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RESEARCH ARTICLE

CEREBRAL AND PULMONARY FINDINGS OF CRYPTOCOCCUS ON COMPUTED TOMOGRAPHY: PICTORIAL ESSAY OF THE MAIN IMAGING FINDINGS.

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ABSTRACT

Cryptococcosis is an invasive infection caused by *Cryptococcus neoformans*, an encapsulated pathogenic fungus found globally in bird excreta, soil, and trees. Inhalation of the organism is the usual route of infection. If the fungal cells survive their initial interaction with alveolar macrophages in the lungs, they migrate to the systemic bloodstream and cross the blood-brain barrier, resulting in a central nervous system (CNS) infection. Cryptococcal infection can occur in individuals with normal immunity but is most common in immunocompromised hosts. Chest tomography typically shows solitary or multiple parenchymal nodules or consolidation with a surrounding area of ground-glass opacity, and cavitation may be observed, particularly in immunocompromised patients. On neuroimaging, the most common findings are leptomeningeal enhancement, followed by perivascular space dilatation with gelatinous pseudocysts. Cryptococcal infection results in significant morbidity and mortality. Imaging plays a critical role in the diagnosis of the illness, monitoring therapy response, and identifying related complications. Early detection can optimize treatment and clinical management.

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INTRODUCTION

Cryptococcus neoformans is anencapsulated yeast found worldwide, particularly in soil contaminated with pigeon excreta and decayed wood. Human infection occurs via inhalation of cryptococcal reproductive spores into the lungs. Unicellular yeasts, such as *Cryptococcus*, are small enough to enter the meningeal microcirculation through hematogenous dissemination, migrating to perivascular spaces, resulting in an inflammatory process and deposition of mucoid material (2). Central nervous system infection following hematogenous dissemination is more common than pneumonia. In this context, cryptococcal meningitis is the most common fungal disease of the CNS (1). The diagnosis of pulmonary and cerebral fungal infections requires the examiner to be familiar with the imaging spectra of this pathology to enable a prompt diagnosis.

Purpose of the Study: This work proposes a didactic presentation of the significant pulmonary and cerebral alterations in cryptococcosis infection, highlighting the main characteristics that every radiologist should recognize when faced with this diagnosis.

MATERIALS AND METHODS

We present a pictorial essay summarizing the main tomographic findings in lung and cerebral cryptococcosis through images, with two cases selected from our service.

DISCUSSION

Early recognition of cryptococcosis, among both immunocompetent and immunocompromised groups, can

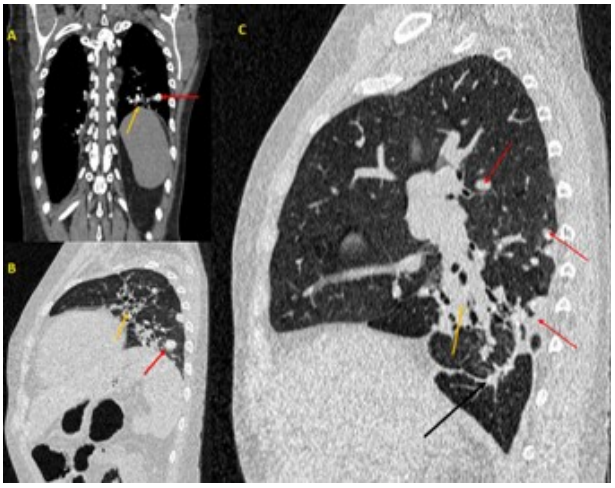

Figure 1. Computed tomography in the coronal (A) and sagittal (B, C) planes. The images show multiple solid nodules with well-defined margins throughout the lung parenchyma bilaterally, mainly in the lower lobes, some in subpleural location and some presenting calcifications (red arrows). It is also depicted bronchiectasis (yellow arrow) associated with subsegmental atelectasis (black arrow), in contact with a thickened pleura. These findings determine significant parenchymal distortion and volume reduction of left lung

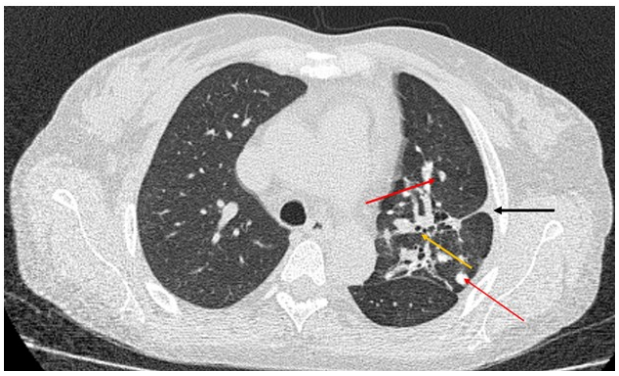

Figure 2. Computed tomography in the axial in lung window. The image show multiple solid nodules with well-defined margins (red arrows), bronchiectasis (yellow arrow) associated with subsegmental atelectasis (black arrow), in contact with a thickened pleura

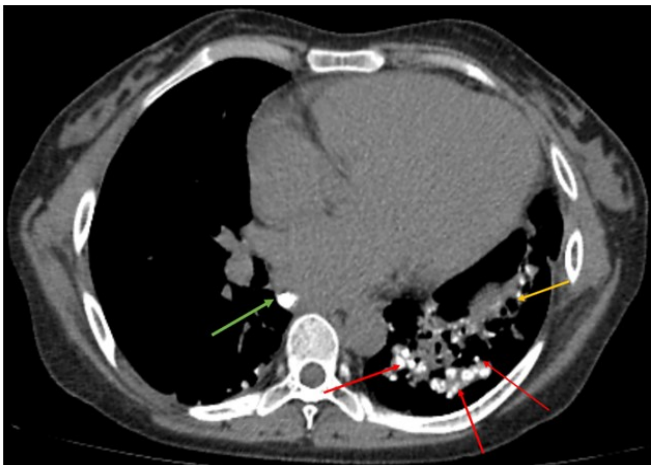

Figure 3. Computed tomography in the axial in the mediastinum/ soft tissue window. The image show multiple solid nodules with well-defined margins presenting large calcifications (red arrows) and bronchiectasis (yellow arrow). In the mediastinum, calcified lymph nodes are also shown (green arrow)

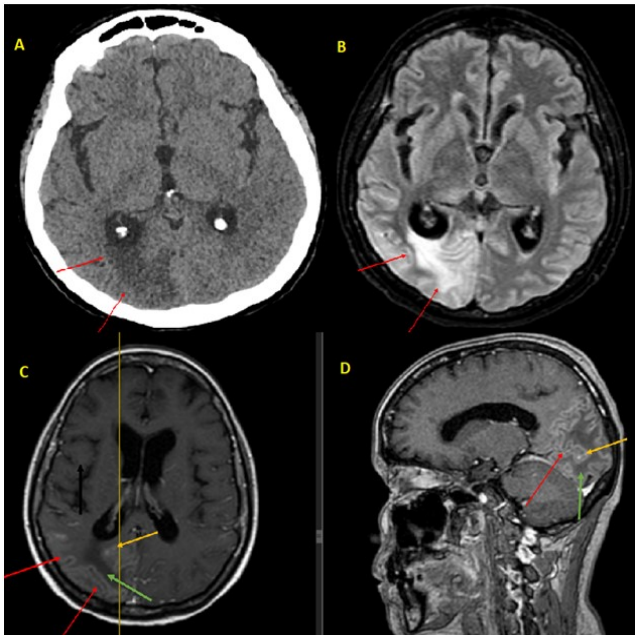

Figure 4. A. Computed tomography in the axial plane shows an ill-defined hypodense area in right occipital lobe (red arrows). B. FLAIR sequence in axial plane. Demonstrates area of hiperintensitiy involving cortical and subcortical white matter in the occipital lobe. That area also showed restricted diffusion with corresponding ADC hypointensity (not shown), compatible with acute infarcts. C and D. T1 sequences post contrast in axial e sagittal planes. There is parenchymal gyriform enhancement, indicating associated meningoencephalitis as well as evolving ischemic changes (red arrows). Leptomeningeal enhancement is observed (yellow arrows). There is also subcortical area of hypointensity in occipital right lobe representing vasogenic edema (green arrow)

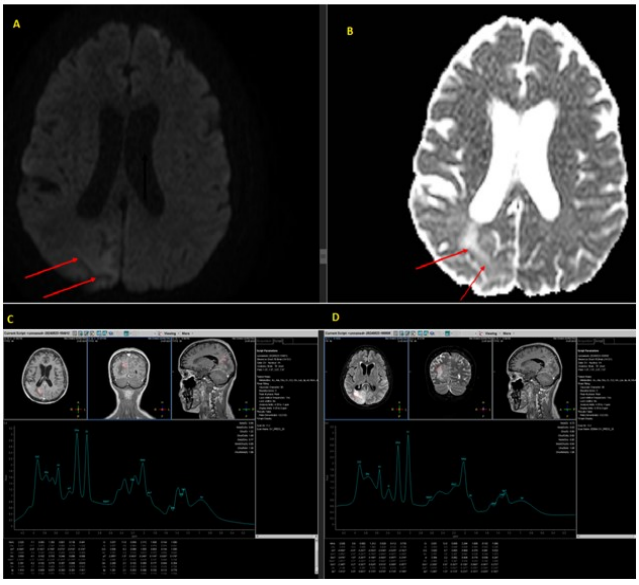

Figure 5. A, B. MRI demonstrates areas of restricted diffusion with corresponding ADC hypointensity, compatible with acute infarcts (red arrows). C, D. Brain MR spectroscopy depicting nonspecific findings, with decrease in N-acetylaspartate peak and discrete increase in the lactate /lipids peak

provide additional therapeutic benefits to the patient. Computed tomography (CT) of the chest plays a significant role due to its availability in many health centers and its lower cost. Cryptococcal infections most commonly occur in immunocompromised hosts, such as those with acquired

immunodeficiency syndrome, transplant-related immunosuppression, chemotherapy, glucocorticoid therapy, diabetes mellitus, or hematologic conditions. However, on rare occasions, disseminated infections can occur in immunocompetent individuals (3). The CT findings of cryptococcosis may differ between immunocompromised and immunocompetent patients due to varying comorbidities or immune statuses. In immunocompromised hosts, the immune deficiency results in more pulmonary exudative and necrotizing changes, as well as intrapulmonary or systemic spread of *Cryptococcus*. In immunocompetent patients, cryptococcal infection tends to be localized due to phagocytosis by macrophages (4). Typically, in non-immunosuppressed patients, single or multiple nodules (the most common radiographic finding), consolidation, or masses in the subpleural surface are mainly presented. In immunosuppressed hosts, interstitial-type patterns, ground-glass surrounding nodules (halo sign), miliary micronodules, nodule cavitation, lymphadenopathy, and pleural effusion may be expected.

The CNS is the main site of disseminated disease, and its involvement without pulmonary findings is possible. On neuroimaging, leptomeningeal enhancement, which may have a nodular appearance, perivascular space dilatation in deep gray nuclei, and gelatinous pseudocysts can be observed. Other parenchymal manifestations include cryptococcomas and/or abscess formation, often occult on non-enhanced head CT images, with surrounding vasogenic edema appearing as indistinct hypoattenuating areas. It is important to note that edema and enhancement may be attenuated in the context of immunodeficiency or corticosteroid therapy (5). In addition to the patterns mentioned above, vascular involvement, such as vasculitis and ischemic infarction, can also result from the hematogenous spread of fungal CNS infections. Patients presenting with meningitis and infarcts have high mortality and significant neurological deficits (6).

CONCLUSION

Cryptococcus infection is potentially serious with the risk of dissemination to multiple systems, notably in immunosuppressed patients. Radiologists must be aware of the imaging findings, considering that the patterns of involvement can vary depending on the patient's immune response.

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