

Series of Cases Associating Radiological Clues Suggestive of Thoracic Actinomycosis

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ABSTRACT

Thoracic actinomycosis, a rare granulomatous disease, is often diagnosed late as it can cause symptoms that mimic those of other diseases, both clinically and radiologically. An early and more accurate diagnosis would prevent the considerable morbidity, and the unwarranted surgery associated with thoracic actinomycosis. Computed tomography (CT) images of thoracic actinomycosis patients are highly variable, and thus, often pose a diagnostic challenge. Herein, we report 4 cases of pathologically confirmed thoracic actinomycosis that presented as chronic cough and chest pain. CT scans of the 4 patients exhibited: a pulmonary mass, a nodule, unilateral lobar consolidation; and bilateral lobar consolidation, respectively, along with minor radiology findings. Although the images were nonspecific, we aimed to focus on subtle imaging clues that are known to be suggestive of thoracic actinomycosis, particularly in conjunction with a characteristic personal history.

Actinomycosis is an infectious bacterial disease caused by a group of anaerobic gram-positive bacteria that normally colonize the mouth, colon, or urogenital tract. Men are 3 times more likely to be infected than women. In 15% of actinomycosis cases there is thoracic involvement [1]. Numerous predisposing factors exist, including diabetes, immunocompromising conditions, poor oral hygiene, mental decay, epilepsy, unconsciousness, and alcoholism [2, 3]. While the clinical presentations of actinomycosis are diverse, the 3 most common presentations are cough, sputum, and chest pain [4]. The most common indication of actinomycosis on a CT (computed tomography) scan is chronic segmental air-space consolidation containing necrotic low-attenuation areas with frequent cavity formation [5, 6]. However, the CT manifestations can be variable; thereby, posing a diagnostic challenge in clinical practice. Since actinomycosis can sometimes mimic malignancy

[3], accurate diagnosis may facilitate both the avoidance of unnecessary surgery and early treatment with the appropriate antibiotics. Herein, we report 4 cases of thoracic actinomycosis and review the literature detailing the CT characteristics of thoracic actinomycosis in an effort to further characterize aspects of digital imaging with regard to the diagnosis of thoracic actinomycosis. Further, we also summarize the clinical manifestations as well as the personal histories of each of the 4 patients that were monitored in this study (Table 1).

Case 1

A 65-year-old man presented with hemoptysis that was occurring for several months and a painful mass on his anterior chest wall for the last 2 weeks. No fever or weight loss was apparent. He had type II diabetes mellitus, which he was treating with prescribed oral hypoglycemic

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Table 1. Clinical data and imaging characters of 4 patients

Case number, age, sex	Symptoms and signs	Duration of symptoms (months)	Medical history	Personal history	CT imaging appearance
1, 65, M	Hemoptysis Chest pain	2	DM	-	<ul style="list-style-type: none"> • A solitary pulmonary mass, unilateral • Heterogeneous enhancement with areas of low density • Associated findings: Neighboring pleural thickening; Adjacent chest wall involvement with a chest wall mass
2, 55, M	Hemoptysis	6	DM	-	<ul style="list-style-type: none"> • A solitary pulmonary nodule, unilateral • Heterogeneous enhancement with areas of low density • Associated findings: Neighboring pleural thickening
3, 34, M	Cough Fever Chest pain	Several	-	-	<ul style="list-style-type: none"> • Lobar consolidation, unilateral • Heterogeneous enhancement with areas of low density • Associated findings: Neighboring pleural thickening; Adjacent rib cortical thickening
4, 50, F	Hemoptysis	12	-	Single, jobless	<ul style="list-style-type: none"> • Lobar consolidation, bilateral • Heterogeneous enhancement with areas of low density • Associated findings: Neighboring pleural thickening; Adjacent rib cortical thickening

*M = Male, F = Female, DM = Diabetes mellitus, - = absent, CT = computed tomography

agents. Physical examination revealed that the painful mass was reddish and palpable near the sternum, with some discharge. A chest radiograph revealed an ill-defined patchy opacity at the right middle lung field adjacent to the right cardiac border. Contrast-enhanced thoracic CT revealed a 3.2 × 2.5 cm soft tissue mass in the right middle lobe with transpleural invasion of the adjacent chest wall, forming a chest wall mass (Fig. 1). No obvious associated bony destruction or pleural effusion was observed. The tentative diagnosis was lung cancer with chest wall invasion, and a percutaneous biopsy of the lesion was performed under the guidance of sonography. Histological examination revealed areas of patchy inflammation with the formation of small abscesses containing ‘sulfur granules’, a pathological component of actinomycosis. The patient was administered antibiotics, and his condition gradually improved.

Case 2

A 55-year-old man presented with hemoptysis. He had been suffering from hemoptysis for approximately 6 months. No fever or weight loss was apparent. He had type II diabetes mellitus, which he was treating with prescribed oral hypoglycemic agent. A chest radiograph revealed a nodular opacity in the left middle lung field. Contrast-enhanced thoracic CT revealed a 1.8 × 1.6 cm nodule with a central cavity in the left upper lobe. Surrounding ill-defined ground-glass infiltration and adjacent pleural thickening was evident (Fig. 2). Based on a tentative diagnosis of lung cancer, video-assisted thoracoscopic (VATS) wedge resection of the lesion in the left upper lobe was

performed. Pathological examination confirmed the diagnosis of actinomycosis. The patient subsequently received antibiotics treatment and was discharged from the hospital in good condition.

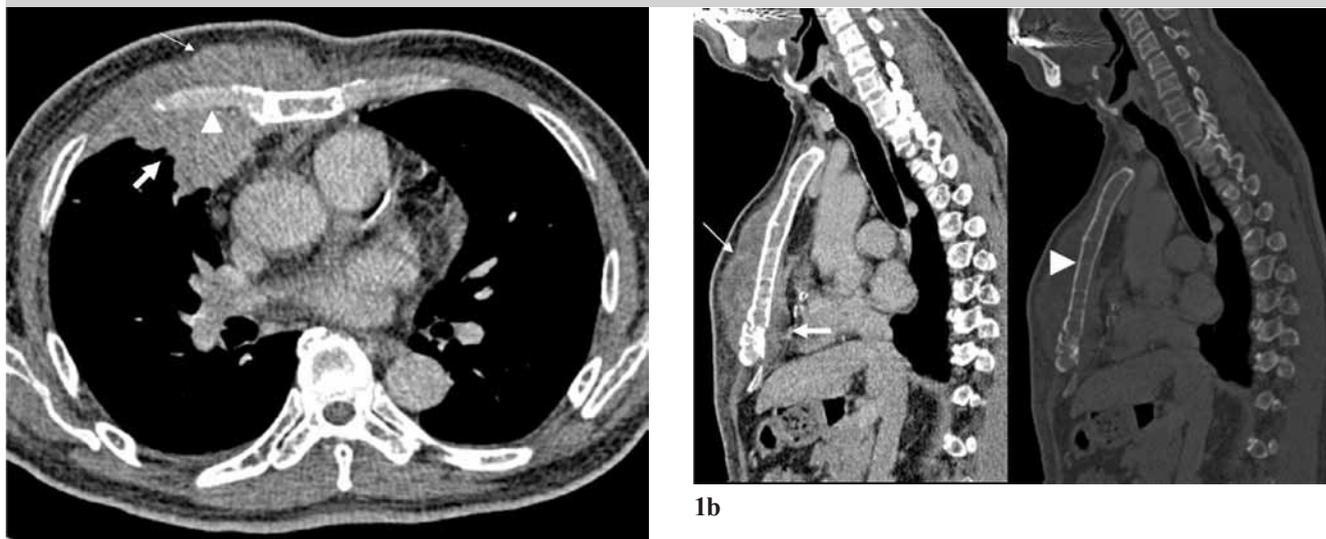
Case 3

A 34-year-old man presented with intermittent fever along with cough and chest pain for several months. He was reported to be fit, previously. A chest radiograph revealed a patchy opacity in the right lower lung field. Contrast-enhanced thoracic CT scan suggested lobar consolidation of the right lower lobe with air-bronchogram (Fig. 3). There were some hypodense non-enhancing areas in the consolidation. Prominent periosteal thickening was observed on the adjacent multiple ribs. Since malignancy could not be ruled out, a CT-guided percutaneous biopsy was performed, and actinomycosis was the final diagnosis. The patient received antibiotic therapy and improved gradually.

Case 4

A 50-year-old unemployed woman presented with blood-tinged sputum. She had been suffering from this for at least 1 year. No fever or weight loss was apparent. An initial chest radiograph revealed a patchy opacity with pleural effusion in the left lower lung field. Post radiography, she did not follow-up. Eighteen months later, she returned to our out-patient department with persistent hemoptysis and the onset of unprecedented chest pain. The follow-up chest radiograph showed massive consolidation in the right upper and left lower lung fields. Contrast-enhanced

Figure 1

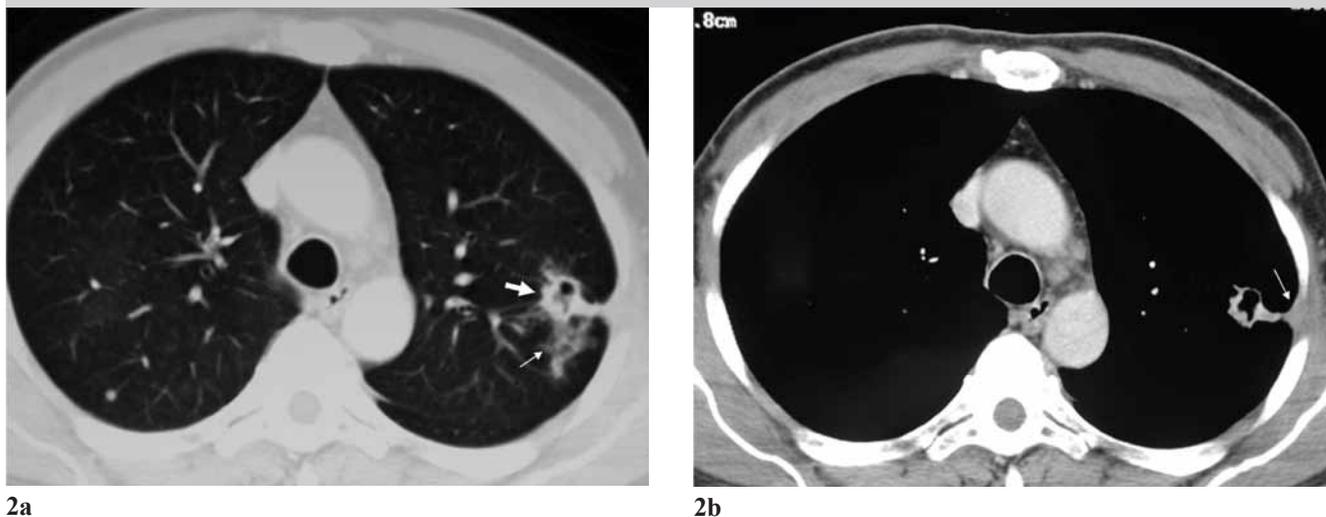


1a

1b

Figure 1. a. Contrast-enhanced axial CT shows a wedge-shaped consolidation (large arrow) in the right middle lobe with transpleural involvement of the adjacent chest wall leading to a mass (small arrow). No bony rib destruction between diseased parenchyma and the chest wall mass (arrowhead) was evident. **b.** Sagittal reconstruction displays the chest wall mass (small arrow) and a portion of parenchymal consolidation (large arrow). No bony destruction of the sternum was noted in the bone window setting (arrowhead).

Figure 2



2a

2b

Figure 2. a. Axial chest CT in the lung window setting revealed a 1.7 cm nodule with central cavitation (large arrow) in the left upper lobe. Surrounding ill-defined ground-glass opacity (small arrow) is evident. **b.** Contrast-enhanced axial chest CT shows pleural thickening (arrow) adjacent to the lung nodule.

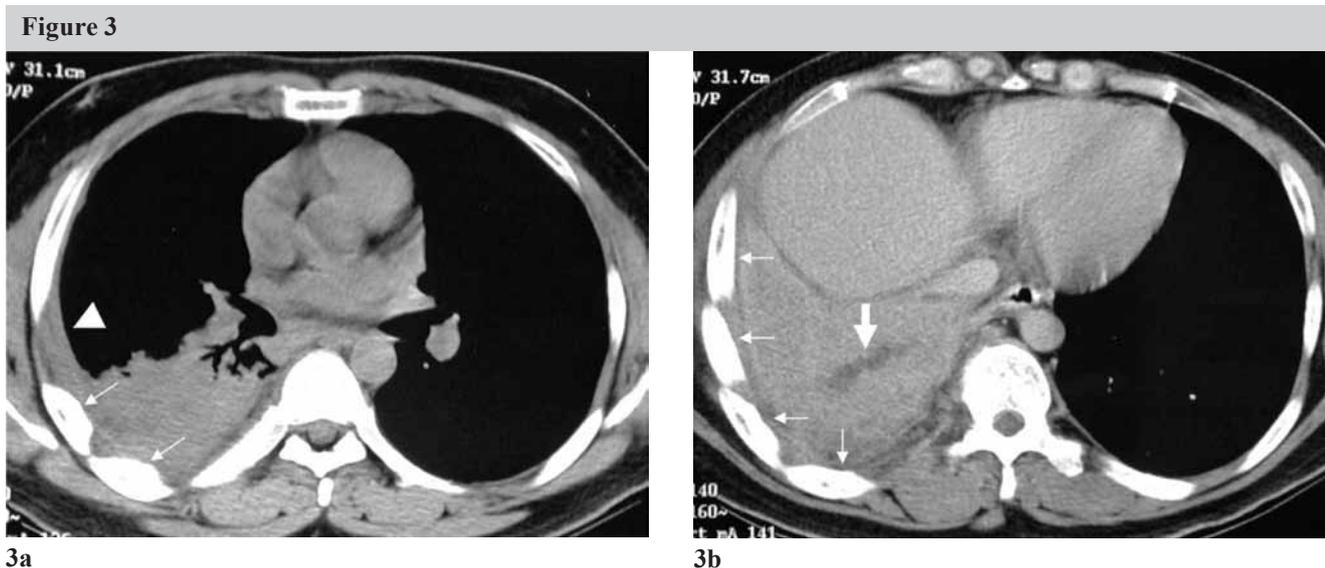


Figure 3. a. Contrast-enhanced axial chest CT shows lobar consolidation in the right lower lobe with pleural (arrowhead) and periosteal thickening of the adjacent ribs (arrows). **b.** The axial view at a lower level reveals a hypodense area (large arrow) and periosteal thickening of the adjacent ribs (small arrows).

thoracic CT showed lobar consolidations of the right upper and left lower lobes, accompanied by some non-enhancing hypodense areas (Fig. 4). Mild rib cortical thickening was seen, adjacent to the consolidations. Suspecting potential malignancy, a biopsy of the right upper lobe consolidation was performed, and pathological examination confirmed a diagnosis of actinomycosis. The patient received antibiotic therapy, and the bilateral opacity, evident on the chest radiograph, resolved gradually.

DISCUSSION

Thoracic involvement is common in actinomycosis, being evident in approximately 15% of the cases [1]. Poor dental hygiene, oral trauma, dental procedures, diabetes mellitus, tracheo-esophageal fistula, immunosuppression, alcoholism, and malnutrition are the known predisposing factors [3, 4, 7]. The symptoms of actinomycosis are diverse, but there are some warning signs, such as indolent course, chronicity, development of pleuro-cutaneous fistula, progression through tissue planes, and relapse of infection after a short course of antibiotics [8]. The prognosis of such infections is excellent, if they are recognized early; conversely, delayed or inadequate treatment can lead to increased morbidity [9].

Radiologically, pulmonary actinomycosis can resemble a spectrum of lung diseases ranging from benign infection to malignant tumors. A study by Jung *et al.* suggests that a characteristic imaging feature of actinomycosis is

chronic segmental air-space consolidation containing low-attenuation areas with peripheral enhancement or adjacent pleural thickening [6]. There may also be some associated symptoms, such as thickness and enhancement of the periosteum of the ribs [10]. In the 4 cases presented herein, the CT images reveal a broad spectrum of radiological findings. In the first case, CT demonstrated a mass with transpleural chest wall involvement without rib destruction between the diseased chest wall and the lung parenchyma, which is atypical with regard to malignant tumors that often lead to localized bone destruction. The rib cortex adjacent to the affected lung parenchyma exhibited no obvious periosteal reaction, unlike in the other 3 cases described above; this may be due to his shorter clinical course as compared to the other 3 subjects investigated in the study. In addition, physical examination revealed an anterior chest wall mass with pus discharge, which may have corresponded to a draining sinus tract extending from the internal parenchymal lesion through to the overlying soft tissue and skin. This phenomenon is characteristic symptom of thoracic actinomycosis, but only occurs in 11% of the cases [11]. The second patient presented with a solitary lung nodule, which has been estimated to occur in approximately 9% of thoracic actinomycosis cases [6]. Images of the third and fourth cases revealed unilateral and bilateral lobar consolidation. There have been a small number of reported cases of thoracic actinomycosis leading to bilateral lobar consolidation as detected by CT, as was apparent in our fourth case, where the initial chest radiograph showed unilateral air space consolidation that progressed to bilateral involvement

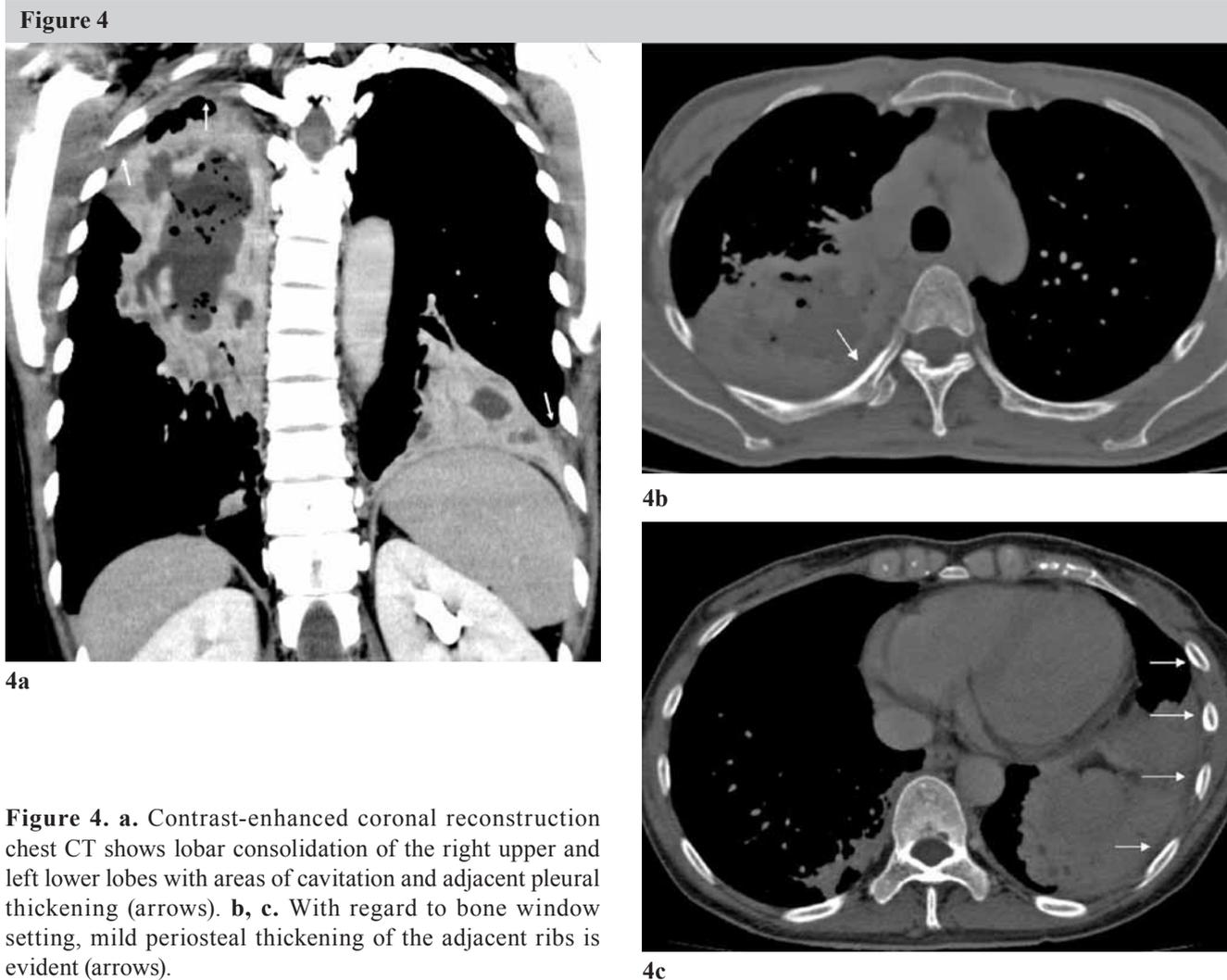


Figure 4. a. Contrast-enhanced coronal reconstruction chest CT shows lobar consolidation of the right upper and left lower lobes with areas of cavitation and adjacent pleural thickening (arrows). **b, c.** With regard to bone window setting, mild periosteal thickening of the adjacent ribs is evident (arrows).

several months later. Nonaggressive periosteal reaction of neighboring ribs is indicative of a slow and less intense process, often resulting from chronic inflammation. [12]

Actinomyces are fastidious bacteria that are difficult to culture [4]. If there is a high index of suspicion indicated by digital imaging, the clinicians should communicate this to the microbiology diagnostic laboratory, in conjunction with supplying samples from the draining sinuses, or from deep needle aspiration, or from biopsy. The presence of Gram positive filamentous organisms and sulfur granules in the pus or tissue specimens (evident via histological examination) is strongly indicative of actinomycosis [8], though there is still a 50% chance of a false negative [11]. Intrathoracic actinomycosis is highly treatable if diagnosed early. Patients with all forms of actinomycosis have been treated with high doses of intravenous penicillin [8]. An inappropriate or inadequate period of treatment with antibiotics increases the risk of disease relapse; a clinical hallmark of this rare infection [4].

In addition to non-specific air space consolidation, or even a solitary pulmonary nodule in thoracic CT, radiologists should also consider subtle imaging clues, such as adjacent pleural thickening or periosteal reaction of the ribs. Linking these imaging clues with the clinical chronicity and predisposing factors discussed above may result in more accurate diagnoses of actinomycosis.

REFERENCES

1. Burden P. Actinomycosis. *J Infect* 1989; 19: 95-99
2. Scully RE, Mark EJ, Mc Neelly WF. Case 29-1993 of the Massachusetts General Hospital. *N Engl J Med* 1993; 329: 264-269
3. Konstantinos P, Foivos K, Patra K. Pulmonary actinomycosis presenting with hemoptysis and a peripheral lung mass: a case report. *Pneumon* 2009; 22: 258-261

4. Mabeza GF, Macfarlane J. Pulmonary actinomycosis. *Eur Respir J* 2003; 21: 545-551
5. Kim TS, Han J, Koh WJ. Thoracic Actinomycosis: CT features with histopathologic correlation. *AJR Am J Roentgenol* 2006; 186: 225-231
6. Jung EC, Jung GI, Mi YK. Thoracic actinomycosis: CT findings. *Radiology* 1998; 209: 229-233
7. Liou DC, Wu CS. Thoracic actinomycosis on radiologic study: case report. *Chin J Radiol* 2001; 26: 75-79
8. Wong VK, Turmezei TD, Weston VC. Actinomycosis clinical review. *Bri Med J* 2011; 343: 6099
9. Francisco A, Rene B, Luz ML. Actinomycosis: a great pretender. Case reports of unusual presentations and a review of the literature. *Int J Infect Dis* 2008; 12: 358-362
10. Miguel A, Zarca-diaz E, Carlos LM. Pulmonary actinomycosis with thoracic soft tissue mass: a rare onset form. *Eur J Radiol* 2001: 195-199
11. Janine R, Uri L, Nizar M. Actinomyces in chronic granulomatous disease: an emerging and unanticipated pathogen. *Clin Infect Dis* 2009; 49: 1703-1710
12. Rich SR, Jim SW, Ronald LE. Periosteal reaction. *AJR* 2009; 193: 259-272