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## The Reversed Halo Sign and the Bronchus Sign: The Eyes See Only What the Mind Knows

To the Editor:

The case conference presented by Narechania and colleagues describes a classic case of pulmonary mucormycosis in a patient with poorly controlled diabetes mellitus (glycated hemoglobin, 9.2%) (1). The initial computed tomography (CT) of the chest shows the reversed halo sign (RHS) or the “atoll sign,” a vital clue that could have led to an early diagnosis. The authors have themselves described the typical RHS in their figure legend: “central ground-glass changes surrounded by a ring of consolidation” (Figure 1). Awareness of this imaging sign and its importance would have certainly prompted a more aggressive pursuit to establish a microbiologic or histopathologic diagnosis at the first instance.

Pulmonary involvement by mucormycosis leads to angioinvasion with resultant arterial thrombosis, pulmonary infarction, and a central area of hemorrhage (appears on CT as ground-glass opacities). As the disease progresses, the central area gets further devitalized and the resulting necrosis leads to cavity formation (2). This sequence of events was also encountered in the index case. Initially described in cryptogenic organizing pneumonia, RHS has been observed in several other diseases including tuberculosis (3, 4). Even though the RHS is not a pathognomonic sign, its presence in an appropriate setting (nonresolving pneumonia in a post-solid organ transplant recipient or poorly controlled diabetes mellitus) strongly suggests invasive mucormycosis and warrants initiation of empiric antifungal therapy (3).

In the index case, another important radiological sign can be appreciated in Figure 3; namely, the bronchus sign. The presence of CT bronchus sign is one of the most important predictors of successful visualization and diagnosis while performing bronchoscopic lung biopsy under radial endobronchial ultrasound guidance (5). The availability of ultrathin bronchoscopes has the potential to further improve the diagnostic yield of radial endobronchial ultrasound-guided bronchoscopic lung biopsies (6). In a large retrospective study, there was 72% success with transbronchial lung biopsy when the CT-bronchus sign was present, against 20% success in patients in whom the CT bronchus sign was absent (5). This imaging sign serves as a useful guide to decide on the initial diagnostic procedure. Thus, if the CT shows the bronchus sign, bronchoscopic lung biopsy under radial

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endobronchial ultrasound guidance is an appropriate initial choice, whereas in the absence of this sign, percutaneous biopsy of the lung lesion under CT guidance would be a reasonable approach.

With the global rise in the population at risk (diabetes mellitus and transplant recipients), invasive mucormycosis is being increasingly recognized. Early diagnosis and aggressive management (medical and surgical) are the key in improving outcomes in mucormycosis. Hence, a high index of suspicion and knowledge of its characteristic radiological appearance is of paramount importance in the diagnosis of pulmonary mucormycosis.

**Author disclosures** are available with the text of this letter at [www.atsjournals.org](http://www.atsjournals.org).


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