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Anti-HCV antiviral therapies as an alternative for the treatment of Covid-19

Terapias antivirais anti-HCV como alternativa para tratamento da Covid-19

Terapias antivirales anti-VHC como alternativa para el tratamiento de Covid-19

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Abstract

The current pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread alarmingly around the world at a significantly faster speed than previous coronaviral outbreaks. Due to the lack of a vaccine at the moment, an early antiviral intervention can prevent the spread of the disease worldwide and improve the clinical results of infected patients. The SARS-CoV-2 virus and the Hepatitis C virus (HCV) have a similar structure, replication, and catalytic mechanisms, therefore, several studies have considered the potential for antiviral activity of anti-HCV drugs such as remdesivir, simeprevir, sofosbuvir, and daclatasvir against SARS-CoV-2. Therefore, the present study aims to evaluate and discuss the antivirals already available against HCV, which have also been shown to be potential inhibitors of SARS-CoV-2 replication. The study was based on a literature review,

of a qualitative nature and an exploratory type. Studies with anti-HCV drugs are promising and are already considered to start clinical trials in patients infected with the new coronavirus, having been observed as inhibitors of SARS-CoV-2 viral replication. Thus, the present study brings a pharmaco-clinical review on antivirals remdesivir, simeprevir, sofosbuvir, and daclatasvir, considering the main studies carried out to date in the treatment for Covid-19.

Keywords: Sars-cov-2; Hepatitis c virus; Antiviral; Treatment.

Resumo

A atual pandemia causada pelo vírus da síndrome respiratória aguda grave 2 (SARS-CoV-2) se propagou mundialmente de forma alarmante em uma velocidade significativamente mais rápida do que os surtos anteriores causados por coronaviroses. Devido à falta de uma vacina no momento, uma precoce intervenção antiviral pode impedir a propagação da doença em todo o mundo e melhorar os resultados clínicos dos pacientes infectados. O vírus SARS-CoV-2 e o vírus da Hepatite C (HCV) possuem estrutura, replicação e mecanismos catalíticos semelhantes, portanto, vários estudos consideraram o potencial de atividade antiviral de medicamentos anti-HCV como o remdesivir, simeprevir, sofosbuvir e daclatasvir contra SARS-CoV-2. Diante disso, o presente trabalho, tem como objetivo avaliar e discutir sobre os antivirais já disponíveis contra o HCV que também demonstraram ser potenciais inibidores da replicação do SARS-CoV-2. O estudo baseou-se em uma revisão bibliográfica, de natureza qualitativa e, do tipo exploratório. Os estudos com medicamentos anti-HCV são promissores e já são considerados para iniciar ensaios clínicos em pacientes infectados com o novo coronavírus, tendo sido observados como inibidores da replicação viral do SARS-CoV-2. Assim, o presente estudo traz uma revisão farmaco-clínica sobre os antivirais remdesivir, simeprevir, sofosbuvir e daclatasvir, considerando os principais estudos realizados até o momento no tratamento para Covid-19.

Palavras-chave: Sars-cov-2; Vírus da hepatite c; Antivirais; Tratamento.

Resumen

La pandemia actual causada por el síndrome respiratorio aguda severo coronavirus 2 (SARS-CoV-2) se ha extendido de manera alarmante por todo el mundo a una velocidad significativamente más rápida que los brotes anteriores de coronavirus. Debido a la falta de una vacuna en este momento, una intervención antiviral temprana puede prevenir la propagación de la enfermedad en todo el mundo y mejorar los resultados clínicos de los pacientes infectados. El virus SARS-CoV-2 y el virus de la hepatitis C (VHC) tienen una

estructura, replicación y mecanismos catalíticos similares, por lo tanto, varios estudios han considerado el potencial de actividad antiviral de medicamentos anti-VHC como remdesivir, simeprevir, sofosbuvir, y daclatasvir contra el SARS-CoV-2. Por lo tanto, el presente estudio tiene como objetivo evaluar y discutir los antivirales ya disponibles contra el VHC, que también han demostrado ser inhibidores potenciales de la replicación del SARS-CoV-2. El estudio se basó en una revisión de la literatura, de carácter cualitativo y de tipo exploratorio. Los estudios con fármacos anti-VHC son prometedores y ya se considera que inicien ensayos clínicos en pacientes infectados con el nuevo coronavirus, habiéndose observado como inhibidores de la replicación viral del SARS-CoV-2. Así, el presente estudio trae una revisión farmacoclínica sobre los antivirales remdesivir, simeprevir, sofosbuvir y daclatasvir, considerando los principales estudios realizados hasta la fecha en el tratamiento de Covid-19.
Palabras-clave: Sars-cov-2; Virus de la hepatitis c; Antivírico; Tratamiento.

1. Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a single-strand RNA virus, responsible for the coronavirus disease 19 (COVID-19), which has originally emerged in December 2019 in Wuhan, China, and has already infected more than 20 million people worldwide with drastic social and economic implications. This new coronavirus is a member of the subgenus *Sarbecovirus* in the *Coronaviridae* family, which also includes other coronaviruses as MERS-CoV and SARS-CoV (Hui & Zumla, 2019; Zhou et al., 2020). The SARS-CoV-2 virus is structurally closely related with other viruses, for instance, the hepatitis C virus (HCV) which has a positive-sense single-strand RNA, furthermore both share a similar replication and catalytic mechanism requiring an RNA-dependent RNA polymerase (RdRp) (Dustin et al., 2016; Zumla et al., 2016; Lu et al., 2020).

Despite all the government campaigns to diminish the virus transition rates, the SARS-CoV-2 is spreading at a scale far worse than previous coronaviral outbreaks. Thus, it is clear that effective antivirals and vaccines will be needed in controlling the current pandemic scenario. However, research on the development of possible antivirals agents against SARS-CoV-2 has decreased after previous pandemics (Chen, Yiu, & Wong, 2020). Fast-paced research is already underway to find a way to immunize people against the virus. Prototypes have already been developed, but their efficiency will only be proven after clinical tests divided into three phases, which can take a long time until each stage is completed. Therefore,

due to the lack of a vaccine at the moment, efficient drug testing is extremely necessary (Lurie et al., 2020).

Currently, the treatment of patients with the new coronavirus is essentially based on medication for symptomatic conditions and the use of drugs already available on the market. The most common symptoms are fever, dry cough, malaise, shortness of breath and respiratory distress (Hui et al., 2020). Other symptoms also reported, were sore throat, sneezing, nasal congestion, sputum production, dyspepsia, vomiting and confusion (Chen et al., 2020). Therefore, the redevelopment of new specific drugs based on the genome and biophysical understanding of SARS-CoV-2 has been used to discover potential treatment therapy (Chen, Yiu, & Wong, 2020).

In general, with the subsequent progression of the disease, respiratory symptoms may occur causing acute respiratory distress syndrome (ARDS) followed by secondary infections, so medications such as chloroquine diphosphate, azithromycin, hydroxychloroquine sulfate, and heparin which have been used to prevent thrombotic events. In cases of bacterial infections, antibiotics are used. (Wu et al.; Lotfi, Hamblin, & Rezaei; Lu, 2020). However, there is still no exact and effective treatment for this disease, although the knowledge acquired through extensive research and development efforts can be useful to inform current therapeutic options (Chen, Yiu, & Wong, 2020).

As the SARS-CoV-2 has become a major global health threat, early administration of antivirals is expected to improve the clinical status of infected patients reducing the occurrence of severe cases, so certain therapeutic agents already common for the treatment of other diseases are being investigated all over the world by *in vitro* studies to relieve the burden on health-care systems (Gordon et al., 2020; Lu, 2020). It has been found in recent studies that drugs currently used to treat hepatitis C inhibited the replication of the novel coronavirus in experiments conducted *in vitro*. These experiments considered the potential of antiviral activity of remdesivir (RDV), simeprevir (SPV), sofosbuvir (SFV), and daclatasvir (DCV) anti-HCV therapy against SARS-CoV-2 (Chien et al., 2020; Li et al., 2020; Lo et al., 2020; Sacramento et al., 2020).

In line with their activity against HCV, these drugs would supposedly impair the SARS-CoV-2 RNA synthesis, so they could be considered as possible candidates in clinical trials to treat and to reduce mortality and hospitalization rates. Based on this premise, the objective of this study is to evaluate and discuss potential antivirals already available against viral hepatitis that would also allow the SARS-CoV-2 replication prevention.

2. Methods and Materials

The study is a bibliographic review, of a qualitative nature, with an exploratory characteristic as recommended by Pereira et al. (2018). Consisting of articles selected through searches in national and international databases, such as Medical Literature Analysis and Retrieval System Online (MEDLINE), National Library of Medicine (PUBMED), in addition the Google Academic tool, dissertations and complete theses available to the public with publication date from 2014 to 2020 and include the keywords used (Viral Hepatitis; SARS-CoV-2; Antivirals; Covid-19).

3. Antiviral Agents

Faced with several pathologies caused by viruses having increased over the years, the pharmaceutical industries had the need to find chemicals with antiviral action. Antivirals are used in the prophylaxis of diseases caused by viruses. It works by inhibiting viral replication and can act at different stages of the replication process. Among the mechanisms of prophylaxis of viral infections, we have the inhibition of DNA/RNA synthesis, inhibition of protein synthesis, inhibition of virus release, blockage of virus binding, and immune stimulation. The main reason that leads to the lack of development of antiviral drugs is that it is a time-consuming and expensive process, which prevents the medication from being administered in time to be useful (Bryan-Marrugo et al., 2015).

The huge outbreak of the COVID-19 pandemic worldwide has overburdened health systems in all countries and found themselves without adequate defense mechanisms to face and control the pandemic. Currently, many tests have been invested worldwide to identify an effective drug that does not have many side effects. In the absence of definitive and specific therapeutic drugs, strategies as the use of antivirals already available on the market are an important line of actions against SARS-CoV-2 infection. Therefore, the efficacy of the treatment against the SARS-CoV-2 remains to be validated by appropriately designed clinical trials (Wu et al., 2020).

Hopefully, an early antiviral intervention is expected to allow the spread of SARS-CoV-2 to be controlled by improving patient outcomes by preventing virus replication. With the speed and volume of basic and clinical SARS-CoV-2 research that several researchers are rushing to develop through drugs and potential therapies for this disease, our hope will be close to being realized.

3.1 Remdesivir

Remdesivir (GS5734) is an antiviral developed by the biopharmaceutical company Gilead Sciences in 2017 which is still under clinical development as a treatment for Ebola virus infection (Siegel *et al*., 2017), but it is also in trials, usually in combination with other drugs, to treat other viral infections like HCV due to its direct action that inhibits RNA-dependent RNA polymerase (Tchesnokov *et al.*, 2019). This drug so far is one of the most promising for the treatment of SARS-CoV-2. It is a phosphoramidate prodrug of the C-adenosine nucleoside analog GS-441524, the active form when metabolized (Agostini *et al*., 2018).

Its triphosphate form (RDV-TP) is used as a substrate of several viral RdRp enzymes or complexes. Hence, as already mentioned SARS-CoV-2 and HCV have a similar replication that requires an RNA-dependent RNA polymerase. Although, it is important to understand that RDV-TP can compete with its natural counterpart ATP as a substrate for the RdRp enzyme, but it has been provided in several studies that the incorporation of RdRp is significantly more efficient as a target for GS5734 (Zumla *et al*., 2016; Agostini *et al*., 2018; Gordon *et al*., 2020). However, instantaneous chain termination is not caused when the inhibitor is added to the growing RNA chain at position i. The inhibitor generated RNA synthesis arrest at position i+3 causing the delayed RNA chain termination. The 3'-hydroxyl group of the RDV-TP allows the inclusion of three extra nucleotides until the RNA synthesis is interrupted in the i + 3 position and protects the inhibitor from excision by the activity of the viral 3'-5 'exonuclease causing a decrease in the viral RNA production. A fragment of the extended primer overcomes this arrest leading to the formation of full-length products (Gordon *et al.*, 2020). This mechanism of action helps to explain the high potency of this drug against the novel coronavirus SARS-CoV-2 and other RNA viruses.

Potential antiviral activity against a broad-spectrum of coronaviruses including MERS-CoV and SARS-CoV was demonstrated both *in vitro* and in animal models (Brown *et al*., 2019; Sheahan *et al*., 2020). *In vitro* testing has also evidenced the activity of RDV against the novel coronavirus in the Vero E6 cells (Wang *et al*., 2020). As a way to verify the efficacy and safety of the RDV against the SARS-CoV-2 infection a phase III clinical trial was launched in Wuhan on February 4th, 2020 (Liu *et al*., 2020). Although RDV is considered to be one of the most promising candidates, randomized controlled trials revealed only a marginal shortening of disease duration in treated patients (Wang, Y. *et al*., 2020). In

addition, further *in vivo* evaluation of this drug against SARS-CoV-2 infection is recommended for instance in nonhuman primate models (Wang *et al*., 2020).

It is still early to guarantee the direct antiviral effect of RDV in increasing the elimination of viral loads in the respiratory tract against SARS-CoV-2, but this drug is suggested with a promising therapeutic effect. The results of the studies covered here argue strongly for the continuation of clinical developments of RDV in order to demonstrate its potential usefulness in the treatment of a wide spectrum of CoV infections.

3.2 Simeprevir

Simeprevir is a drug used in combination with other medicines approved for the treatment of chronic HCV infection and it works by inhibiting the NS3/4A protease of the virus (Rosenquist *et al*., 2014; Verbinnen *et al*., 2015). Moreover, *in vitro* data studies showed this drug as a potent inhibitor of SARS-CoV-2 replication in the Vero E6 cellular infection model. Simeprevir showed to be a potent candidate for clinical use alone, but also when used synergistically with RDV has had its efficacy improved. The combination of SPV and RDV apparently provided better suppression of the novel coronavirus SARS-CoV-2 replication than RDV alone. This finding mainly allows lower doses of both drugs to be used to treat SARS-CoV-2 infection.

A study conducted by Lo, has shown that the RDV EC50 was 4.08 μM, while the cytotoxicity concentration (CC50) was 19.33 μM, these reported values were consistent with those already reported in other human cell lines with HCV infection. As for the anti-SARS-CoV-2 mechanism of action of SPV awaits more investigations, it was seen only weakly inhibits M^{pro} protease activity while no inhibition of RNA-dependent RNA polymerase activity *in vitro* was found (Lo *et al*., 2020). A virtual screening procedure also introduced SPV as a potent inhibitor of the main protease of SARS-CoV-2 (Hosseini, & Amanlou, 2020). Besides, a comparative computational trial about SARS-CoV-2 receptors showed SPV as one strong candidate and effective inhibitor of the RdRp as well as the 3CL protease and NSP12 RNA polymerase (Wan, *et al*., 2020).

Studies so far have revealed SPV as a potent inhibitor of SARS-CoV-2 viral replication for the pharmacological management of patients and a preclinical justification has been provided for the combination of SPV and RDV, the latter being an antiviral that has already shown positive results of its use in the treatment of the new coronavirus. Nevertheless, there remains a significant need for clinical approval.

3.3 Sofosbuvir

Sofosbuvir (Sovaldi®, from Gilead Sciences) is a 2`Me-F uridine monophosphate nucleotide approved anti-hepatitis C treatment that blocks HCV replication. SFV acts inhibiting the HCV protein NS5B RNA-dependent RNA polymerase, which is necessary for viral replication. In order to enter the cells, SFV has hydrophobic protections in its phosphate, and then it is metabolized to its active form of nucleoside analog triphosphate GS-461203. The active triphosphate form incorporates into HCV RNA by NS5B polymerase then it acts as a chain terminator (Keating, 2014; Sacramento *et al*., 2020).

However, there is not a specific homolog of NS5A polymerase in the novel coronavirus SARS-CoV-2 genome, their activities may be utilized by other proteins. Studies in cell culture have shown that the triphosphates of SFV, Alovudine (3'-F-dT), and AZT (3'-N3-dT) inhibited the SARS-CoV RdRp by preventing further addition of nucleotides forcing RNA synthesis termination efficiently (Chien *et al*., 2020).

Enzymatic trials have shown that SFV competitively acts as a chain terminator and an inhibitor of SARS-CoV-2 RdRp enzyme (Ju *et al*., 2020). Neurological manifestations in human infected brain organoids related to SARS-CoV-2 infection were recovered by SFV therapy (Mesci *et al*., 2020). Some *in silico* studies of SFV have speculated that it and other nucleosides/nucleotide analogs would bind fully to the SARS-CoV-2 RNA-dependent RNA polymerase and inhibit its function (Elfiky, 2020). Furthermore, a study developed at Oswaldo Cruz Foundation (Fiocruz) showed the antiviral potential of SFV against SARS-CoV-2, which inhibited SARS-CoV-2 replication more potently in hepatoma cells (Huh-7) then in respiratory cell lines (Calu-3 type II pneumocytes) and indeed impaired the RNA synthesis in SARS-CoV-2 infected cells (Sacramento *et al*., 2020).

This nucleotide analogue provided a molecular basis for the inhibition of SARS-CoV-2 RdRp which has explored it being considered a potent therapeutic agent against SARS-CoV-2 by several studies worldwide. As this drug displayed efficacy in inhibiting SARS-CoV-2 RdRp in cell culture, as recently demonstrated in brain organoids, hepatoma cells, respiratory cells, and certainly impaired the RNA synthesis, SFV can be considered as potential candidate in clinical trials for the treatment of SARS-CoV-2 infection.

3.4 Daclatasvir

Daclatasvir (Daklinza®) is an antiviral used in combination with other medications for chronic hepatitis C. It is a direct-acting antiviral (DAA) that inhibits the HCV replication as

well as the virion assembly and secretion by incorporating into the NS5A, a N-terminus of non-structural protein (Smith, Regal & Mohammad, 2015; Keating, 2016).

The NS5A replication complex is necessary for Hepatitis C virus RNA replication as it provides a suitable environment for viral growth (Gandhi *et al.*, 2018). The NS5A polymerase has several functions that overlap with SARS-CoV-2 proteins as non-structural proteins 1 to 14. Hence, may indicate that these different proteins (nsp) in the SARS-CoV-2 life cycle could be incorporated by DCV, which originally targets the NS5A (Gordon, D. E. *et al.*, 2020).

An *in vitro* trial developed at Oswaldo Cruz Foundation (Fiocruz) demonstrated that DCV indeed inhibits the replication of the novel coronavirus SARS-CoV-2 in the Vero cells, hepatoma cells (HuH-7), and in type II pneumocytes (Calu-3 cells) by targeting initial events during viral replication cycle and impairing subgenomic RNA synthesis. Daclatasvir also prevented the increased induction of inflammatory mediators TNF-α and IL-6, characteristic of SARS-CoV-2 infection (Sacramento, *et al.*, 2020).

In view of a consistent discovery of inhibition of virus replication in different cells and preventing the induction of TNF-α and IL-6, inflammatory mediators associated with the large increase of cytokines from SARS-CoV-2 infection. The data point to DCV as an antiviral candidate that should be considered for eventual treatment for COVID-19. Thus, this anti-HCV drug may reinforce its evidence as a potential compound for clinical trials.

4. Discussion

The current pandemic caused by SARS-CoV-2 infection has progressed at an alarming rate worldwide, generating major challenges as overcrowding health systems, and stopping the entire world which has led the economy to collapse in several countries. No one was prepared for this highly infectious pathogen. Deng, (2020) compared the other coronaviruses, SARS-CoV and MERS-CoV, which infected about 8,096 people, affecting 29 countries and 2,494 people in 26 countries in 2003 and 2012, respectively, thus the SARS-CoV-2 outbreak has shown greater virulence. However, a major obstacle is a lack of antivirals and vaccines available for the treatment and prevention of this sudden and lethal disease to control this current pandemic scenario. Faced with this, researchers from all over the world are in a race against time in pursue of efficient therapeutic agents already available on the market that can also be used against SARS-CoV-2 infection (Deng, 2020).

Both SARS-CoV-2 and HCV possess similar structures, such as a single-stranded positive RNA and viral replication through a mechanism that demands the RdRp enzyme. Recent studies have brought the possibility of using the drugs already prescribed for HCV infection. The DAAs against HCV are among the safest antiviral agents as they became routinely used in the past five years (De Clercq & Li, 2016; Lu *et al*., 2020). Several studies have shown positive results regarding the inhibition of SARS-CoV-2 viral replication when using drugs already common for the treatment of HCV such as RDV, SPV, SFV and DCV. Among these drugs, RDV was previously tested for other coronaviruses as MERS-CoV and SARS-CoV and showed promising antiviral activity through *in vitro* trials and animal models (Brown *et al*., 2019; Sheahan *et al*., 2020). Although, Sacramento *et al.* (2020) highlights that drugs such as DCV and SFV have not been previously tested against MERS-CoV and SARS-CoV in previous outbreaks, due to their recent incorporation among therapeutic agents.

Wang *et al.* (2020) showed that the EC90 value of RDV against SARS-CoV-2 in Vero E6 cells was 1.76 μM, through this concentration of the drug, it is likely to have good results in non-human primate models when administering it.. Also, the data showed that RDV inhibited viral infection in a human cell line, Huh-7 cells. However, the studies developed by Wang, *et al.* (2020), found that the intravenous use of RDV does not improve symptoms, mortality ratio, or viral load in patients with severe SARS-CoV-2 infection when compared with placebo administration. The dosing regimen of the intravenous RDV presented did not provide significant antiviral effects in severely ill patients with SARS-CoV-2. However, limitations such as the decrease in number of new patients over time in the region of the study may have contributed due to lack of further analysis of the results. Suggestions have been presented to improve the antiviral potency of RDV as a regimen of larger doses of the drug or combination of it with other antivirals (Wang *et al.*, 2020).

Lo *et al.* (2020) found out through viral replication assay copies of the SARS-CoV-2 whose viral genome were suppressed by administering SPV at ≤ 10 μM, a concentration that is aimed to be achievable in the human lung. Additionally, in their study on a cell model, it was seen that SPV can synergize with RDV, the potential latter already well studied for the treatment of coronaviruses, by increasing the replication inhibition capacity of SARS-CoV-2, allowing lower doses of both medicines being used to treat SARS-CoV-2 infection. By a virtual screening procedure, Hosseini & Amanlou (2020) showed that the SPV interacts with RdRp, the main protease of SARS-CoV-2, showing a significant affinity to interact with its receptor. Interestingly, SPV had already been identified in other virtual screens of studies to identify a potential antiviral against SARS-CoV-2 infection. The results of Alamri *et al.*

(2020) also identified SPV as one of the potential inhibitors of the main SARS-CoV-2 protease (Alamri *et al*., 2020).

In relation to SFV, this potential drug for the treatment of the new coronavirus has been tested in some human cells by *in vitro* studies. Considering that some adult patients with SARS-CoV-2 infection had several other neurological symptoms, including stroke, epilepsy, hallucinations, and encephalopathy, it is suspected that this disease could also impact the nervous system (Asadi-Pooya & Simani, 2020). According to Mesci *et al.* (2020) SFV therapy caused human cerebral organoids infected with SARS-CoV-2 to be recovered. In the study conducted by Sacramento *et al.* (2020) through cell-based and molecular assays, as both are considered safe anti-HCV drugs with the potential to be used with broader antiviral activity, SFV and DCV were tested on different cell types such as in Vero cells, hepatoma cells, and respiratory cell lines. It was observed that SFV inhibited viral replication by SARS-CoV-2 more potently in hepatoma than in respiratory cell lines, but in Vero cells, this drug had no activity. On the other hand, DCV actually inhibited the production of the virus in the three different cells by acting early in the viral replication cycle and also prevented the induction of IL-6 and TNF-α. Through this study, it was demonstrated that, according to their activity against HCV, these two drugs also impaired the RNA synthesis of SARS-CoV-2, since it was susceptible to DCV in different types of tested cells, while SFV was more in hepatoma cells and at high concentrations in Calu-3 type II pneumocytes.

Early antiviral intervention can stop the spread of this current disease worldwide and improve patients' clinical outcomes. Furthermore, it is expected to bypass the uncontrolled pro-inflammatory cytokine storm caused by SARS-CoV-2, allowing a balanced adaptive immune response that could end the infection (Sacramento *et al.*, 2020). In light of all, these anti-HCV drugs have shown promising results so far and some are noteworthy since they include drugs already available on the market, and their side effects on the human body are known. However, the precise mechanisms of action to inhibit SARS-CoV-2 viral replication of some agents such as DCV, SPV and SFV are still to be determined. Therefore, further investigations are needed to uncover these molecular mechanisms. Despite this, we brought here some potential drugs which indicated promising results and could be an indication of promising compounds for clinical trials. Thus, further discussions would be necessary for testing these drugs effectiveness and viability.

5. Final Considerations

In summary, the SARS-CoV-2 pandemic has become a global issue due to its widespread outbreaks and the lack of a specific treatment. Since SARS-CoV-2 and HCV have similar structures, replication, and catalytic mechanisms, recent studies have brought the possibility of using the drugs already prescribed to treat HCV. The results of the research so far are promising and already consider these drugs potentials to start clinical trials. The advantage of using medications already available on the market is the reduction of time and investment that would be spent searching for a new antiviral agent that might still need to be evaluated at all stages from scratch until approval for commercialization.

The inhibition of SARS-CoV-2 viral replication was observed when using the drugs RDV, SPV, SFV, and DCV. However, there is no consensus on which of these drugs would be most successful so far, so there remains an enormous need for more pharmacological tests to declare the most viable and effective one to start the approval phase in clinical trials for treatment and prevention of COVID-19. In addition, the lack of a vaccine to combat the spread of SARS-CoV-2 makes the discovery of effective drugs more urgent. Thus, further research and data collection on the antiviral responses mentioned here are essential, since the vaccine until the date of publication of this article was not yet available.

Conflict of interest

The authors declare no conflict of interest.

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