Imaging Findings of Pulmonary Cryptococcosis in Non-HIV Individuals

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Learning objectives/outcomes

Learning Objectives: To know the imaging spectrum of the CT findings of pulmonary cryptococcosis in non-HIV individuals

Outcomes: The radiologists could be familiar with the CT findings of pulmonary cryptococcosis and be able to include this uncommon but important fungal infectious disease in the differential diagnosis.
Cryptococcus neoformans is a thin-walled, nonmycelial, budding encapsulated yeast\(^1\)\(^2\)\(^3\). It is found worldwide, particularly in soil contaminated with pigeon excreta and decayed wood\(^1\)\(^2\)\(^3\).

Human infection occurs via inhalation of cryptococcal particles into the lungs, although pneumonia is relatively uncommon in infected individuals\(^1\)\(^2\). Cryptococcal infections most commonly occur in immunocompromised hosts, such as those with acquired immunodeficiency syndrome, transplant-related immunosuppression, or hematologic malignancies\(^1\)\(^2\). Immunocompetent individuals are infected less commonly\(^1\)\(^4\)\(^5\), and may be asymptomatic\(^1\)\(^3\)\(^7\).
The radiographic features of pulmonary cryptococcosis can be broadly categorized into:

- Pulmonary nodules or masses with well- or ill-defined margins
- Segmental or lobar consolidation
- Small nodular or reticulonodular opacities

Associated features include cavitation, lymphadenopathy, and pleural effusion are relatively common in immunocompromised patients.
Imaging features

- Ground-glass opacities adjacent to or surrounding nodules in an appearance consistent with the CT halo sign is reported to be one the additional features, and histologic correlation showed the ground-glass opacities to represent granulomatous inflammation¹²).

- A “crazy-paving” appearance consisting of a linear network pattern superimposed on ground-glass opacity is also reported¹²).
Two cases of pulmonary cryptococcosis with irregular shaped solitary nodule are shown. Both nodules mimic the finding of lung cancer.
Tiny nodule

Irregular shaped nodule is shown in superior segment of left lower lobe.
Multiple nodules are the most common findings in pulmonary cryptococcosis. When multiple nodules are seen in a single pulmonary lobe, granulomatous infection such as pulmonary cryptococcosis should be included in the differential diagnosis.
Multiple irregular shaped nodules and some ground-glass opacities are scattered in right upper lobe. Some of the nodules contain cavity. This is not a typical finding in pulmonary tuberculosis, in which well demarcated satellite lesions surrounding the cavitary nodule or mass is much more common. It is one of the point to distinguish from pulmonary tuberculosis.
Multiple irregular shaped nodules are shown in right lower lobe. When multiple nodules in a single pulmonary lobe are seen, granulomatous infection such as pulmonary cryptococcosis should be included in the differential diagnosis.
Early stage

Faint ground-glass opacities around the cluster of solid nodules are shown in right pulmonary apex. The lesion was detected incidentally at the very early stage of pulmonary cryptococcosis.

Ground-glass opacity is reported to be correlated with granulomatous inflammation\(^{12}\).
Cavity formation is a relatively uncommon finding in immunocompetent individuals. The figure of the cavity may be irregular. It is important to distinguish from pulmonary tuberculosis (TB) and nontuberculous mycobacterial infection.
Chest CT revealed thick-walled cavitary mass with septation and some irregular shaped nodules around the mass in posterior portion of right lower lobe during health check incidentally. Although the diagnosis was not confirmed, the patient was treated with anti-tuberculous antibiotics. While she developed pneumothorax 5 months later, right lower lobe was resected and the diagnosis of pulmonary cryptococcosis was confirmed.
Development of cavity

A well-demarcated solitary nodule is shown in periphery of right lower lobe. Seven months later, an eccentric cavity appeared in the nodule. After another month, the cavity increased in size and the figure of the nodule changed to a thin-walled cavitary lesion.
A well-defined solid nodule with eccentric cavity is shown in right pulmonary apex. Note tiny nodules around the cavitary nodule. Some of the nodules are shown as faint ground-glass opacity (arrows). This lesion mimics the finding of pulmonary TB. The point to differentiate pulmonary cryptococcosis from TB is that well-demarcated solid nodules tree-in-bud appearance are common whereas faint ground-glass opacities are rare in TB.
Mixed consolidation and ground-glass opacity

Irregular nodular and patchy consolidations and ground glass opacities are shown in right lower lobe in a patient of rheumatoid arthritis treated with MTX (methotrexate) and Infliximab.
Two tiny solid nodules and some faint ground-glass opacity along the pulmonary vein are shown in right lower lobe. Although this lesion was missed before treatment with MTX and Infliximab, it was thought to be the primary lesion of pulmonary cryptococcosis. It is important not to miss even tiny nodular lesion as a potential risk for the development of granulomatous infectious disease such as cryptococcosis.
Organizing pneumonia (OP) pattern in a patient of rheumatoid arthritis treated with methotrexate and Infliximab. When OP pattern is seen in immunocompromised patients, pulmonary cryptococcosis should be included in the differential diagnosis, which has a potential risk for systemic dissemination or cryptococcal meningitis.
A 35-year-old immunocompetent woman presented with fever (38.5°C). WBC 6000/μL, CRP 3.04 mg/dL. While bacterial pneumonia was suspected and was treated with antibiotics, it was ineffective. Patchy consolidation surrounded by ground-glass opacity is shown in left lower lobe on CT. Transbronchial lung biopsy revealed organizing pneumonia with granulomatous inflammation histologically. Further examination confirmed the diagnosis of pulmonary cryptococcosis.
Organizing pneumonia pattern

Patchy consolidation was pointed out on CXR during health check in 55y/o male without symptoms and any abnormal findings suggestive of inflammatory process on laboratory data. Patchy consolidation in left upper lobe surrounded by some ground-glass opacity suggesting OP pattern is shown on CT. Pulmonary cryptococcosis should be included in the differential diagnosis of OP pattern without symptoms.
The most common finding of pulmonary cryptococcosis in non-HIV individuals is solitary or multiple nodules or masses. Solitary nodule may mimic the finding of lung cancer.

When multiple nodules in a single pulmonary lobe are shown, granulomatous infection such as pulmonary cryptococcosis should be included in the differential diagnosis.

Although the nodules or masses may contain cavity, it is important to distinguish from pulmonary TB. Well demarcated multiple satellite lesions and branching opacities called “tree-in-bud appearance” are common in pulmonary TB. On the other hand, faint ground glass opacities may be seen around the main lesion in pulmonary cryptococcosis.
Pulmonary cryptococcosis may present with a nonspecific finding of pneumonia or with a finding of OP pattern on chest CT. Pulmonary cryptococcosis should be included in the differential diagnosis of OP pattern, even if the patient is immunocompetent.

The risk of systemic dissemination and cryptococcal meningitis are increased in patients of pulmonary cryptococcosis with OP pattern misdiagnosed as cryptogenic or other secondary OP, and treated with corticosteroids.

Pulmonary cryptococcosis with OP pattern may be asymptomatic.

Pulmonary hilar and/or mediastinal lymphadenopathy and pleural effusion is rare in non-HIV individuals.
The most common finding of pulmonary cryptococcosis is solitary or multiple nodules.

The nodules or masses may contain cavity.

Pulmonary cryptococcosis should be included in the differential diagnosis of organizing pneumonia pattern.
References

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