



Respiratory multiple infections by bacteria, viruses, fungi, and parasites in a COPD patient: A case report

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ABSTRACT

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SARS-CoV-2 is the causative agent of COVID-19, an infection that can manifest with mild to severe respiratory symptoms. A 70-year-old man with COVID-19 and COPD presented to a hospital complaining of breathing difficulties. A sample was taken, leading to the finding of the *Acanthamoeba* parasite. *Stenotrophomonas maltophilia*, a bacterium known for its resistance to most antibiotics and its significance as a nosocomial pathogen, was identified. Furthermore, for the first time, the *Gloeotinia fungus* was discovered as an endosymbiont of *Acanthamoeba*. The patient underwent successful treatment and was discharged from the hospital. Immunocompromised people should be concerned about the increasing incidence of nosocomial infections. The presence of *Acanthamoeba* should not be overlooked in respiratory disorders, as it has the potential to carry numerous pathogenic microorganisms as endosymbionts.

Keywords: SARS-CoV-2, COPD, *Acanthamoeba*, Endosymbiont, *Stenotrophomonas maltophilia*, *Gloeotinia*

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1. Introduction

SARS-CoV-2 causes COVID-19, which may infect individuals with mild to severe symptoms (1, 2). Patients with severe coronavirus disease are susceptible to a variety of infections, especially bacterial infections (1). COVID-19 patients with bacterial coinfection or secondary infection have a higher in-hospital mortality rate (3). The predominant agent detected, *Staphylococcus aureus*, accounted for about half of the early-onset bacterial etiologies (4). However, with the increase in the number of COVID-19 patients, the possibility of bacterial, fungal, and even parasitic co-infections may exist. On the other hand, exposure to opportunistic microorganisms and a compromised immune system may result in life-threatening diseases (5). In this unique case, we would like to introduce a patient with chronic obstructive pulmonary disease (COPD) who infected COVID-19 and was interestingly infected with *Stenotrophomonas bacterium*, *Glutinaea fungus*, and *Acanthamoeba* parasite.

2. Case report

A 70-year-old male was admitted to the Razi hospital in northern Iran with complaints of having breathing difficulties and a loss of appetite. The patient has also had several respiratory infections in the past few years due to his history of smoking and COPD. The decision was reached to admit the patient and carry out further inquiry based on the patient's condition, laboratory results, and positive COVID-19 test result. Considering the respiratory disorder caused by the *Acanthamoeba* parasite, samples were taken from his nasal and pharyngeal. Then it was cultured in non-nutrient agar (NNA) medium and underwent daily surveys to ascertain the existence of parasites. On the third day, *Acanthamoeba* was detected (Fig. 1).

To confirm the pathogenicity assessment, a polymerase chain reaction (PCR) was done, and it was found that the genotype of the

isolate is T4, which is the most pathogenic type of *Acanthamoeba*.

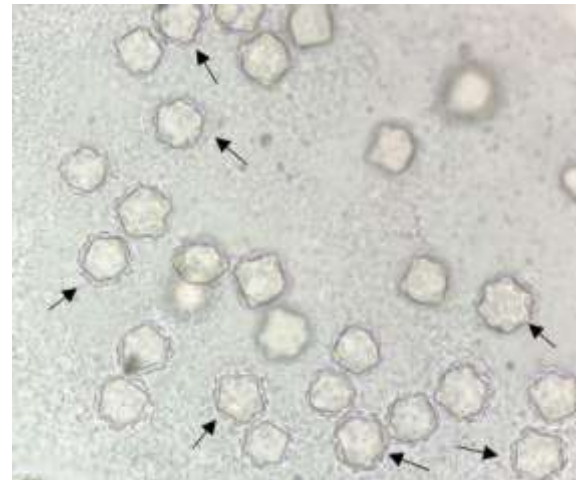


Fig 1. Cysts of *Acanthamoeba* (arrows) in NNA medium culture

Also, to further evaluate the pathogenicity, osmo-tolerance, thermo-tolerance, and cytopathic effect assays (CPE) were done. The isolate was able to grow even at an osmolarity of 1% and a temperature of 37 and even 42 degrees Celsius. It also had the killing power of all Vero cells in the CPE test, which showed its high pathogenicity. Also, due to the ability of *Acanthamoeba* to carry different microorganisms, endosymbiont fungi and bacteria were investigated through PCR and relevant universal primers and sequencing in the Gene Bank. *Stenotrophomonas maltophilia* (*S. maltophilia*), a significant nosocomial and resistant to most antibiotics, has been detected. For the first time in the world, the *Gloeotinia* fungus was found as an endosymbiont of *Acanthamoeba*. Pathogenicity assessment and genotyping of *Acanthamoeba* and its endosymbionts are shown in Table 1. Prescribed Tab: cotrimoxazole 960 mg and ciprofloxacin 500 every 12 hours. Also, for remdesivir, the initial dose was 200 mg on the first day, followed by a dosage of 100 mg for the next four days.

Table 1. Genotyping and pathogenicity assessment of *Acanthamoeba* and endosymbionts in a COPD patient in northern Iran

<i>Acanthamoeba</i> Genotype	Accession numbers	Pathogenicity assessment					CPE	Endosymbiont Bacterium	Accession numbers	Endosymbiont Fungus	Accession numbers
		Osmo- tolerance		Thermo- tolerance							
		0.5 M	1 M	30°	37°	42°					
T4	OQ804428	+	+	+	+	+	+	<i>Stenotrophomonas maltophilia</i>	OR230259	<i>Gloeotinia</i> sp	OQ822822

He was discharged from the hospital in relatively good condition. The follow-up of the patient in relation to these four microorganisms continued for two months until he completely recovered.

Discussion:

This is the first report of a simultaneous infection involving four different types of microorganisms in COPD patients. Individuals with a susceptibility to opportunistic infections should be concerned about the rising number of *S. maltophilia* infections because of the high fatality/case ratio linked to this bacterial killer. Although this bacterium can infect a variety of organs and tissues, respiratory tract infections are the most prevalent site of infection (1). The presence of *Acanthamoeba* in dust and biofilm samples collected from hospitals and clinical environments across the world gives rise to significant health apprehensions, especially for individuals who are highly susceptible to infections (2, 3). This prevalent and widely spread free-living amoeba is commonly found in various ecological settings, such as soil, water, air, dust, and sewage samples (4). It is considered a nosocomial infection and can serve as a reservoir for some pathogenic microorganisms (5, 6).

The relationship between *Acanthamoeba* and SARS-CoV-2 is currently not well understood, and much more study is needed (7). *Gloeotinia* is an unexplored group of plant pathogenic fungi that exhibit necrotrophic and

opportunistic behavior. It decomposes tissues of diverse plant species (8), and probably this person had been exposed to soil that was contaminated by it and also *Acanthamoeba*. It is very interesting that *Acanthamoeba*, a nosocomial infection (6), has been discovered to harbor another nosocomial infection (*S. maltophilia*) in a patient with COVID-19. In some studies, evidence has been provided that endosymbionts play a role in increasing the pathogenicity of *Acanthamoeba*. A study done by Fritsche et al. showed that endosymbionts could enhance CPE in cell culture (9). Also, Hajjalilo found that *Acanthamoeba* lacking endosymbionts exhibited mild pathogenicity, whereas those with endosymbionts were highly pathogenic and caused the destruction of vero cells in the CPE test (6). We recommend that related assessments be taken for *Acanthamoeba* and its endosymbionts in respiratory patients because the treatment of those can be other respiratory disorder challenges, such as COVID-19.

Conflict of interest

None declared.

Author contribution

Eissa Soleymani and Amir Hossein Maghsood were involved in the collection of samples and data. Shadi Shayesteh Azar, Keihan Shabankhani, and Seyed Reza Mirbadie were involved in the interpretation, writing, and editing of the manuscript. Eissa Soleymani prepared the draft and final version of the

manuscript and also performed the PCR. Mahdi Fakhar judgmentally revised the entire manuscript. All authors reviewed and approved the final version of the manuscript.

Data availability statement

The data that supports the findings of this study is available from the corresponding authors upon reasonable request.

Ethics statement

The authors declared that appropriate written informed consent was obtained from the patient for the publication of this manuscript.

Reference

- O'Toole RF. The interface between COVID-19 and bacterial healthcare-associated infections. *Clin Microbiol Infect.* 2021;27(12):1772-6.
- Taheri A, Davoodi L, Soleymani E, Ahmadi N. New-onset myasthenia gravis after novel coronavirus 2019 infection. *Respirol Case Rep.* 2022;10(6):e0978.
- Wu HY, Chang PH, Chen KY, Lin IF, Hsieh WH, Tsai WL, et al. Coronavirus disease 2019 (COVID-19) associated bacterial coinfection: Incidence, diagnosis and treatment. *J Microbiol Immunol Infect.* 2022;55(6 Pt 1):985-92.
- Elabbadi A, Turpin M, Gerotziafas GT, Teulier M, Voirit G, Fartoukh M. Bacterial coinfection in critically ill COVID-19 patients with severe pneumonia. *Infection.* 2021;49(3):559-62.
- Siddiqui R, Niyayati M, Abouleish MY, Khamis M, Ibrahim T, Khan NA. COVID-19: Acanthamoeba Creeps into the Brain. *Iran J Parasitol.* 2023;18(2):272-4.
- Li K, Yu K, Huang Z, Liu X, Mei L, Ren X, et al. *Stenotrophomonas maltophilia* complex: insights into evolutionary relationships, global distribution and pathogenicity. *Frontiers in Cellular and Infection Microbiology.* 2024;13:1325379.
- Niyayati M, Rezaeian M. Current Status of Acanthamoeba in Iran: A Narrative Review Article. *Iran J Parasitol.* 2015;10(2):157-63.
- Soleymani E, Fakhar M, Davoodi L, Motavallihaghi S, Sharifpour A, Maghsood AH. Isolation, characterization, and pathogenicity assay of Acanthamoeba and its endosymbionts in respiratory disorders and COVID-19 hospitalized patients, northern Iran. *Exp Parasitol.* 2024;262:108774.
- Rayamajhee B, Willcox MDP, Henriquez FL, Petsoglou C, Subedi D, Carnt N. Acanthamoeba, an environmental phagocyte enhancing survival and transmission of human pathogens. *Trends in Parasitology.* 2022;38(11):975-90.
- Henriquez FL, Khan NA: Acanthamoeba: Biology and Pathogenesis. *Parasites & Vectors.* 2009;2(1):16.
- Hajjalilo E, Rezaeian M, Niyayati M, Pourmand MR, Mohebbi M, Norouzi M, et al. Molecular characterization of bacterial, viral and fungal endosymbionts of Acanthamoeba isolates in keratitis patients of Iran. *Exp Parasitol.* 2019;200:48-54.
- Mirabedini Z, Ahmed Khan N, Niyayati M, Javanmard E, Hamedanipour M, Arab-Mazar Z. Can Free Living Acanthamoeba Act as a Trojan Horse for SARS-Cov-2 on Viral Survival and Transmission in the Environment? A Narrative Review. *Iran J Parasitol.* 2022;17(2):138-44.
- Viviano a, Benvenuti c, Strangi a, Iovinella i, Mazza g, Paolo g, et al. Preliminary assessment of entomopathogenic fungi and nematodes in hot springs in central Italy with the first record of *Pristionchus uniformis* for the country. *Biogeographia—The Journal of Integrative Biogeography.* 2022;37:a017.
- Fritsche TR, Sobek D, Gautam RK. Enhancement of in vitro cytopathogenicity by Acanthamoeba spp. following acquisition of bacterial endosymbionts. *FEMS Microbiol Lett.* 1998;166(2):231-6.