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Can HIV drugs help COVID-19 patients?

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Abstract

Since its emergence in December 2019, the new *coronavirus* has killed tens of thousands of people. While *social distancing* limits the spread of the disease, it's not enough to end the *epidemic*. Both *vaccines* and drugs are a great weapon against viruses, but they take a long time to create. This is why we turned to existing antiviral drugs.

We chose an anti-*HIV* treatment because it showed positive results against other coronaviruses. A total of 200 adults with confirmed severe coronavirus infection participated in our trial. Half of them received the anti-HIV treatment while the others served as a *control group*. We found that these drugs weren't particularly useful in patients with severe coronavirus infection. The treatment failed to speed up the patients' improvement. It didn't reduce the *viral load*, either.

Introduction

The coronavirus (Fig. 1) is everywhere on the news! The new disease, named *COVID-19*, has scared a lot of people with its easy *transmission* and the many deaths it has caused. In just three months, COVID-19 has claimed the lives of more than 30,000 people. Moreover, as with any new disease, scientists are still unsure of its long-term effects.

The new coronavirus is not only in the news, but also in most of our lives – with many countries trying to limit its spread. And while *social distancing* definitely works and slows down the virus, governments can't prolong this forever. What other measures are out there? This is where science can help.

Vaccines are a great measure against many viruses. If the virus can't infect you, you can't transmit it further. But it takes a long time for scientists to create a perfectly safe vaccine.

A more immediate measure would be drugs. Unfortunately, new drugs also take a long time to produce and test. Many physicians are thinking of using drugs we already have for other viruses. Even though they weren't created for use against COVID-19, they could still be useful. After all, despite all the differences among different viruses, they share certain similarities as well. This is why we tried an approved anti-*HIV* drug among adult patients with confirmed COVID-19 infection. Would it stop the virus from *replicating*? Would it improve the patients' health? That's what we wanted to find out.

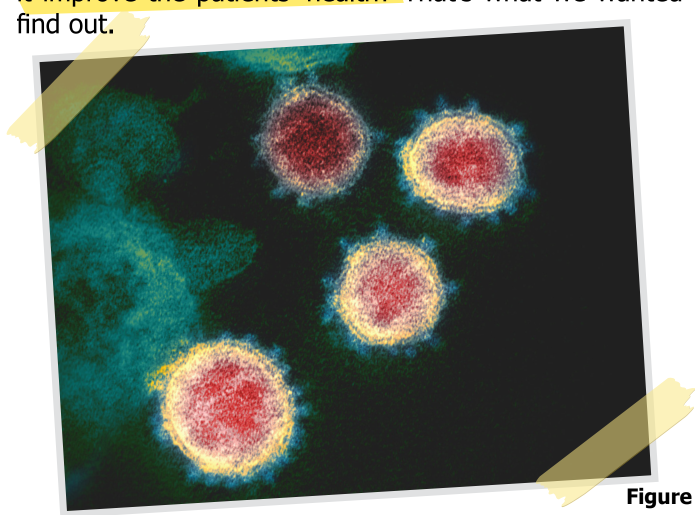

Figure 1:
Electron microscope image of the virus SARS-CoV-2, which causes the disease COVID-19. (Image: NIAID)

Methods

We decided to try an approved combination of anti-HIV drugs: lopinavir-ritonavir. We knew these drugs significantly slow down HIV replication. But more importantly, they were useful in the fight against previous coronavirus epidemics caused by SARS and MERS. (See *coronaviruses* in the Glossary) For our trial, we chose 200 adult patients with confirmed severe COVID-19 infections. Their median age was 58 years. Half of these patients received the anti-HIV drugs for 14 days, plus *standard care*, while the other half received standard care only. The second group served as a *control*. All of the patients had pneumonia (a severe form of the illness) and difficulty breathing.

We regularly checked the patients' blood for the presence of the virus using *PCR* (a genetic test). Even more importantly, we tracked whether they had any improvement, or not.

What is a clinical trial?

Researchers have to evaluate the **effectiveness** and **safety** of different treatments or vaccines. This is why they monitor the effects on a number of people. Usually, the researchers divide the patients into two or more groups:

- a group that receives the new treatment
- a control group (which doesn't receive it)
- a group that receives an inactive substance, called placebo, while thinking they are receiving real treatment. This is used to eliminate psychological effects.
- a group that receives a previously approved medicine.

Usually, new medications are tested first on healthy people before testing them on patients.

Results

Unfortunately, the patients who received anti-HIV drugs did not improve faster than the control group (Fig. 2).

Moreover, in most cases, we were able to detect the virus in both groups at various time points (days 5, 10, 14, 21 and 28). This shows that the drug was not able to significantly reduce viral replication.

On the other hand, *mortality* among patients who received anti-HIV drugs was slightly lower in comparison to the control group but the difference was not significant.

Are the patients receiving the anti-HIV treatment improving significantly faster than the control group?

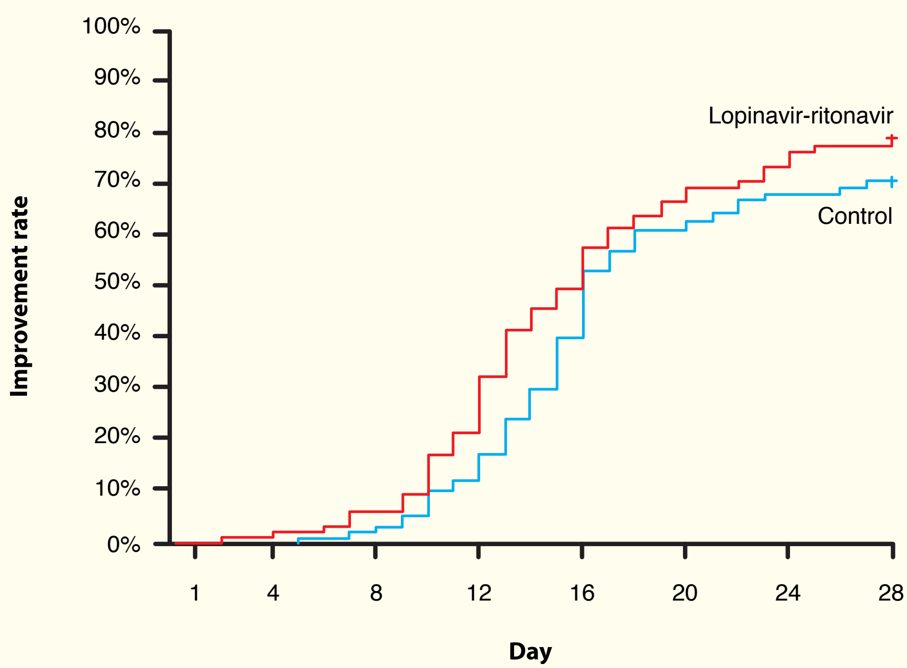

Figure 2: Improvement by day in both groups: the group receiving the anti-HIV drugs (in red) compared to the control group (in blue).

Discussion

Our trial showed that lopinavir-ritonavir treatment did not improve the patients' health faster than standard care did. The anti-HIV treatment didn't have a significant impact on mortality rates either – at least not in severe cases, which are the ones we chose for our trial. These findings pose some questions for further research:

- Would this treatment have a positive effect in less severe cases?
- Would earlier treatment have a greater impact on the patients' health?

Lopinavir-ritonavir treatment wasn't able to reduce the viral load (concentration) either. This means the drugs don't have an antiviral effect and can't slow down the replication of the virus. Since the patients received a fixed concentration of the drugs, we wonder whether a higher concentration would perform better. Furthermore, we only took the patients' samples on certain days. We believe more frequent samples would have provided richer information on the virus's behavior.

Conclusion

Science is not always about positive results. On the contrary, scientists learn a lot from "failed experiments". And while we would have loved for this treatment to help a lot of patients, our research is still another step towards finding a solution.

And while we all wait for that, remember that the best prevention so far against the virus is:

- Wash your hands regularly with soap for 20 seconds.
- Avoid close contact with people, especially sick ones.

Glossary of Key Terms

Control group – the standard to which scientists make comparisons in an experiment. In our case, people who don't receive the drug are the control group.

Coronaviruses – a group of closely related viruses that usually cause respiratory infections in humans. The symptoms can be mild or non-existing, or severe - pneumonia, coma, death. Well-known coronaviruses are SARS-CoV (severe acute respiratory syndrome coronavirus), MERS-CoV (Middle East respiratory syndrome coronavirus) and SARS-CoV-2 - the virus causing the current pandemic.

COVID-19 – Coronavirus disease, a disease caused by SARS-CoV-2, symptoms may include fever and dry cough in milder cases and difficulty breathing in more severe cases.

Epidemic – a spread of a disease in a large number of people at the same time. If the epidemic spreads to many areas of the world, it's called a pandemic.

HIV (Human Immunodeficiency Virus) – the virus that can lead to Acquired Immune Deficiency Syndrome (AIDS), if not treated. There are several different types of drugs against HIV.

Mortality – the number of deaths during a particular period of time.

PCR (Polymerase Chain Reaction) – a method for creating multiple copies of a specific part of the genetic material. By making a lot of copies, we can visualize them and eventually identify them.

Replication (viral) – the formation of new viruses.

Social distancing – deliberately increasing the space between people to avoid the spreading of illness.

Standard care – as needed, patients receive antibiotics, supplemental oxygen, etc.

Transmission – the passing of a bacteria, virus or other pathogen from one person to another.

Vaccine – a person receives parts of virus/bacteria or weakened versions of pathogens and develops antibodies against them: the immune system now knows how to fight this type of infection. For instance, most children receive Measles, Mumps and Rubella vaccine (MMR) to prevent getting these diseases in the future.

Viral load – the number of viral particles in a certain volume (e.g. of blood), the concentration of the virus.

Check your understanding

1. What is the difference between COVID-19 and SARS-CoV-2?

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2. Why is social distancing important?

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3. Why did we choose anti-HIV drugs to try treating severe COVID-19 patients?

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4. Why did we include 100 patients who didn't receive the anti-HIV treatment in our experiment?

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5. The anti-HIV drugs weren't able to reduce viral replication. Would you say they were an effective antiviral agent?

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