The onsets of the symptoms were around April 2008, the patient was admitted to the internal medicine unit of Saint-André Hospital in Bordeaux, France with fever (38.9°C/102°F), progressive asthenia, anorexia, weight loss, productive cough, and New York Heart Association grade III dyspnea. Bilateral basal crackles could be heard in the lungs; physical examination findings were otherwise within normal limits. Biological tests showed inflammatory syndrome with elevated C-reactive protein (74 mg/L, reference value <5 mg/L) without any other consequential abnormality. Gamma globulin levels were normal. A chest radiograph showed bilateral interstitial infiltrate. A computed tomogra-

### References

phy scan of the chest confirmed an interstitial micronodular infiltrate with thickening of the peribronchovascular interstitium, associated with paratracheal and left anterior mediastinal subcentimetric lymph nodes.

To determine whether this infiltrate was linked to sarcoidosis, tuberculosis, or another opportunistic infection, bronchoscopy and bronchoalveolar lavage (BAL) were performed and showed multiple submucous nodules of the left superior bronchus. Biopsy samples contained epithelioid granulomas and a nonspecific, amorphous eosinophilic material without focal necrosis, but no bacteria, by using periodic acid–Schiff, Ziehl–Neelsen, and auramine-rhodamine stains. BAL culture isolated a Streptomyces sp. (2 \times 10^5 \text{ CFU/mL}) but no other pathogens.

Treatment with intravenous imipenem (2 g/day for 14 days) and amikacin (1 g/day for 3 days) was initiated. After antimicrobial susceptibility tests, the treatment was changed to oral rifampin (1.2 g/day) and ciprofloxacin (1.5 g/day) for 6 months. After 3 days of treatment, clinical signs and symptoms resolved; a thoracic computed tomography scan performed 6 months later showed complete regression of pulmonary infiltrates. Bronchoscopy at that time showed no nodules, and BAL culture showed no pathogens.

Streptomyces sp. are widespread environmental bacteria that rarely cause severe invasive infections. During our literature search, we found 21 cases of invasive Streptomyces infections, including 8 pulmonary infections. A contributing factor was found for all cases: immunosuppression linked to HIV infection (1), antineoplastic chemotherapy (2), Crohn disease (3), use of oral (4) or inhaled corticosteroids (5), and presence of foreign material such as a central venous catheter (6) or a prosthetic aortic valve (7).

Specific features of pulmonary Streptomyces infection are summarized in the online Technical Appendix Table (wwwnc.cdc.gov/EID/pdfs/12-0797-Techapp.pdf). Death related to such an infection is mostly dependent on the underlying disease associated with Streptomyces infection. Deaths have not been linked to Streptomyces infections described in the literature when Streptomyces sensibility testing was performed and treatment length recommendations were followed.

To understand how the patient was infected with a Streptomyces sp., we explored 2 possibilities. First, sarcoidosis induces immune deficiency (8). This phenomenon is clinically well known as anergy to tuberculin or other immunogenic haptenens after subcutaneous injections. Expansion of regulatory T lymphocytes (8) and attenuated myeloid dendritic cell functions (9) decrease cellular immunity efficiency and increase infectious episodes in affected patients. Second, splenectomy can increase susceptibility to infection, such as bloodstream infections with encapsulated bacteria or opportunistic infections with Campylobacter jejuni, Pneumocystis jiroveci, or Babesia spp. The lung infection with Streptomyces in the patient described was not acquired through the bloodstream, but through direct airway contact. However, we could not exclude other immune mechanisms not related to blood, such as dysregulation or lack of some lymphocyte populations.

A pathologic feature of pulmonary infections with Streptomyces spp. is the presence of granulomas sometimes associated with focal necrosis. This feature makes differentiating infection with these species from that of tuberculosis difficult. Bacterial culture is often used to confirm the diagnosis. Histologic differences between the 2 entities are not well defined because of the rarity of invasive Streptomyces infections. In our observation of this patient, histologic examination revealed granulomas potentially linked to sarcoidosis and a nonspecific, amorphous eosinophilic material that was not caseous necrosis. Both lesions could have also resulted from the Streptomyces infection. For further identification, Dunne et al. added the presence of sulfur granules to the specific histological description of Streptomyces infection (1).

An overall literature review for results of in vitro testing for Streptomyces spp. identified a common susceptibility to aminoglycosides, macrolides, imipenem, or trimethoprim/sulfamethoxazole. This finding suggests that the first-line treatment against invasive Streptomyces infections should begin with imipenem and aminoglycosides for at least 6 weeks (online Technical Appendix Table). Quinolones have an immunomodulatory effect that might be therapeutic in patients with disease-induced immunosuppression such as sarcoidosis or after splenectomy (10). In conclusion, invasive Streptomyces infection of the lungs should be included in differential diagnoses of interstitial pneumonia in immunocompromised patients.

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References

Pneumonia after Earthquake, Japan, 2011

To the Editor: The earthquake that occurred in Japan on March 11, 2011, triggered an extremely destructive tsunami (1), which destroyed cities along the Pacific coastline in the Tohoku area and resulted in the loss of >19,000 human lives. Water from the tsunami inundated ≈33.7% of Tagajo City (population ≈61,000) and caused 188 deaths. Many local residents were left without lifeline utilities, including electricity, gas, water, or any means of transportation and thus were forced to live in crowded shelters or limited small spaces (e.g., the upper floor of their home); ≈11,000 persons were displaced from their damaged or destroyed homes to crowded school gymnasiums or community centers. In March, the mean daily maximum air temperature in Tagajo City was cold (8°C/46.4°F). After the earthquake, cases of pneumonia increased rapidly.

Saka General Hospital is located in this region near the coast. The destruction around the hospital was so severe that persons were without electricity, water, gas, and fuel for several weeks. Fortunately, the hospital laboratory was almost completely functional and could perform bacterial and other tests at a near-normal level, despite the earthquake. However, several other hospitals in the area were severely damaged and thus had difficulty treating patients with severe pneumonia.

To determine the characteristics of pneumonia after the earthquake, we conducted a retrospective study of patients who had pneumonia during the 6 weeks before the earthquake and the first 9 weeks after the earthquake. To identify patients with pneumonia, we checked all chest radiographs and computed tomography scans of adult patients (>16 years of age) who had visited the hospital. We examined clinical and bacteriologic data for these patients. We excluded from the study patients without sputum culture and patients with other conditions, such as lung cancer, pulmonary infarction, or cardiac failure.

During the 6 weeks before the earthquake, pneumonia had been diagnosed for 49 adults (controls), and within the 9 weeks after the earthquake, community-acquired or health care–associated pneumonia was newly diagnosed for 172 adults. Patient data from 2 pre-earthquake periods and 3 postearthquake periods are shown in the Table. Although the number of patients with pneumonia in the first 3 weeks after the earthquake increased sharply, no substantial differences were noted in mean age, death rates, or underlying concurrent conditions among these patients. The interval between the onset of respiratory signs and symptoms and a diagnosis of pneumonia did not increase after the earthquake. The proportion of patients who received antimicrobial drugs before the diagnosis of pneumonia (premedication) in the early postearthquake period did not differ significantly. The number of patients with pneumonia peaked in the first 3 weeks after the earthquake, followed by a gradual decrease starting from 4 weeks after the earthquake.

Chest radiographs were taken and hematologic examinations were performed for all patients; computed tomography of the chest and rapid diagnostic tests for influenza were performed for 42.2% and 54.2% of 83 patients, respectively, who had pneumonia in the early postearthquake period. During the first 3 weeks after the earthquake, Haemophilus influenzae and Moraxella catarrhalis were more predominant than Streptococcus pneumoniae; most strains were isolated from purulent sputum specimens. In contrast, pneumonia caused by enterobacteria, staphylococci, or atypical pathogens did not increase after earthquake.
**Technical Appendix**

Table. Pulmonary *Streptomyces* infection in a patient with sarcoidosis and case-patients studied in review of literature, France, 2012

<table>
<thead>
<tr>
<th>Age, y/sex</th>
<th>Contributing factor</th>
<th>Fever</th>
<th>Results of chest CT scan</th>
<th>Diagnosis</th>
<th>Streptomyces sp.</th>
<th>Antibacterial treatment</th>
<th>Treatment duration, wks</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>57/M</td>
<td>Sarcoidosis, splenectomy</td>
<td>Yes</td>
<td>Micronodular interstitial infiltrate with mediastinal supracentimetric lymph nodes</td>
<td>BAL/culture</td>
<td>Unknown</td>
<td>Imipenem and amikacin, then rifampin and ciprofloxacin</td>
<td>24</td>
<td>This case</td>
</tr>
<tr>
<td>43/M</td>
<td>HIV infection for 8 y</td>
<td>Yes</td>
<td>Multiple lung nodules</td>
<td>Lung biopsy specimen</td>
<td>Unknown</td>
<td>Ceftriaxone, then TMP/SMZ, then clarithromycin and moxifloxacin</td>
<td>&gt;24</td>
<td>Dunne et al. (1)</td>
</tr>
<tr>
<td>21/F</td>
<td>AML/chemotherapy</td>
<td>No</td>
<td>Multiple lung nodules</td>
<td>Fine-needle aspiration/culture</td>
<td>maritimus or olivaceus</td>
<td>None (surgery: excised nodule)</td>
<td>2 (died)</td>
<td>Kapadia et al. Case 1 (4)</td>
</tr>
<tr>
<td>23/F</td>
<td>SLE/corticosteroids</td>
<td>No</td>
<td>Lung nodule and mediastinal lymph nodes</td>
<td>Lung biopsy specimen</td>
<td>albus</td>
<td>None (surgery: excised nodule)</td>
<td>NA</td>
<td>Kapadia et al. Case 2 (4)</td>
</tr>
<tr>
<td>18/M</td>
<td>Burkitt lymphoma/chemotherapy</td>
<td>No</td>
<td>Multiple lung nodules</td>
<td>Lung biopsy specimen</td>
<td>Unknown</td>
<td>None (surgery: excised nodule)</td>
<td>NA</td>
<td>Kapadia et al. Case 6 (4)</td>
</tr>
<tr>
<td>52/F</td>
<td>Inhaled corticosteroids</td>
<td>Yes</td>
<td>Multiple alveolar-type limited fibrotic lesions and bronchiectasies</td>
<td>BAL/culture</td>
<td>lanatus</td>
<td>Ceftriaxone, then TMP/SMZ, then clarithromycin</td>
<td>24</td>
<td>Kofteridis et al. (5)</td>
</tr>
<tr>
<td>35/M</td>
<td>HIV infection</td>
<td>Yes</td>
<td>Alveolar-type infiltration</td>
<td>Sputum sample, BAL/culture</td>
<td>Unknown</td>
<td>Piperacilline and tazobactam, then imipenem</td>
<td>Unknown</td>
<td>Ahmed et al. (11)</td>
</tr>
<tr>
<td>30/M</td>
<td>HIV infection</td>
<td>Yes</td>
<td>Multiple lung nodules in an interstitial infiltrate</td>
<td>BAL/culture</td>
<td>Unknown</td>
<td>Cefuroxim and amikacin, then amoxicillin and clavulanate</td>
<td>6</td>
<td>Caron et al. (12)</td>
</tr>
<tr>
<td>50/M</td>
<td>None</td>
<td>Yes</td>
<td>Alveolar-type infiltration</td>
<td>Blood cultures</td>
<td>Unknown</td>
<td>Penicillin, sulfasalazine, streptomycin, aureomycin, and terramycin</td>
<td>6</td>
<td>Kohn et al. (13)</td>
</tr>
</tbody>
</table>

*CT, computed tomography; TMP/SMZ, trimethoprim/sulfamethoxazole; AML, acute myeloid leukemia; SLE, systemic lupus erythematosus; NA, not applicable; BAL, bronchoalveolar lavage.*
References


