Disseminated Actinomyces meyeri infection: A case report and review of the literature

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Abstract

Actinomycosis is a chronic granulomatous infection rarely presenting as disseminated disease. We describe a case of disseminated Actinomyces meyeri infection involving the lung, brain, heart, and skin, and review cases of disseminated A. meyeri. To our knowledge, this is the first report of a disseminated A. meyeri case associated with endocarditis.

Keywords: Disseminated actinomycosis; Actinomyces meyeri.

Introduction

Actinomycosis is an indolent infection caused by Actinomyces, a gram-positive anaerobic bacteria. It is characterized by infection crossing tissue planes, and mass-like features mimicking malignancy. Actinomycosis most often presents as oral-cervical facial disease and can sometimes involve the abdominal-pelvic and thoracic areas. It rarely causes disseminated disease [1]. We report a rare presentation of disseminated A. meyeri with skin, lung, brain, and heart involvement.

Case Presentation

A 36-year-old man with no past medical history was admitted with multiple skin abscesses of his extremities and chest wall for 4 months. He endorsed having 40-pound weight loss, fatigue, and night sweats for the past few months, and developed headaches and left eye blurry vision for the past 2 weeks. Outside hospital records showed multiple emergency department visits over the past 3 months, where he was diagnosed and treated for pneumonia, followed by short courses of antibiotics for his skin abscesses. On admission, he was afebrile. He had multiple subcutaneous abscesses on his extremities, with an 8 cm fluctuant mass overlying his sternum (Figure 1). He had heavy dental plaques on oral exam. His social history
was significant for being a 20 pack-year cigarette smoker, worked in a warehouse as a package handler, he was born and had lived in New Jersey all his life, and denied any recent travel.

Computed Tomography (CT) of the chest showed a consolidation within the lingula with extension into the anterior chest wall, and a 2 x 5.7 cm soft tissue chest wall fluid collection (Figure 2). Magnetic Resonance Imaging (MRI) brain showed innumerable enhancing intraparenchymal and leptomeningeal/ependymal lesions and enhancement within the right mastoid and below the skull base (Figure 3A). On second night of hospitalization, he developed a fever of 102.3°F. After chest wall abscess was aspirated, he was started on isoniazid, rifampin, pyrazinamide, ethambutol, azithromycin, linezolid, cefoxitin, amikacin and dexamethasone for suspicion of possible mycobacterium infection. Chest wall lesion was also biopsied, and preliminary pathology review showed foamy histiocytes and no granulomas. Transthoracic and transesophageal echocardiogram revealed a small mitral valve vegetation. Culture from chest wall aspirate grew a Gram-positive rod anaerobe after 6 days of incubation, subsequently identified as *Actinomyces meyeri* by Matrix-Assisted Laser Desorption/Ionization-Time of Flight (MALDI-TOF) mass spectrometry. *Fusobacterium necrophorum* (beta-lactamase negative) also grew on culture and later identified. 16S ribosomal RNA testing showed minor abundance of *Aggregatibacter actinomycetemcomitans*, *Fusobacterium nucleatum*, *Ralstonia pickettii*, *Methylbacterium radiotolerans*, *Caulobacter spp*, *Novosphingobium spp*, and *Pseudomonas japonica*. Final pathology review of chest wall lesion showed acute and chronic inflammation with prominent histiocytic infiltrates. Gram, acid-fast bacillus, Fite, Giemsa, and periodic acid-Schiff stains did not reveal any microorganisms.
His antimicrobials were changed to high dose intravenous ceftriaxone (2 gm every 12 hours). Metronidazole was added but discontinued after 8 days due to pruritis and lack of beta-lactamase positive anaerobes identified on cultures. Positron Emission Tomography (PET) scan confirmed disseminated disease with fluorodeoxyglucose avid foci in the left temporal lobe of brain, multiple subcutaneous nodules in the neck, chest, abdomen, pelvis and both upper and lower extremities, and airspace consolidation in the anterior left upper lung lobe extending to the adjacent mediastinum and left anterior chest wall. After 6 weeks, his chest wall abscess had significantly improved with resolved lesions on MRI brain (Figure 3B), and he was switched to high dose oral amoxicillin with plan to complete a 12 month treatment course.
<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Clinical manifestations</th>
<th>Comorbidities and risk factors</th>
<th>Treatment</th>
<th>Antibiotic duration (months</th>
<th>Outcome</th>
<th>Copathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>72</td>
<td>Empyema, pelvic mass</td>
<td>None</td>
<td>Amoxicillin</td>
<td>6</td>
<td>Resolved</td>
<td>None</td>
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<td>2</td>
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<td>46</td>
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<td>None</td>
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<td>12</td>
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<td>50</td>
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<td>Resolved</td>
<td>Actinobacillus actinomycetemcomitans</td>
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<tr>
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<td>Thoracic mass, peritonitis</td>
<td>A, S</td>
<td>Penicillin</td>
<td>6</td>
<td>Resolved</td>
<td>None</td>
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<td>12</td>
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<tr>
<td>6</td>
<td>M</td>
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<td>Lung mass, skin abscesses, pleural effusion</td>
<td>A, PO, S</td>
<td>Amoxicillin, abscess drainage</td>
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<td>Resolved</td>
<td>Actinobacillus actinomycetemcomitans</td>
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<tr>
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<td>Lung mass, brain abscesses</td>
<td>S, A</td>
<td>Penicillin, thoracotomy</td>
<td>6</td>
<td>Resolved</td>
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<td>PO</td>
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<td>4</td>
<td>Resolved</td>
<td>None</td>
</tr>
<tr>
<td>18</td>
<td>M</td>
<td>36</td>
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<td>PO</td>
<td>Penicillin, surgical drainage</td>
<td>4</td>
<td>Resolved</td>
<td>None</td>
</tr>
</tbody>
</table>

A: alcohol abuse; IUD: intrauterine device; N/A: not applicable; PC: present case; PO: periodontal disease; RA: rheumatoid arthritis; S: current smoker; *possible aspiration risk as a tuba player.
Discussion

Actinomyces is a branched, filamentous, Gram-positive bacteria usually causing slowly progressive oral-cervical, thoracic, abdominal, or pelvic disease. Disseminated Actinomyces infection is rare, occurring when hematogenous seeding of infection results in multi-organ involvement. We highlighted a rare case of disseminated A. meyeri infection involving the lung, brain, heart, and skin. To our knowledge, only 16 disseminated A. meyeri cases have previously been reported (Table 1). Only 2 reported A. meyeri infective endocarditis cases without disseminated disease have previously been reported [2,3].

Disseminated infection is most often associated with Actinomyces meyeri [1,4], as in our case. The mechanism that predisposes A. meyeri for disseminated disease is unclear, but it has a predilection for lung disease, which is often the source of hematogenous seeding [4]. Poor oral hygiene (as in our case) and alcoholism have been risk factors associated with A. meyeri infection, and predispose to aspiration of Actinomyces species from the oropharynx to the lungs [1]. Infection occurs when there is a disruption of mucosal surface with subsequent bacterial invasion of the tissue.

Review of previously reported disseminated A. meyeri cases are summarized in Table 1. Similar to our case, they highlight clinical characteristics that are hallmarks of actinomycosis infection. These include an indolent, chronic course, development of abscesses with dense fibrosis, and progression of infection through normal fascial and tissue boundaries, with mass-like features that mimic malignancy. The vast majority of these cases involved the lungs.

Our case appears to be the first reported A. meyeri disseminated infection-involving endocarditis. By clinical history, we hypothesize that the lungs was the likely source of hematogenous dissemination in our case, however, endocarditis could also have contributed to septic emboli to the brain. It is possible that endocarditis in disseminated Actinomyces infection is unrecognized due to lack of associated positive blood cultures in disseminated cases and lack of performing echocardiography (Table 1). Actinomycosis and common copathogens are classically associated with culture-negative endocarditis. Positive blood cultures have been rare in association with disseminated infection [3]. It is possible contiguous invasion of tissues and erosion into blood vessel walls may lend to hematogenous dissemination, similar to that described in nocardiosis infection [19]. The central nervous system (CNS) is infrequently involved in disseminated A. meyeri infection [4]. Similar to our case, CNS actinomycosis most commonly presents as brain abscess.

Diagnosis of actinomycosis requires a high index of clinical suspicion and is based on the presence of sulfur granules (dense aggregates of bacteria and neutrophilic infiltrate) on histopathology, visualization of Gram-positive branching filamentous organisms on Gram stain (a few Actinomyces species including A. meyeri are non-branching) and microbiologic isolation on cultures. Failure rate for culture isolation is high (>50%), and optimal microbiologic yield requires avoidance of antibiotics prior to specimen collection, appropriate timely collection of specimens, and alerting microbiology lab to hold specimens for prolonged anaerobic incubation (usually 5-21 days). Usually, Actinomyces species is isolated with common copathogens, such as Aggregatibacter actinomycetemcomitans, Eikenella corrodens, Fusobacterium, Bacteroides, Capnocytophaga, Staphylococcus, Streptococcus, and Enterobacteriaceae. Rapid diagnostic testing, such as
MALDI-TOF and molecular studies with 16S ribosomal RNA sequencing, as used in our case, have led to more rapid and accurate identification of *Actinomyces* infection [1].

Standard treatment for extensive disease usually entails prolonged and high-dose antibiotic therapy for favorable outcomes. Average duration of treatment for disseminated cases was 8 months (range 4-12 months), often with intravenous penicillin G followed by oral amoxicillin. *Actinomyces* is generally susceptible to most antibiotics with the exception of metronidazole, quinolones, and clindamycin [20]. For CNS disease and endocarditis, intravenous ceftriaxone is desirable given penetration into tissues at these critical sites, and for greater dosing convenience. Some experts also recommend a short course of treatment for copathogens. CT/MRI studies and PET scans are useful in monitoring for disease resolution. Surgery is usually reserved for critical sites of infection and refractory disease and drainage of abscesses [1].

**Conclusion**

Although a rare event, clinicians should be aware that *Actinomyces* infection, particularly *A. meyeri*, has the potential to cause disseminated disease. Actinomycosis should be considered in indolent granulomatous diseases characterized by chronic abscesses, sinus tracts, and disease progression through normal tissue planes, prompting appropriate diagnostic testing. Therapy requires prolonged high-dose antibiotic therapy, often with penicillin G or beta-lactam antibiotics.

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**References**


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