

**COVID-19: No Guaranteed Protection From Future
Infection After the Initial Diagnosis**

Abstract

The world of microbiology is vast in nature and viruses continue to be a subset that contains a lot of unknowns. We develop lifelong immunity after the initial infection with some viruses like Varicella-Zoster and Measles. For other viruses like Influenza, on the other hand, we require yearly vaccines that may not always be effective. This can be attributed to antigenic shift and drift preventing previously made antibodies against ineffective against the new strain of Influenza.

The five cases to be displayed in this manuscript presented with mild acute respiratory symptoms and tested positive for COVID-19. After recovering from their diagnosis and being asymptomatic for a couple of months, again presented with acute respiratory symptoms. They all tested positive for COVID-19 once again and their second infection would also prove to be worse than the first.

In the current state of the world, COVID-19 has created a lot of unknowns in the medical community including presentation and treatments. With the new discoveries of the virus that occur daily, there is still a lot of unknowns. Will a sufficient antibody response be created by the human body in those infected with COVID-19 and how long will that immunity last? Will antigenic drifting occur quickly allowing the virus to evade previously made antibodies? An immune response similar to what was observed with SARS-CoV-1 and MERS-CoV, part of the same viral family as COVID-19 was expected. This may not necessarily be true as outlined in this manuscript.

Background:

The COVID-19 pandemic has taken the medical community off guard with the amount of uncertainty regarding the virus. The treatment algorithms change frequently and the basic understanding of how the virus acts is also ever evolving. One idea that has been a consistent thought process through the infectious world is that once a patient has been infected with COVID-19, there would be adaptive immunity as a result. Kirkcaldy et. al. (2020) presented the belief that antibodies are generated over the subsequent weeks and that suggest that a reinfection with COVID-19 would be unlikely. With the ever-evolving information that is gathered about COVID-19, what will be demonstrated is that adaptive immunity may not be present in all those who have been infected by COVID-19 and/or antibodies may wear off in a short time period.

The cases:

The first case, a 49-year-old male with no significant past medical history who initially had upper respiratory illness symptoms in February 2020 but was never diagnosed due to lack of testing ability at that time. In April, he presented to urgent care with his only symptoms being nasal congestion but history of exposure to individuals with COVID-19. At this time, his COVID-19 was positive and retested positive five days later. Serum IgG levels were negative six days after the initial positive test. He had no symptoms at that time of the retest, five days after the initial test.

In July, he had a new exposure to a family member with COVID 19 infection and presented to the emergency department with upper respiratory symptoms including low grade fever, shortness of breath, nausea, and diarrhea was tested for COVID-19 and was subsequently negative. Four

days later, he presented to the emergency department once again due to worsening shortness of breath and acute hypoxic respiratory failure. The patient's PCR COVID-19 was positive, the serum IgG was negative, and the stool PCR was positive. The patient was discharged after receiving Dexamethasone, tocilizumab, received 2 units of convalescent plasma, and completed a course of Remdesivir. SARS-COV-2 antibody test done a couple weeks after discharge resulted positive for serum IgG.

The second case is a 73-year-old female with a past medical history significant for diabetes, hypertension, and GERD initially presented with upper respiratory symptoms at the end of April and tested positive for COVID-19 by RT-PCR. She subsequently tested negative two weeks later. At the end of July, the patient was admitted for increasing shortness of breath. She was started on Dexamethasone, Remdesivir, and given one dose of tocilizumab for high suspicion for COVID-19. The COVID-19 PCR test returned positive. She currently remains hospitalized at the time of submitting this manuscript.

The third case is a 50-year-old female with a past medical history significant for COPD, CHF, and seizure disorder initially was admitted at the end of March for a COPD exacerbation. At this time, her COVID-19 test was negative. She presented to the emergency department mid-April for a worsening cough and was tested once again for COVID-19 which was negative. A week later, she was admitted for worsening shortness of breath, wheezing, and worsening cough. At this time, she tested positive for COVID-19 and discharged two days later. One and a half weeks later, she presented to the emergency department again for worsening shortness of breath and discharged three days later, COVID-19 during this time was negative. She was admitted once again in June 2020 for three days for worsening shortness of breath secondary to a COPD exacerbation and COVID-19 during this time was negative. At the beginning of July, she once

again presented to the emergency department for worsening shortness of breath. Was admitted for two days and tested positive for COVID-19 but from a respiratory stand point was asymptomatic and saturating well on room air.

A fourth case is an 80-year-old male with a past medical history significant for end stage renal disease, hypertension, and diabetes initially presented at the beginning of April with a chief complaint of general weakness. Chest x-ray was pertinent for pulmonary vascular congestion. He ended up testing positive for COVID-19 during this admission and discharged after 4 days. The patient returned at the beginning of July for a malfunctioning vas-cath but tested negative for COVID-19 during this short stay. He returned to the hospital at the end of July for altered mental status and lethargy. Chest x-ray showed similar pattern as before with pulmonary vascular congestion. He tested positive once again for COVID-19 and currently remains hospitalized at the time of manuscript being submitted, being treated with empiric antibiotics and dexamethasone.

The final case is a 24-year-old female with a past medical history significant for asthma, morbid obesity, and PCOS initially presented to urgent care at the end of April with complaints of fever, nausea, vomiting, and cough. She tested positive for COVID-19 but was stable enough to be sent home. At the beginning of July, she presented to urgent care with upper respiratory symptoms and fever. She was sent home with COVID-19 pending which resulted positive. The patient returned to the emergency department three weeks later complaining of lower extremity weakness. She was tested once again for COVID-19 and tested positive. During this hospital stay, the patient was treated with a course of solumedrol and Remdesivir.

Discussion:

The purpose of this manuscript is to demonstrate that the information regarding COVID-19 is ever evolving. What was once thought that there may be immunity from COVID-19 after being infected has shown that this is not the case. Whilst it is hard to prove whether these cases represent infection versus reactivation, confirmed new exposure followed by development of symptoms in one of them is highly concerning for reinfection.

As written by Kellam and Barclay (2020), an antibody response is expected between 10-14 days after infection but there is the possibility that like other coronaviruses, that antibodies will decrease over time. There is also evidence through these cases that these individuals were infected initially had mild courses. It was their second infection that proved to be much worse requiring hospitalization.

Ibarrondo et. al. in their letter to the editor correspondence New England Journal of Medicine (2020), state that while it is unknown how protective an adaptive immunity may be, the duration of the COVID-19 antibodies that may exist and immunity offered is finite. The antibodies generated start to down trend over one to three months after the initial diagnosis. This would allow a possible reinfection due to a limited immune response from an adaptive immunity standpoint.

Long et. al. (2020) were able to detect the virus for up to four weeks after infection showing the extended duration of the virus's presence. It was initially thought that the virus may behave similarly with the other coronavirus family viruses such as SARS-CoV-1 and MERS-CoV with IgG levels remaining for greater than two years after an infection to provide immunity.

Ultimately, they proved that the IgG levels in COVID-19 infected individuals decreased much

faster than the other coronavirus family members with a noticeable decrease within a few months after the initial diagnosis. Those with asymptomatic infection became sero-negative earlier than those with symptomatic infection.

While we hope that the development of herd immunity might be an useful technique to prevent the spread of COVID-19, that can prove challenging if the immunity only lasts for two to three months after the initial infection. While we hope that COVID-19 infection will result in life long immunity as seen with Varicella-Zoster or Measles, current evidence and our experience does not support that theory.

Prevention of Influenza, requires yearly vaccines, due to the minor genetic changes via antigenic drifts or occasional major changes due to antigenic shift. The unknown of how COVID-19 behaves may prove difficult to generate vaccines to trigger an immune response. Vaccines may prove to be difficult if there is in fact rapid antigenic drifting occur which would explain why individuals can be re-infected in as little as two months after their initial infection. This supports the notion that reinfection with COVID-19 is possible and should be included in a differential in any patient that may be presenting with upper respiratory symptoms regardless of a prior diagnosed infection of COVID-19.

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