respiratory disease, smoking, alcoholism, intravenous drug use, viral hepatitis, HIV seropositivity), the type of travel (destination, purpose, length of stay, type of accommodation, number of accompanying persons), and the interval between the beginning of the trip and both symptom onset and presentation. The following respiratory and extrapulmonary signs were recorded: cough, dyspnea, chest pain, expectoration, crepitations, ronchi, wheezing, pleural syndrome, arthralgias, general health impairment, and hepatic, gastrointestinal, neurologic, cutaneous, ophthalmologic or upper respiratory tract disorders. Biological data included blood cell counts, plasma ionogram, liver function tests, thin and thick blood smears, urinanalysis, and routine stool tests. These tests were done in every patient. In addition, serologic tests for *Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella pneumophila, Coxiella burnetti*, leptospirosis, brucellosis, dengue fever, typhoid fever, schistosomiasis and histoplasmosis were done according to clinical presentation and biological data. Viral testing was not done. The following radiographic abnormalities were recorded: alveolar or interstitial opacities, signs of bronchitis, and pleural effusion. All data were recorded in Microsoft software Excel and analyzed with SPSS 9.0.

**Results**

Seventeen patients (nine men and eight women) were included in this study. Twelve were born in France, four were immigrants from Africa (Algeria and Djibouti in one case each, Cameroun in two cases), and one was from Korea. All the patients lived in France, 15 for more than 10 years, one for 2 years and one for 4 years. The mean age was 44 years (range 26 to 67 years, standard deviation 12.73).

All patients had traveled abroad during the month preceding hospital admission, 10 (58.8%) to sub-Saharan Africa, one (5.9%) to Asia, two to South America (11.8%), and one each (5.9%) to French Polynesia, Mauritius, the French West Indies, and Spain. The mean duration of the stays was 26.4 days (2 to 120 days). Twenty-nine percent of the patients had traveled for more than 4 weeks. Thirteen patients (76.5%) had traveled as tourists, three for business, and one on a humanitarian mission. Most had traveled by air (88.2%), one by boat and one by road (5.9%). The accommodation consisted of airconditioned hotels in seven cases (41.2%), a local inhabitant’s house in six cases (35.3%), a cruise ship in one case (5.9%), and nonurban accommodation in three cases (17.6%). Three patients traveled alone (17.6%).

Symptoms occurred during travel in nine cases (53%) and after return to France in eight cases (47%). Among the nine patients who developed symptoms during the trip, five (56%) had consulted a doctor in the country of travel. One patient required medical evacuation. The other eight patients developed symptoms a mean of 9 days (1 to 15 days) after their return. In one case, the symptoms occurred within 15 days after a short business trip in Burkina Faso, but the final diagnosis of tuberculosis was linked to a previous humanitarian mission in the Calcutta slums, India, 8 years before. One patient was HIV-infected but was not on antiretroviral therapy (CD4 cell count 116/mm³, viral load 36,000 copies/mL); he was diagnosed with tuberculosis. The third patient with tuberculosis had a history of primary tuberculosis. Seven patients had no recent medical history. Four patients smoked, and two of them had complications (chronic respiratory failure in one case, and chronic bronchitis in the other).

Thirteen patients were febrile. The mean body temperature at admission was 38.4°C (range 36.7°C to 39.7°C, standard deviation 1.07). Sixteen of the patients (94%) had both thoracic and extrathoracic signs. Cough, dyspnea, chest pain, expectoration and chills were observed in, respectively, 17 (100%), nine (52.9%), two (11.8%), three (17.6%) and 11 (64.7%) of our patients. Alveolar pneumonia was diagnosed in 11 patients, and interstitial pneumonia in two cases. Pleuritis was noted in two cases. Four patients (three with tuberculosis and one with histoplasmosis) had mediastinal opacities. None of the patients died, and no complications occurred after hospital admission. The mean duration of hospital stay was 6.4 days (range 2 to 15 days).

The cause of pneumonia was established in 13 patients (table). Bacterial pneumonia was documented in 10 cases, and involved *Streptococcus pneumoniae, Mycoplasma pneumoniae, Legionella pneumophila, Coxiella burnetti, Leptospira*, and *Mycobacterium tuberculosis*. “Exotic” causes consisted of histoplasmosis (return from South America), invasive schistosomiasis (return from Benin) and dengue fever (return from French West Indies) in one case each.

**Discussion**

These results show the wide range of causes of pneumonia among returning travelers. It is of note that an etiologic diagnosis was made in 13 (76.5%) of 17 patients. This high percentage is explained by the sole inclusion of hospitalized patients, the criteria for hospitalization being either a severe disease or an unexplained cause.

The range of etiologies is wider than in other studies, which were biased by the inclusion of febrile patients. In a study of 232 febrile travelers, influenza and bacterial pneumonia represented respectively 20% and 25% of the 56 respiratory admissions, but microbiological...
documentation was only obtained in 50% of the 14 cases of bacterial pneumonia. In a study of 195 febrile British travelers, pneumonias were diagnosed in eight patients, and comprised four cases of bronchopneumonia, three of pulmonary tuberculosis and one of atypical pneumonia. In a prospective 2-year study of 281 adults living in Kenya for more than 3 months (both travelers and residents), Gram-positive bacteria (mainly Streptococcus pneumoniae) represented 47.4% of identified etiologic agents of pneumonia, followed by Gram-negative bacilli in 7.1% (Salmonella sp. in 2.1%), mycobacteria in 12.5%, Mycoplasma pneumoniae in 2.5%, and influenza virus in 5%.5

We observed only one case of Legionnaire’s disease, although this is the type of pneumonia most frequently reported in travelers. Interestingly, 23% of cases of Legionella pneumophila pneumonia in the US and 45% of cases in the UK involve patients who have made a sea cruise in the 10 days preceding symptom onset.6,7 Outbreaks of Legionnaire’s disease are frequent after sea cruises.8 Although the risk of tuberculosis is lower, we observed three cases. This overrepresentation of tuberculosis in our population is explained by the inclusion of two migrants (one HIV-infected, one with a history of primary tuberculosis infection) in whom pulmonary tuberculosis was diagnosed shortly after their return from their country of origin. The third patient, a woman, was diagnosed with tuberculosis 8 years after a trip to India. She was included in our study because the symptoms started 15 days after her return from a professional trip to Burkina Faso. In a cohort of Dutch travelers, the estimated incidence rate of tuberculosis was 2.8 cases/1,000 personmonths among non-health care workers and 9.8 cases/1,000 personmonths among expatriate health care workers. According to the authors, the risk of latent Mycobacterium tuberculosis infections in this cohort of travelers (overall incidence rate = 3.5 cases/1,000 personmonths) was similar to that of hepatitis A in holiday-makers or of malaria in tourists to Kenya, and was several-fold higher than the incidence rates of most other preventable infections. The risk of acquiring tuberculosis while traveling in a developing country is therefore high. It has thus been suggested that this risk is similar to that for the local population.9 In addition, the risk of acquiring tuberculosis while traveling near a contagious patient varies according to the means of transportation. Cases of transmission during air travel have been reported, whereas the risk seems to be very low on train and bus journeys.10,11 Thus, among 240 travelers exposed to a highly contagious patient during two long journeys in a train (29 h) and in a bus (5.5 h), only four passengers (2%) were shown to have become intradermic tuberculin positive. Two of these four patients had no other risk factors for tuberculin test conversion.12

We observed one case of Q fever (due to Coxiella burnetti). Other cases have been reported in travelers returning from sub-Saharan Africa, Syria, the Persian Gulf and French Guyana.13 We observed one case of dengue fever pneumonia. Dengue fever is frequent in travelers, accounting for 8% of cases of fever in a study of 232 febrile Australian travelers returning home.2 In contrast, pulmonary manifestations of dengue fever are rare. A few cases of dengue fever associated with pleuropneumonia and hemoptysis revealing pulmonary hemorrhage have been reported.14

Other potential causes of viral pneumonia include Hantaviruses, measles and influenza. Hantavirus is

| Table | Final Diagnoses in 17 Patients Returning from Travel with Pneumonia |
|-------|---------------------------------------------------------------------|
| Diagnosis | Number | Deciding Factors (Including Destination of Travel) |
| Bacterial pneumonia without microbiological documentation | 4 | French Polynesia (1), Mauritius (1), Mali (2) |
| Bacterial pneumonia with microbiological documentation | 10 | Sub-Saharan Africa (1) and Spain (1)—Blood cultures positive |
| Streptococcus pneumoniae | 2 | Sub-Saharan Africa (2)—seroconversion |
| Mycoplasma pneumoniae | 2 | Asia—Urinary test negative—serology positive |
| Legionella pneumophila | 1 | French Guyana—serology positive |
| Coxiella burnetti | 1 | Sub-Saharan Africa—serology positive |
| Leptospira sp. | 1 | Sub-Saharan Africa—serology positive |
| Mycobacterium tuberculosis | 3 | Sub-Saharan Africa (3)—2 bullous tuberculin skin test—1 sputum positive |
| Viral pneumonia | 1 | French West Indies—serology positive (IgM) |
| Dengue fever | 1 | South America—exposure (cave), tomodensitometric aspect, response to antifungal treatment |
| Fungal infections | 1 | |
| Histoplasma capsulatum | 1 | |
| Helminthic infections | 1 | Sub-Saharan Africa—serology positive |
| Invasive schistosomiasis | 1 | |

*a*In one case, tuberculosis was linked to a previous humanitarian mission in the Calcutta slums, India, 8 years before.
cosmopolitan and can cause a variety of clinical manifestations. Hemorrhagic forms predominate in Asia, and renal forms in Europe. Recently, respiratory forms were described in the US (Hantavirus pneumonia syndrome, HPS). Small outbreaks of influenza have been reported during boat cruises and after air travel. The more recent report described an outbreak occurring on the same boat during three successive cruises to Australia and North America. It probably started during the first cruise, in a group of Australian travelers. Among the 1,284 passengers on board during the second cruise, 215 (17%) described acute respiratory signs, and influenza virus was isolated from some. The boat staff probably comprised the reservoir, and could be a source of transmission to populations at risk, such as elderly people, in enclosed spaces. The incidence of influenza in travelers is probably underestimated. It was recently estimated at 0.03/person-month of travel in a cohort of 1,483 travelers returning home; in this study, seroconversion for influenza virus infection was demonstrated in 3% of the 1,483 travelers and in 23% of the 205 feverish travelers tested. This diagnosis should therefore be considered in all febrile travelers, keeping in mind that the virus circulates mainly from May to September in the southern hemisphere. The coronavirus pneumonia pandemic has focused attention on travelers returning from endemic areas with fever and respiratory signs, but our study took place before that period of time.

One of our patients probably acquired pulmonary histoplasmosis while visiting a cave in Colombia. Histoplasma capsulatum histoplasmosis is endemic in South and Central America, Africa and eastern Asia. Entry to a basement or cave may lead to a risk of exposure to bat faces, and short exposure is sufficient for contraction of the disease. Outbreaks have been reported in groups of travelers, especially after underground expeditions, excavations, or simple passage through caves or tunnels housing bats, as recently described among 13 members of a boat during three successive cruises to Australia and North America. It probably started during the first cruise, in a group of Australian travelers. Among the 1,284 passengers on board during the second cruise, 215 (17%) described acute respiratory signs, and influenza virus was isolated from some. The boat staff probably comprised the reservoir, and could be a source of transmission to populations at risk, such as elderly people, in enclosed spaces. The incidence of influenza in travelers is probably underestimated. It was recently estimated at 0.03/person-month of travel in a cohort of 1,483 travelers returning home; in this study, seroconversion for influenza virus infection was demonstrated in 3% of the 1,483 travelers and in 23% of the 205 feverish travelers tested. This diagnosis should therefore be considered in all febrile travelers, keeping in mind that the virus circulates mainly from May to September in the southern hemisphere. The coronavirus pneumonia pandemic has focused attention on travelers returning from endemic areas with fever and respiratory signs, but our study took place before that period of time.

In conclusion, “exotic” causes of pneumonia in travelers are rare in comparison to common community-acquired infections and tuberculosis. Nevertheless, the increase in intercontinental air travel and the emergence of new respiratory diseases such as SARS may alter this situation.

References

1. Caumes E, Brucker G, Brousse G, et al. Travel-associated illness in 838 French tourists in Nepal in 1984. Travel Med Int 1991; 8:72–76.
2. O’Brien D, Tobin S, Brown V, et al. Fever in returned travelers: review of hospital admissions for a 3-year period. Clin Infect Dis 2001; 33:603–609.
3. Doherty JE, Grant AD, Bryceon ADM. Fever as the presenting complaint of travellers returning from the tropics. Q J Med 1995; 88:277–281.
4. MacPherson DW, Guérillot F, Streiner DL, et al. Death and dying abroad: the Canadian experience. J Travel Med 2000; 7:227–233.
5. Scott JAG, Hall AJ, Muyodi C, et al. Aetiology, outcome, and risk factors for mortality among adults with acute pneumonia in Kenya. Lancet 2000; 355:1–15.
6. Joseph C, Morgan D, Birtles R, et al. An international investigation of an outbreak of legionnaires disease among UK and French tourists. Eur J Epidemiol 1996; 12:215–219.
7. Jernigan DB, Hofmann J, Cetron MS, et al. Outbreak of Legionnaire’s disease among cruise ship passengers exposed to a contaminated whirlpool spa. Lancet 1996; 347:494–499.
8. Edelstein PH, Cetron MS. Editorial response: sea, wind, and pneumonia. Clin Infect Dis 1999; 28:39–41.
9. Cobelens FGJ, Van Deutekom H, Draayer-Jansen IWE, et al. Risk of infection with Mycobacterium tuberculosis in travellers to areas of high tuberculosis endemicity. Lancet 2000; 356: 461–465.
10. Kenyon TA, Valwai SE, Ihele W, et al. Transmission of multidrug-resistant Mycobacterium tuberculosis during a long airplane flight. N Engl J Med 1996; 334:933–938.
11. Witt MD. Editorial response: trains, travel, and tubercle. Clin Infect Dis 1999; 28:57–58.
12. Moore M, Valwai SY, Ihele W, et al. A train passenger with pulmonary tuberculosis: evidence of limited transmission during travel. Clin Infect Dis 1999; 28:52–56.
13. Baret M, Klement E, Dos Santos G, et al. Pneumopathie à Coxiella burnetii au retour de Guyane française. Bull Soc Pathol Exot 2000; 93:325–327.
14. Nelson ER. Haemorrhagic fever in children in Thailand. J Paediatr 1960; 56:101–108.
15. Khan AS, Young JC. Hantavirus pulmonary syndrome: at the crossroads. Curr Opin Infect Dis 2001; 14:205–209.
16. Wenzel RP. Airline travel and infection. N Engl J Med 1996; 334:981–982.
17. Miller JM, Tam TWS, Maloney S, et al. Cruise ships: high-risk passengers and the global spread of new influenza viruses. Clin Infect Dis 2000; 31:433–438.
18. Marx A, Tavernini M, Gregory V, et al. Influenza virus infection in travellers to developing countries [abstract FC05.01]. In: Abstracts of the 8th Conference of the International Society of Travel Medicine, New York. Stone Mountain, GA: ISTM, 2003:108.
19. Update: outbreak of severe acute respiratory syndrome—Worldwide, 2003. MMWR. 2003; 52:241–248.
20. Salomon J, Flament Saillour M, De Truchis P, et al. An outbreak of acute pulmonary histoplasmosis in members of a trekking trip in Martinique, French West Indies. J Travel Med 2003; 10:87–93.
21. Casey KR. Atypical pneumonia and environmental factors—where have you been and what have you done? Clin Chest Med 1991; 12:285–302.
22. Ansart S, Caumes E. Pneumonie au retour de voyages. Rev Mal Respir 2002; 19:693–697.
23. Visser LG, Polderman AM, Stuiver PC. Outbreak of schistosomiasis among travelers returning from Mali, West Africa. Clin Infect Dis 1995; 20:280–285.
24. Joubert JJ, Evans AC, Schutte CH. Schistosomiasis in Africa and international travel. J Travel Med 2001; 8:92–99.
25. Hirsh J, O’Donnell MJ. Venous thromboembolism after long flights: are airlines to blame? Lancet 2001; 357:1461–1462.

Amsterdam canal. Submitted by Dr. Davidson H. Hamer.