

A Case Study of the Treatment Strategies Employed to Cure a COVID-19 Patient with Multiple Infections Successfully

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Abstract

The COVID-19 pandemic has given rise to new clinical challenges in healthcare settings. One of these challenges includes a heightened risk of secondary invasive bacterial and fungal infections, which have been associated with a notable mortality rate. We report a fatal case of a COVID-19 patient with two bacterial and one fungal infection successfully cured. A woman went to the hospital with fatigue, cough, chest and abdominal pain, nausea, and vomiting symptoms. She tested positive for COVID-19 and had underlying health conditions. She had a bacterial infection called *Klebsiella Pneumoniae*. The bacteria were resistant to many antibiotics, but colistin was effective. After 20 days in the ICU, she developed a fungal and *Enterococcus faecalis* (which was a Vancomycin-Resistant Enterococcus (VRE)) infection. The second bacteria were treated with linezolid. After 35 days in the hospital, she was discharged with no signs of infection. It is crucial to include proper bacterial screening and treatment when addressing COVID-19.

Keywords: Q Angle; COVID-19; *Klebsiella Pneumoniae*; *Enterococcus Faecalis*; Fungal Infection; Case Report.

1. Introduction

The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had a profound impact on the world. This virus is responsible for causing the coronavirus disease 2019 (COVID-19), which has rapidly spread across the globe since it was first identified in China at the end of 2019 [1, 2]. COVID-19 patients typically present with a range of symptoms, including fever and respiratory tract symptoms such as coughing, shortness of breath, and sore throat. These symptoms can vary in severity from mild to severe and can lead to hospitalization or even death in some cases [3, 4]. A secondary bacterial infection was found in fifty percent of patients who succumbed to COVID-19 [5]. The occurrence of bacterial coinfection and secondary infection is typically low, but it is higher in those who are critically ill and require intensive care. Several studies have reported that antibiotics are frequently administered to COVID-19 patients admitted to the ICU, which may contribute to the rise of multidrug-resistant bacteria [6]. Among COVID-19 patients, the bacteria, namely, *Klebsiella pneumoniae*, *Acinetobacter spp.*, *Pseudomonas spp.*, *Escherichia coli*, and *Staphylococcus spp.* are the most frequently detected causative pathogens [7]. In this case report, we describe

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a case of co-infection with *Klebsiella pneumoniae*, vancomycin-resistant enterococcus (VRE), and SARS-CoV-2. The timely diagnosis and prompt management of the patient's condition proved to be beneficial.

2. Case Report

A 58-year-old woman presented to Al-Zahra Hospital in Isfahan City, Iran. Her symptoms were Fatigue, dry cough, chest pain, abdominal pain, nausea and vomiting which were presented for 8 days. She had a history of underlying diseases such as DM*, HTN† and HLP‡. Two days before admission to the emergency ward of the hospital the SARS-CoV-2 RT-PCR test was positive. At the time of referral, the blood oxygen was 73%, as measured by pulse oximetry.

Table 1. Relevant lab investigations

Tests	Results
WBC ($\times 10^3/\mu\text{L}$)	4800
CRP	35
HGB [§] (g/dL)	10.2
D-Dimer	1800
PLT ^{**} ($\times 10^3/\mu\text{L}$)	139000
PTT(s)	28

On the first day of admission, the patient was transferred to the ward. C- reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were evaluated 35mg and 44 (mm/hr) respectively. Lung High-Resolution Computed Tomography (HCRT) was reported moderate severe COVID-19 Pneumonia. Other laboratory data are presented in (Table 1). In addition, remdesivir 200mg/d IV started from the second day of hospitalisation and the day after remdesivir injected 100mg/d.

Table 2. All medications taken by the patient during hospitalization in the intensive care unit

Dosage form	Medicine	Dosage
Amp	Midazolam	3 gr
Tab	Furosemide	20 mg
Eff	N-Acetyl Cysteine	600 mg
Amp	Dexamethasone	8 mg
Amp	Insulin	Regular and NPH
Amp	Colistin	4.5 mg
Amp	Acetaminophen	150 mg
Amp	Pantoprazole	40 mg
Tab	Magnesium	250 mg
Tab	Chlordiazepoxide	5 mg
Syrup	Bisacodyl	5 mg
Syrup	Bromhexine	8 mg
Spray	Atrovent N	20 mc/puff
Tab	Prednisolone	20 mg
Cap	Ferrous Glycine Sulphate	80 mg
Mouthwash	Chlorhexidine	2% w/v

She stayed at the ICU for 2 weeks with orotracheal intubation. The patient received supportive care and antibiotic and antiviral therapy (Table 2). After 72 hours the patient is physical findings were as follows: fever (39.0 °C), [SpO₂]

* Diabetes mellitus

† Hypertension

‡ Hyperkeratosis lenticularis perstans

§ Hemoglobin

** Platelet

90% with oxygen, blood pressure was normal (117/77 mmHg), RR* (27), PR† (71) and there was an increase in CRP (92) level. On the 5th day, *Klebsiella Pneumoniae* (> 10⁵ CFU/mL) was observed in the sample of tracheal secretions and urine culture, which was sent to the laboratory unit. Due to an antibiogram test, the bacteria was reported as “no sensitive” (resistant to Amikacin, Trimethoprim / Sulfamethoxazole, Meropenem, Cefepime, Piperacillin-Tazobactam, Levofloxacin.) Investigation of sensitivity and resistance to colistin based on the CLSI standard pattern requires MIC‡, which performs in 24hours. The E-test result showed MIC 1.5 Mg/mL of colistin for *Klebsiella Pneumoniae*. Colistin was prescribed once daily for 14 days in response to an increase in CRP. Because of long immobility, back and limb physiotherapy was performed on the 8th day of hospitalization in the ICU. The following day, it was verified that the patient had shown an improvement in their level of consciousness. Subsequently, we conducted a spontaneous awakening trial and a spontaneous breathing trial before extubation. After the extubation procedure, the patient was required to abstain from eating or drinking until 8 hours had passed. Additionally, it is worth noting that the respiratory condition and level of consciousness of the patient became stable.

The patient was moved to the respiratory ward after 20 days of admission to the ICU. Two days' later urine culture showed growth of fungi (6000 CFU/mL) and 75000 CFU/mL of *Enterococcus faecalis* (VRE) and there was no sign of *Klebsiella Pneumoniae*. The antibiogram test for *E. faecalis* reported that the bacteria were susceptible to Linezolid and resistant to ciprofloxacin, vancomycin, penicillin G, tetracycline, gentamycin, and ampicillin. Therefore, linezolid 600mg prescribed every 12 hours. A Nasogastric Tube (NGT) and Foley catheter weren't needed for her during the time she stayed in the ICU.

Finally, the patient's fever stopped, and vital signs and spontaneous breathing stabilized. Therefore, she was discharged after 35 days after her first admission to the hospital with normal general condition and no signs of infection.

3. Discussion

In this report, we are pleased to present a case study that highlights the successful early diagnosis and treatment of a patient who was suffering from SARS-CoV-2 and coinfection with both *Klebsiella Pneumoniae* and *Enterococcus faecalis*. This case is particularly noteworthy because it underscores the importance of considering the possibility of co-infection in patients who are diagnosed with COVID-19.

From this study, we can draw two important conclusions. Firstly, healthcare professionals should be aware of the possibility of co-infection in patients who are diagnosed with COVID-19. This means that patients should be thoroughly examined and tested for other potential infections in addition to COVID-19. Secondly, early diagnosis and treatment of any bacterial infections that may be present is crucial for ensuring positive patient outcomes.

Approximately 7% of all admitted COVID-19 patients are co-infected with bacteria. In severe cases of COVID-19 requiring ICU admission, the rate of co-infection rises to 14%, with *Mycoplasma* being the most prevalent bacterium responsible for co-infections, followed by *Pseudomonas aeruginosa*. Among viruses, respiratory syncytial virus (RSV) is the most frequently encountered, followed by influenza A [8-10].

In 2023, a comprehensive meta-analysis was conducted to determine the prevalence of bacterial co-infection among patients. The results of the study indicated that approximately 12% of the patients presented with bacterial co-infection, with a confidence interval of 95% ranging from 8% to 16%. Out of the twenty studies analyzed, which accounted for 31.4% of the total sample, it was found that a clear definition of bacterial co-infection was provided. This definition states that the diagnosis of bacterial co-infection must be made within 48 hours of admission. To make this diagnosis, all twenty studies included cultures, urinary antigen testing, and PCR analysis [11].

The pivotal care administered to this patient encompassed several essential measures, including the provision of a dedicated isolation room marked with a red label, stringent adherence to hand hygiene protocols for therapeutic purposes, compulsory utilization of personal protective equipment, proper disposal of infectious patient waste in double biohazard-labelled bags, regular washing and disinfection of both equipment and the patient's immediate environment 2-3 times per shift, meticulous preparation of recultures under sterile precautions overseen by the infection control interface, and the scheduled bathing of the patient with a 2% chlorhexidine solution on alternate days.

This case report aligns with previous case reports that highlight the association between diabetes mellitus and its predisposing role for SARS-CoV-2 and candidiasis co-infection. Furthermore, the patient in this case presented with multiple comorbidities, notably diabetes mellitus and hypertension, both of which amplify the severity of COVID-19 and the susceptibility to co-infection or superinfection with other microorganisms.

The patient in this case is co-infected with two bacterial pathogens, which were confirmed by urine and tracheal samples, making it a rare presentation. Antibiotics were initiated upon admission and changed based on culture

* Respiration Rate

† Pulse Rate

‡ Minimum Inhibitory Concentration

sensitivity results. Since the patient was suffering from underlying diseases, changes in the patient's liver enzyme levels were checked every two days after being transferred to the intensive care unit. It was found that ALT* went from about 33 to 215. This increase can be due to the use of antiviral drugs and their side effects.

Therefore, we monitored the patient for 6 months after his discharge from the hospital and checked his condition. Except for the common complications caused by COVID-19 such as hair loss and weakness in the leg muscles, no other complications were observed. The patient's liver enzymes had returned to their normal levels.

It is unclear whether these medications provided protection against further respiratory compromise or multi-organ involvement despite the presence of COVID-19 infection, and further exploration is necessary. The outbreak of this new virus has challenged the economic, medical, and public health infrastructure worldwide.

4. Conclusion

Multi-drug-resistant bacterial infections can prove fatal in COVID-19 patients, particularly those with co-morbidities such as diabetes, as demonstrated by this case report. Additionally, the report highlights the inadequacy of biochemical testing in identifying rare and emerging bacterial infections. Therefore, it is essential to incorporate proper bacterial screening and treatment in managing COVID-19, especially for patients with co-morbidities like diabetes, hypertension and those with indwelling devices.

5. Declarations

5.1. Author Contributions

Conceptualization, R.A. and D.M.; methodology, D.M.; validation, K.S., D.M., and R.A.; formal analysis, R.A.; investigation, K.S.; resources, A.P.; data curation, K.S.; writing—original draft preparation, R.A.; writing—review and editing, D.M.; visualization, A.P.; supervision, D.M.; project administration, R.A. All authors have read and agreed to the published version of the manuscript.

5.2. Data Availability Statement

Third Party Data: Restrictions apply to the availability of these data. Data was obtained from Al-Zahra Hospital and are available from Arezoo Pourdad with the permission of Al-Zahra Hospital.

5.3. Funding

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5.5. Ethical Approval

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the Ethics Committee of Isfahan University of Medical Sciences (IR.ARI.MUI.REC.1402.048) approved the protocol.

5.6. Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of the Isfahan University of Medical Sciences (protocol code 60036 and date of approval).

5.7. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

5.8. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

* Alanine transaminase

6. References

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