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An unexpected opportunist: *Magnusiomyces capitatus* infection in an immunocompetent patient

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ABSTRACT

Magnusiomyces capitatus is an uncommon opportunistic fungal pathogen primarily affecting immunocompromised individuals. While rare, cases have been reported in immunocompetent patients. We present a documented case of *Magnusiomyces capitatus* invasive infection in an immunocompetent patient with no previous medical history. This case shows that invasive fungal infections by *Magnusiomyces capitatus* might affect even the immunocompetent patients.

1. Introduction

Magnusiomyces capitatus (*M. capitatus*), previously known as *Saprochaete capitata*, *Geotrichum capitatum*, and *Blastoschizomyces capitatus*, is a fungus commonly found in the environment. It can also be part of the normal microbiome of the skin, the gastrointestinal tract, and the respiratory tract [1,2]. While uncommon, *M. capitatus* can cause invasive infections, particularly in immunocompromised individuals like those with hematological malignancies, organ transplants, or co-existing infections [2]. These infections are rarely seen in immunocompetent patients. The severity of *M. capitatus* infections can vary. The spectrum of involvement can be localized, affecting the lungs, or become disseminated throughout the body. *M. capitatus* can lead to a wide array of clinical manifestations including but not limited to bloodstream infection, pneumonia, brain abscess, osteomyelitis, urinary tract infection, and endocarditis [2–4]. Due to the limited effectiveness of fluconazole and echinocandins against *M. capitatus* and the high mortality rate associated with these infections, prompt diagnosis and targeted treatment are crucial [5]. Here we report a case of *M. capitatus* lung infection in a 63-year-old previously healthy patient with no significant comorbidities.

2. Case presentation

A 63-year-old man with a 3-month history of cough, initially productive but becoming dry, presented with fever, loss of appetite, and weight loss (5 kgs). He denied prior tuberculosis (TB) infection, TB contact, chronic lung disease, malignancy (personal or family history), and long-term medications. He has no smoking history. On examination, the patient was alert and oriented, normotensive, afebrile, and appeared to be cachectic and underweight (37 kgs). There was no jaundice or skin rash, clubbing, or lower limb edema. On lung exam: vesicular breathing and coarse crepitations were noted upon chest osculation. The remainder of the physical examination was unremarkable.

Upon admission on day 0, the patient was placed in airborne isolation. Laboratory investigations revealed the following: anemia: red blood cell count (RBC) 3.71 x 10^12/L (normal range (NR) 4.3–5.8), hemoglobin (Hb) 101 g/L (NR 130–175), hematocrit (Hct) 0.31 (NR 0.41–0.50). White blood cell count was normal: 7.13 $\times$ 10^9/L (NR 3.5–9.5 $\times$ 109/L), with neutrophils of 4.56 $\times$ 10^9/L (NR 1.8–6.3 $\times$ 109/L) and lymphocytes: 1.07 $\times$ 10^9/L (NR 1.1–3.2 $\times$ 109/L). Elevated Erythrocyte Sedimentation Rate (ESR): 95 mm/hr (NR 0–15). Elevated C-Reactive Protein (CRP): 74 mg/dL (NR $<$ 0.3). Renal function tests,

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liver function tests, cardiac enzymes, and troponin I were all within normal range. Urine analysis was positive only for microscopic hematuria: 0.03 mg/dL. As a case of suspected pneumonia, was antibiotic treatment was initiated with intravenous (IV) azithromycin 500 mg daily and IV ceftriaxone 2 gm daily, then switched after CT findings to IV Piperacillin/Tazobactam on day 8.

The chest CT scan which was done on day 1 demonstrated a large cavitary lesion with thick walls in the right lung apex (Fig. 1). There was also adjacent apical pleural thickening. Bilateral traction bronchiectasis was present, predominantly involving the right lung. Additionally, scattered ground-glass opacities and bilateral small lung nodules of indeterminate nature were identified.

Workup for tuberculosis (TB), including three sets of acid-fast bacilli (AFB) smears and TB PCR that were done on day 14, all came out negative. A bronchoscopy was performed on day 4 and revealed findings suggestive of a lung abscess. Bronchial brushing and bronchoalveolar lavage (BAL) cytology did not show malignant cells, AFB, fungal elements, or Pneumocystis. However, it did reveal the presence of pulmonary macrophages and reactive bronchial epithelial cells within a background of severe acute inflammation. In addition, on day 32, the patient underwent a computed tomography (CT) guided lung core needle biopsy for histopathological evaluation. Hematoxylin and eosin (H&E) stain showed a complete replacement of lung tissue by a diffuse lymphoplasmacytic inflammation, fibrosis, and numerous fungal elements (Fig. 2). These fungal elements showed broad, sparse septated, branching hyphae (Fig. 3). Furthermore, Periodic Acid-Schiff (PAS) and Grocott methenamine silver (GMS) stains were positive for fungal organisms. However, the tissue was negative for granuloma and malignancy. Fungal culture, after more than two weeks incubation, revealed *M. capitatus* using MALDI-TOF Biomerieux Vitek MS. Biomerieux E-Test MIC (minimal inhibitory concentration) strips were used for susceptibility testing: Amphotericin B MIC 0.5 mcg/ml (susceptible), Flucytosine MIC 0.25 mcg/ml (susceptible), Fluconazole MIC 8 mcg/ml (susceptible), Voriconazole MIC 0.25 mcg/ml (susceptible), and Anidulafungin MIC 32 mcg/ml (resistant).

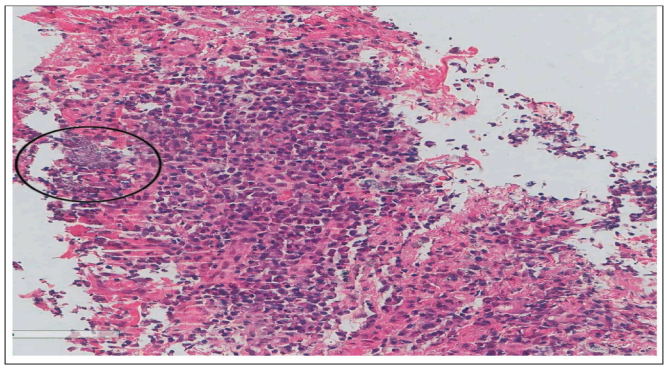

Fig. 2. Hematoxylin and eosin (H&E) stain. A section showing lymphoplasmacytic inflammatory reaction within a fibro-collagenous stroma infiltrated by fungal hyphae (circle).

The patient was initiated on IV liposomal amphotericin B 5 mg/kg daily on day 38. As the patient improved clinically, he was discharged after two weeks on oral voriconazole maintenance 200 mg twice daily. Voriconazole serum trough level was 5.5 mcg/ml within the therapeutic range for treatment (trough 2.0–5.5 mcg/ml)

At the 3-month follow-up, the patient reported significant improvement in cough and other symptoms. Repeat chest CT revealed improvement in soft tissue density within the apical cavitary lesion, with complete resolution of bilateral ground glass opacities. Due to a slow radiographic response, the antifungal treatment was extended to one year during the subsequent follow-up. Subsequent chest CT scans demonstrated a further reduction in the size of the right apical cavitary lesion, which then stabilized without significant changes (Fig. 4).

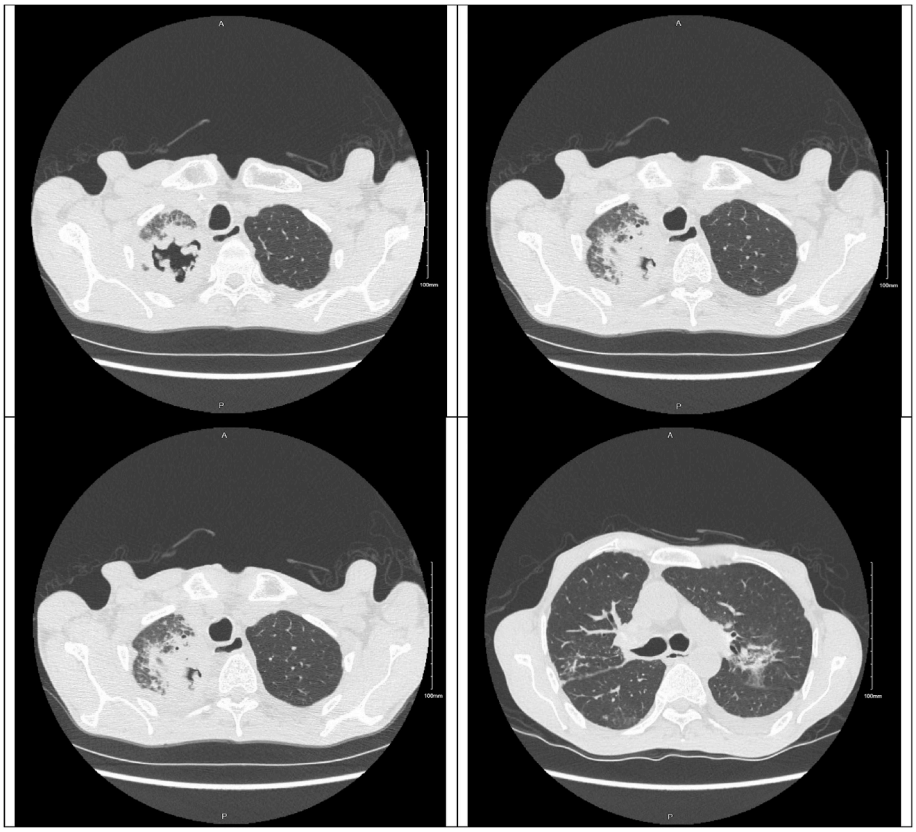

Fig. 1. Chest CT scan at the time of presentation.

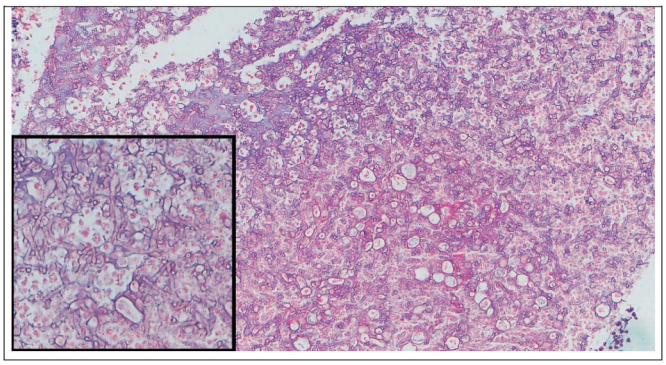

Fig. 3. Hematoxylin and eosin (H&E) stain. A section showing a dense aggregate of broad, infrequently septate, branching fungal hyphae. Inset: A high-power view of fungal hyphae.

3. Discussion

Magnusiomyces capitatus is an uncommon opportunistic fungal pathogen primarily affecting immunocompromised individuals and has been exceptionally rare in immunocompetent patients [2]. This report presents a case of *M. capitatus* infection in an immunocompetent patient with no previous medical history. A comprehensive literature review encompassing PubMed, Medline, and Google Scholar identified only 15 documented cases of *M. capitatus* lung infection in immunocompetent patients (Table-1). [6–10]. Notably, all but two of these cases reported pre-existing pulmonary pathologies such as chronic obstructive pulmonary disease (COPD), asthma, lobectomy history, tuberculosis (TB), or smoking history.

The diagnostic strategy for *M. capitatus* infection aligns with that of other rare yeast infections. It encompasses a multi-pronged approach involving imaging studies, histopathological examination, and culture-based analysis guided by clinical presentation and clinician discretion. Definitive diagnosis hinges on the isolation of *M. capitatus* from body sites such as blood and others [11]. Morphologically, the fungus manifests as pseudohyphae, hyphae, and various conidial forms [11]. Additionally, Matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) has emerged as a reliable tool for identifying diverse ascomycetous yeast strains, including *M. capitatus* [12].

In the present case, the diagnostic workup commenced with chest radiography, followed promptly by a chest CT scan. However, these imaging modalities yielded non-specific findings. Definitive diagnosis was initially established based on histopathological features, particularly the presence of abundant fungal elements characterized by broad branching hyphae and was subsequently confirmed by culture. Susceptibility testing revealed susceptibility to amphotericin B, flucytosine, voriconazole, and fluconazole; however, the isolate demonstrated resistance to anidulafungin. Given the non-specific clinical presentation, extensive investigations encompassing three negative sets of acid-fast bacilli (AFB) smears, TB polymerase chain reaction (PCR), bronchoalveolar lavage (BAL) cytology, and lung biopsy excluded TB. Similarly, imaging and biopsy findings effectively ruled out malignancy.

Prompt identification and treatment are critical for *M. capitatus* infections, given the reported mortality rate ranging from 50 % to 90 % [13]. Due to the rarity of this infection, there are no clinical trials to establish optimal antifungal regimens. Management decisions should be based on the patient's clinical presentation as well as the results of comprehensive investigations [11]. The 2021 Global Guideline for the Diagnosis and Management of Rare Invasive Yeast Infections recommends liposomal amphotericin B with or without flucytosine as the first-line therapy or voriconazole as an alternative based on the patient's

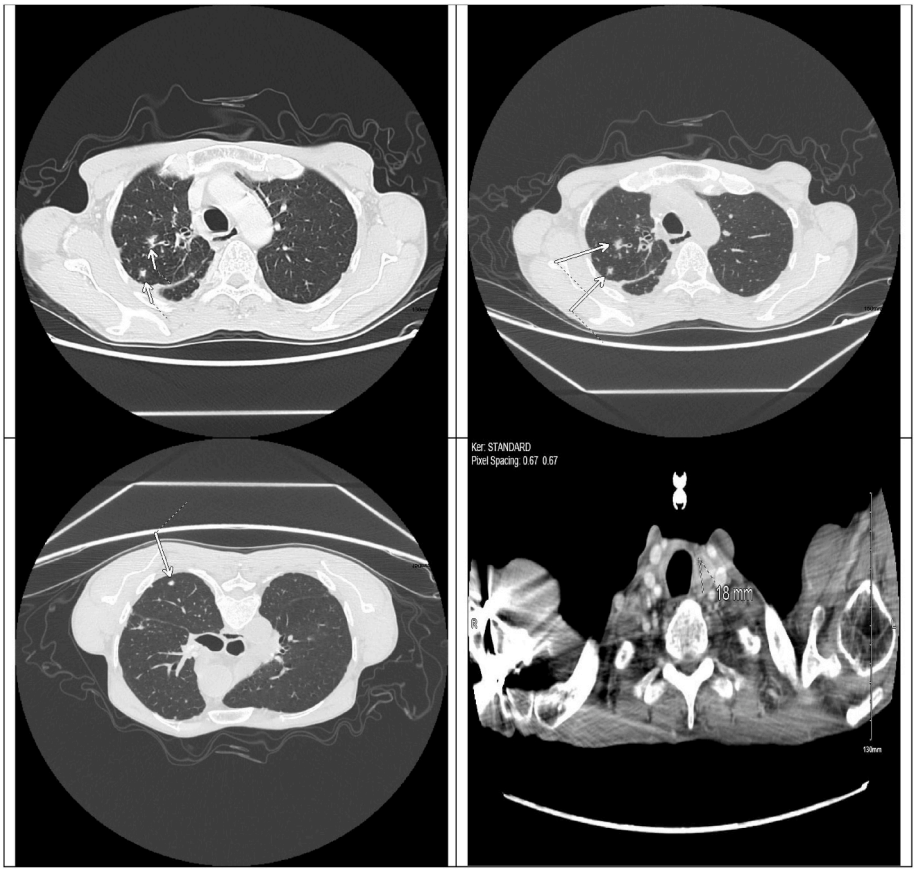

Fig. 4. 1 year follow-up CT scans demonstrated a further reduction in the size of the right apical cavitary lesion, which then stabilized without significant changes.

Table-1
Summarized literature review of *M. capitatus* lung infection in immunocompetent patients.

Author	Year	Patient age	Gender	Country	Relevant history	Antifungal Treatment	Outcome
Peng J et al.	2021	67	M	China	Smoker, hx of TB, Farmer	Voriconazole, amphotericin B	Improved clinically, radiologically, and repeated cultures were negative
Duan PN et al.	2019	80	M	Vietnam	COPD, hx of gout	Fluconazole	Improved clinically, repeated cultures were negative
Tanabe MB et al.	2018	86	F	USA	Asthma	Itraconazole	Improved clinically, lost follow up
	2004	40	M	USA	Tobacco chewing	Fluconazole, amphotericin B	Improved clinically, radiologically, and repeated cultures were negative
	2008	46	M	Serbia	Smoker	Unsure	Improved clinically
	2011	58	M	India	COPD, SMOKER, HTN	Patient died prior to fungi identification and initiation of antifungal treatment	Death secondary to septic shock with multiorgan failure
	2007	64	M	USA	heavy smoker and alcohol use, COPD, 20-lb unexplained recent weight loss	Voriconazole	Improved clinically
	2014	52	M	India	TB	Itraconazole	Improved clinically
	2014	68	M	India	COPD, TB	Itraconazole	Improved clinically
	2015	75	M	India	Hx of TB	Fluconazole	Improved clinically, lost follow up as patient left against medical advice
	2016	82	M	Nepal	COPD, Contact hx with poultry and farm animals	Fluconazole	Improved clinically, repeated cultures were negative
Zhu M et al.	2013	64	M	China	COPD, CAD	Fluconazole	Improved clinically, repeated cultures were negative
	2018	74	M	China	RUL lobectomy, history of LRTI	Fluconazole	Improved clinically, repeated cultures were negative
	2018	92	M	China	DM	Fluconazole, Flucytosine	Improved clinically, repeated cultures were negative
Supram H et al.	2016	68	M	Nepal	DM, hypertension, ischemic CVA, Contact with poultry.	Fluconazole	Improved clinically, repeated cultures were negative

- Hx: History, TB = tuberculosis, COPD = chronic obstructive pulmonary disease, RUL = right upper lobe, LRTI = lower respiratory tract infection, CAD: coronary artery disease, DM: diabetes mellitus, CVA: cerebrovascular accident, NA: not available.

clinical picture [11]. Additionally, the guideline recommends the timely removal of any central venous access devices. Conversely, the use of echinocandins is strongly discouraged due to their association with high mortality rates and the expected intrinsic resistance. In this case, upon confirming *M. capitatus* infection, the patient was promptly initiated on liposomal amphotericin B for a 14-day course, followed by oral voriconazole. This treatment regimen resulted in demonstrable clinical and radiological improvement. However, due to a slow radiological response, the treatment duration was extended.

M. capitatus is an exceptionally rare infection typically affecting immunocompromised individuals. Internationally, documented cases in immunocompetent patients are limited, and most reported cases involve pre-existing lung pathology. This report details a case of *M. capitatus* infection in an immunocompetent patient with no previous medical history. The diagnostic process for this infection is challenging due to its non-specific clinical presentation. Isolation of the organism remains the cornerstone of definitive diagnosis.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical form

Written informed consent was obtained from the patient or legal guardian(s) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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CRediT authorship contribution statement

Mohammad Bosaeed: Writing – review & editing, Validation, Supervision, Methodology, Investigation, Conceptualization. **Rana Ayesh Alshehri:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Danah Abdullah Albarrak:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Tauseef Sharif:** Writing – review & editing, Validation, Investigation. **Majed Alghamdi:** Writing – review & editing, Validation, Investigation. **Abdullah Abdulrahman Alsunidy:** Investigation, Data curation.

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