Check for updates

CLINICAL PRACTICE ARTICLE

Use of remdesivir in the treatment of coronavirus disease 2019 (COVID-19) infection among Sudanese patients: a case series [version 1; peer review: 1 approved, 1 approved with reservations]

Maysoun Yousif¹, Ghada Abd El-Raheem ², Doaa Mohamed³

¹Emergency, Imperial Hospital, Khartoum, Khartoum, 11114, Sudan

²Pharmacy, Imperial Hospital, Military Hospital, Soba University Hospital, Khartoum, Khartoum, 11114, Sudan

³Emergency Department, Imperial Hospital, Khartoum, Khartoum, 11114, Sudan

V1 First published: 29 Jun 2021, 10:512
<https://doi.org/10.12688/f1000research.51375.1>
 Latest published: 10 Mar 2022, 10:512
<https://doi.org/10.12688/f1000research.51375.2>

Abstract

Introduction: The coronavirus disease 2019 (COVID-19) pandemic is affecting populations worldwide. Remdesivir is an anti-retroviral agent, with a broad spectrum of usage. Remdesivir usage against COVID-19 had been studied both *in vitro* and *in vivo* but is still considered a new treatment for COVID-19 and is not available in all countries. The aim of our study was to report several cases of the use of remdesivir in Sudanese patients and report the adverse events related to the course of treatment.

Methods: A case series study was conducted in Imperial Hospital, Khartoum, Sudan reporting two cases who received remdesivir for treating COVID-19 besides other treatments such as steroids and supportive therapy in December 2020. Cases were males aged over 65 years.

Cases presentation: Both patients were severe cases of COVID-19 admitted to the intensive care unit (ICU), who received remdesivir for treating COVID-19 infection. Several side effects were reported: the first case had increased liver enzymes and then unexpectedly died from severe resistant hypotension; and hypoalbuminemia was noticed in the second case.

Conclusions: Remdesivir use among patients in Sudan must be studied extensively in order to determine the unexpected fatal event and assess the association of this event to remdesivir use, as well as to report the frequency of the side effects.

Keywords

COVID-19, treatment, liver enzymes, Remdesivir, hypotension, Imperial Hospital, Sudan, Sudanese patients.

Open Peer Review

Approval Status

	1	2
version 2 (revision) 10 Mar 2022		view
version 1 29 Jun 2021	view	view

1. **Bashir Alsiddig Yousef** , University of Khartoum, Khartoum, Sudan

2. **Andri Frediansyah** , National Research and Innovation Agency (BRIN), Jakarta, Indonesia
 Indonesian Institute of Sciences (LIPI), Wonosari, Indonesia

Any reports and responses or comments on the article can be found at the end of the article.

This article is included in the **Coronavirus** collection.

Corresponding author: Ghada Abd El-Raheem (ghadaomer90@gmail.com)

Author roles: **Yousif M:** Data Curation, Investigation, Writing – Review & Editing; **Abd El-Raheem G:** Conceptualization, Methodology, Project Administration, Software, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing; **Mohamed D:** Data Curation, Investigation, Resources

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2021 Yousif M *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Yousif M, Abd El-Raheem G and Mohamed D. **Use of remdesivir in the treatment of coronavirus disease 2019 (COVID-19) infection among Sudanese patients: a case series [version 1; peer review: 1 approved, 1 approved with reservations]** F1000Research 2021, 10:512 <https://doi.org/10.12688/f1000research.51375.1>

First published: 29 Jun 2021, 10:512 <https://doi.org/10.12688/f1000research.51375.1>

Abbreviations

CPAP: Continuous Positive Airway Pressure
 CT: Computed Tomography
 DM: Diabetes Mellitus
 FFP: Fresh Frozen Plasma
 GCS: Glasgow Coma Scale
 ICU: Intensive Care Unit
 IgG: Immunoglobulin G
 IgM: Immunoglobulin M
 I.V.: Intravenously
 MOH: Ministry of health
 PCR: Polymerase Chain Reaction
 RNA: Ribonucleic Acid
 RT-PCR: Reverse Transcription Polymerase Chain Reaction
 SARS-CoV-2: Severe Acute Respiratory Syndrome
 SPO₂: Oxygen Saturation

Introduction

The coronavirus disease 2019 (COVID-19) pandemic is affecting people worldwide with all populations susceptible to getting infected; especially health care personnel and elderly populations.¹ Concomitant comorbid conditions, such as diabetes mellitus (DM), are related to increased severity of COVID-19 symptoms.^{1,2} Remdesivir is an anti-retroviral agent, with a broad spectrum of activity. It is a prodrug, which was first developed to be used for the treatment of Ebola.³ Recently, it was proposed to treat COVID-19 infection.^{4,5} The use of remdesivir against COVID-19 had been studied both *in vitro* and *in vivo*, but still considered new for COVID-19 treatment and not available in all countries.^{6,7} Although some remdesivir trials have not had enough power,⁸ one large scale clinical trial has been done, in which, there was no statistically significant difference in the improvement time with the use of remdesivir (hazard ratio 1.23 [95% confidence interval (CI) 0.87–1.75]. Further, the course of remdesivir was stopped early due to the side effects noted in 12% of the patients which included increased alanine and other side effects.⁹ The aim of our study was to report the use of remdesivir among two cases in Sudan and report the adverse events related to the course of treatment.

Methods

A case series study design was implemented involving three Sudanese patients. Cases are described in detail below. The data were collected retrospectively from the medical records. Confidentiality of participants was assured through the use of an anonymous research tool that had no identifiers to the involved patients and documented the medical data through codes. This data collection sheet was developed by the researchers and validated by a specialist in research methodology with a PhD. [Epi-info-7](#) was used.

Ethical approval and participant consent

Approval was firstly obtained from the Medical administration of Imperial Hospital. The study proposal was then submitted to the Administration of Innovation and Scientific Research at the State Ministry of Health (MOH), Khartoum, Sudan. Expedited review was conducted by the IRB of the MOH and approval was granted. Another copy of the proposal was submitted to the Administration of Private Medical Facilities.

Since the study was conducted using the archived medical records of the patients after death or discharge, informed consent was obtained from surrogate decision makers by contacting them through their registered phone numbers. In our study, the wives gave the approval after consulting the family. The objectives of the study and what data would be collected from the patients' medical records was explained in full. The collected data were used strictly for the purpose of the study objectives.

Case 1 presentation

A 78 years old male presented to the emergency isolation room at Imperial hospital, Khartoum, Sudan on 8 December 2020. The patient was tested for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and antibodies on 4 December 2020 (brand of tests unknown) and the results were received on 5 December. SARS-CoV-2 RNA by polymerase chain reaction (PCR) was detected, while the SARS-CoV-2 antibody test was negative. The patient had been complaining of shortness of breath for 3 days. His comorbidities were diabetes mellitus (DM) for which he was on insulin treatment, and a history of colon cancer for which he had an operation two 2 years previously and he was on oral chemotherapy. The patient had no other co-morbid conditions. A confirmatory test by using reverse transcription polymerase chain reaction (RT-PCR) was done on 10 December confirming the infection (brand of the test unknown). The medications in [Table 1](#) were given to

Table 1. COVID-19 treatment medications administered to the patients.

Medications
Remdesivir 200 mg I.V. LD, 100 mg I.V. O.D.
Meropenem 1 gm I.V. B.D.
Enoxaparin 40mg S.C. B.D.
Dexamethasone 6 mg O.D. I.V.
Paracetamol 1gm I.V. on need
Pantoprazole 40 mg I.V. O.D.
Vitamin C 1000 mg O.D.
Zinc sulphate 15 mg O.D.
Azithromycin 500 mg O.D.
Salbutamol nebulized solution 6 Hourly
Ipratropium nebulized solution 6 Hourly
Pulmicort 0.5 gm nebulized solution 6 Hourly

COVID-19 = coronavirus disease 2019, LD = loading dose, I.V. = intravenously, O.D. = once daily, B.D. = twice daily.

the patient from day 1 and planned for 10 days, besides 1.5 litres of fluids per day. The patient was admitted to the isolation ICU on the same day of hospital arrival.

Remdesivir was started on day 1, 8 December 2020. A loading dose of 200 mg was given in 250 mL of normal saline followed by a maintenance dose of 100 mg intravenously (I.V.) in 250 mL of normal saline once daily, planned for 10 days. On admission, the patient's oxygen saturation (SPO₂) was 92% and continuous positive airway pressure (CPAP) was applied. Table 2 illustrates the daily vital signs of the patient.

Laboratory examinations were done daily starting from day 3, 10 December 2020. The results are presented in Table 3.

Chest computed tomography was done for the patient on the first day of hospital arrival, 8 December, shown in Figure 1.

On day 3, the patient started deteriorating as the GCS was reducing. Nasogastric feeding was started and I.V. fluids were increased to 3 litres per day alongside the same plan. On day 6, severe hypotension had occurred in the patient, to an extent that blood pressure was undetectable on any monitor or manual devices. Hypotension was resistant to fluids and

Table 2. Daily vital signs of the patient (Case 1).

Vital signs	Day 1 8/12/2020	Day2 9/12/2020	Day 3 10/12/2020	Day 4 11/12/2020	Day 5 12/12/2020	Day 6 13/12/2020
SPO ₂	92%	94%	95%	94%	90%	83%, 80%
RR	30	35	33	30	32	34
HR (taken twice/ day day 1-3)	100 bpm 109 bpm	128 115 bmp	122 130 bpm	130 bpm	132 bpm	125 bpm
B.P.	130/70 140/80	139/87 133/85	149/92 168/100	170/83	155/83	99/56 Undetectable 84/40
GCS	15/15	15/15	13/15	10/15	10/15	3/15
RBG (taken twice/ day)	233 mg/dl 402 mg/dl	343 230	300 370	350 310	369 368	268 280
Temp. (degrees Celsius)	37.3	36.0	36.4			

SPO₂ = oxygen saturation, RR = respiratory rate, HR = heart rate, B.P. = blood pressure, GCS = Glasgow Coma Scale, RBG = random blood glucose.

Table 3. Results of laboratory examinations of the patient (Case 1).

Laboratory tests	Day 3	Day 5	Laboratory tests	Day 3	Day 5
Blood Urea	121 mg/dl		pH		7.347
Serum creatinine	1.2 mg/dl		SO ₂ %		97.50%
Na ⁺ (Sodium)	153 mmol/L	165.2 mmol/L	HCO ₃		27meq/L
K ⁺ (Potassium)	5.3 mmol/L	4.66 mmol/L	Hct		49.50%
D-dimer	5mcg/ml		Cl		114.5 mmol/L
CRP	215 mg/L		Total protein	7.5 g/dL	7.6 g/dL
TWBCs	17.7*10 ⁹ /L		Serum albumin	2.4 g/dL	2.6 g/dL
RBCs	5.7*10 ⁹ /L		ALP	97 U/L	111 U/L
Neutrophils	88*10 ⁹ /L		ALT (GPT)	288 I.U/L	142 I.U/L
Lymphocytes	7*10 ⁹ /L		AST (GOT)	431 I.U/L	70 I.U/L
PLts	351*10 ⁹ /L		Prothrombin time	65 Sec	24 Sec
PCO ₂		50.6 mmHg	INR	>10	1.8
PO ₂		105.4 mmHg	APTT	49 Sec	

CRP = c-reactive protein, TWBCs = total white blood cell count, RBCs = red blood cells, PLts = platelets, PCO₂ = partial pressure of carbon dioxide, PO₂ = partial pressure of oxygen, SO₂ = oxygen saturation, HCO₃ = bicarbonate, Hct = hematocrit, Cl = chlorine, ALP = alkaline phosphatase, ALT (GPT) = alanine aminotransferase (glutamic pyruvic transaminase), AST (GOT) = aspartate aminotransferase (glutamic oxaloacetic transaminase), INR = international normalized ratio, APTT = activated partial thromboplastin time.

vasopressors which eventually led to the death of the patient. The patient was deceased on day 6, 13 December 2020, as a result of severe refractory hypotension.

Case 2 presentation

A 75 years old male presented to the Emergency Isolation room at Imperial hospital on 18 December 2020, with generalized fatigue and fever for 1 week, and hemiparesis. Co-morbid conditions of the patient were a pacemaker device and benign prostate enlargement (BPH) condition, which was operated on five years previously. Oxygen saturation with CPAP mask was 87%. The patient was diagnosed with COVID-19, pneumonia and sepsis which were confirmed by PCR and CT-chest. An incidence of haemorrhagic stroke was confirmed through brain imaging. The patient was admitted to the Isolation ICU immediately, with reduced GCS (9/15). Respiratory support was initiated with physiotherapy and prone positioning for 16 hours per day. The patient was administered 3 units of fresh frozen plasma (FFP) once, platelet concentrate 50 U/Kg once and vitamin K 10 mg I.V. once. The patient developed hypernatremia (Serum Na⁺ 153), International normalized ratio (2.8). Remdesivir was initiated on day 1 of admission (18 December 2020), by the dose detailed in Table 1, and stopped on day 5, 23 December 2020. Hypoalbuminemia was noticed on 24 December (2.2 g/dl), for which albumin 20% infusion was given twice daily for 4 days, the serum albumin level results after treatment were not recorded. On 27 December, the 10th day of hospital admission, the patient was transferred to a different healthcare facility, based on the request of the surrogate decision maker of the patient, and we had no follow up information after the discharge from Imperial Hospital. The medications in Table 1, were given exactly to the patient during the hospital stay, same as for Case 1.

Discussion

Our patients were aged 75 and 78 years, similar ages to other published studies^{9,10} being above 65 years. Both study cases were male, as COVID-19 infection is more prevalent in males.¹⁰⁻¹² In our study, case 1 was diabetic, which is known to be associated with increased COVID-19 severity of infection.² This comorbidity was reported for 25% and 16% of patients who received remdesivir.^{9,10} Remdesivir is considered a viable treatment option in severe COVID-19 infections.^{13,14} Remdesivir doses administered for our patients were a 200 mg intravenously loading dose followed by 100 mg daily dose, which is the recommended dosage.^{9,15} Both cases had received antibiotics and steroids along with remdesivir, which is in line with.⁹

Hypoalbuminemia has been reported in patients taking remdesivir,⁹ as in case 2 of our study. But case 1 had hypoalbuminemia on presentation. The case 1 patient had 6 treatment days with remdesivir, with no improvement, in contrast to published trials in which remdesivir treatment course of 5 days has shown significant improvements.^{16,17} Our second case patient received remdesivir after 4 days of presentation of COVID-19 symptoms, which is consistent with

Figure 1. Chest computed tomography of case 1 on hospital arrival.

published literature reporting that the efficacy of remdesivir is higher in patients who receive it within 10 days of symptom presentation.¹⁸ While another study concluded that delayed treatment initiation with remdesivir was beneficial as well.¹⁹

Liver enzymes abnormalities have also been reported among patients who received remdesivir.^{4,10,20} For such cases, treatment course should be stopped.¹⁴ In our first case, liver enzymes were extremely elevated since day 3 of treatment (Table 3), but remdesivir course had not been discontinued. One of our cases was deceased and that was expected, as per a case series study in US, in which 50% of patients with severe COVID-19 infection on remdesivir were deceased.²¹ Also, in a clinical study only 3% of patients on remdesivir had clinical improvement on day 7.⁹ In another study, compassionate use of remdesivir resulted in improvements in 69% of patients.¹⁰ The cause of death was severe resistant hypotension, which has been reported as a serious event in remdesivir use.^{10,20}

The limitations of our study were the observational nature of case series that cannot establish direct cause-effect relationships. Also, the data were collected retrospectively from the medical records of the patients which had some missing medical results.

Conclusions and recommendations

Both patients were severe cases of COVID-19 admitted to the ICU. Unexpectedly, severe resistant hypotension was the cause of death of one of the patients. Increased liver enzymes was noticed in one case (case 1), as well as hypoalbuminemia (case 2). Wider studies regarding remdesivir use among patients in Sudan must be conducted extensively in order to study this unexpected fatal event and assess the association of this event to remdesivir use, as well as, to report the frequency of the side effects.

Consent

Written informed consent for publication of their clinical details and images was obtained from the surrogate decision makers of the patients. The surrogate decision makers gave written informed consent before data was collected and this was confirmed again after the manuscript was completed.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

Acknowledgments

The authors are grateful to the departments of Imperial Hospital whose participation enabled this study to be completed.

References

1. Tu H, Tu S, Gao S, *et al.*: **Current epidemiological and clinical features of COVID-19; a global perspective from China.** *J Infect.* 2020 Jul; **81**(1): 1–9. Epub 2020 Apr 18.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
2. Kumar A, Arora A, Sharma P, *et al.*: **Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis.** *Diabetes Metab Syndr.* 2020 Jul-Aug; **14**(4): 535–545. Epub 2020 May 6.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
3. Jorgensen SCJ, Kebriaei R, Remdesivir DLD: **Review of Pharmacology, Pre-clinical Data, and Emerging Clinical Experience for COVID-19.** *Pharmacotherapy.* 2020 Jul; **40**(7): 659–671. Epub 2020 Jun 28.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
4. Davies M, Osborne V, Lane S, *et al.*: **Remdesivir in Treatment of COVID-19: A Systematic Benefit-Risk Assessment.** *Drug Saf.* 2020 Jul; **43**(7): 645–656.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
5. Al-Tawfiq JA, Al-Homoud AH, Memish ZA: **Remdesivir as a possible therapeutic option for the COVID-19.** *Travel Med Infect Dis.* 2020 Mar-Apr; **34**: 101615. Epub 2020 Mar 5.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
6. Frediansyah A, Nainu F, Dhama K, *et al.*: **Remdesivir and its antiviral activity against COVID-19: A systematic review.** *Clin Epidemiol Glob Health.* 2020 Aug 7. Epub ahead of print.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
7. Musa A, Pendi K, Hashemi A, *et al.*: **Remdesivir for the Treatment of COVID-19: A Systematic Review of the Literature** *West J Emerg Med.* 2020 May 20; **21**(4): 737–741.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
8. Norrie JD: **Remdesivir for COVID-19: challenges of underpowered studies.** *Lancet.* 2020 May 16; **395**(10236): 1525–1527. Epub 2020 Apr 29.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
9. Wang Y, Zhang D, Du G, *et al.*: **Remdesivir in adults with severe COVID-19: a randomised, double-blind, placebo-controlled, multicentre trial.** *Lancet.* 2020 May 16; **395**(10236): 1569–1578. Epub 2020 Apr 29. Erratum in: *Lancet.* 2020 May 30; **395**(10238):1694.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
10. Grein J, Ohmagari N, Shin D, *et al.*: **Compassionate Use of Remdesivir for Patients with Severe Covid-19.** *N Engl J Med.* 2020 Jun 11; **382**(24): 2327–2336. Epub 2020 Apr 10.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
11. Li LQ, Huang T, Wang YQ, *et al.*: **COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis.** *J Med Virol.* 2020 Jun; **92**(6): 577–583. Epub 2020 Mar 23.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
12. Fang X, Li S, Yu H, *et al.*: **Epidemiological, comorbidity factors with severity and prognosis of COVID-19: a systematic review and meta-analysis.** *Aging (Albany NY).* 2020 Jul 13; **12**(13): 12493–12503. Epub 2020 Jul 13.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
13. Davies M, Osborne V, Lane S, *et al.*: **Remdesivir in Treatment of COVID-19: A Systematic Benefit-Risk Assessment.** *Drug Saf.* 2020 Jul; **43**(7): 645–656.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
14. Spinner CD, Gottlieb RL, Criner GJ, *et al.*: **GS-US-540-5774 Investigators. Effect of Remdesivir vs Standard Care on Clinical Status at 11 Days in Patients With Moderate COVID-19: A Randomized Clinical Trial.** *JAMA.* 2020 Sep 15; **324**(11): 1048–1057.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
15. Hashemian SM, Farhadi T, Velayati AAA: **Review on Remdesivir: A Possible Promising Agent for the Treatment of COVID-19.** *Drug Des Devel Ther.* 2020 Aug 6; **14**: 3215–3222.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
16. McCreary EK, Angus DC: **Efficacy of Remdesivir in COVID-19.** *JAMA.* 2020 Sep 15; **324**(11): 1041–1042.
[PubMed Abstract](#) | [Publisher Full Text](#)
17. Yokoyama Y, Briasoulis A, Takagi H, *et al.*: **Effect of remdesivir on patients with COVID-19: A network meta-analysis of randomized control trials.** *Virus Res.* 2020 Oct 15; **288**: 198137. Epub 2020 Aug 19.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
18. Edwards JK, Cole SR, Adimora AA: **Remdesivir and COVID-19.** *Lancet.* 2020 Oct 3; **396**(10256): 953.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
19. Hillaker E, Belfer JJ, Bondici A, *et al.*: **Delayed Initiation of Remdesivir in a COVID-19-Positive Patient.** *Pharmacotherapy.* 2020 Jun; **40**(6): 592–598. Epub 2020 May 20.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
20. Goldman JD, Lye DCB, Hui DS, *et al.*: **GS-US-540-5773 Investigators. Remdesivir for 5 or 10 Days in Patients with Severe Covid-19.** *N Engl J Med.* 2020 Nov 5; **383**(19): 1827–1837. Epub 2020 May 27.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
21. Singh AK, Singh A, Singh R, *et al.*: **Remdesivir in COVID-19: A critical review of pharmacology, pre-clinical and clinical studies.** *Diabetes Metab Syndr.* 2020 Jul-Aug; **14**(4): 641–648. Epub 2020 May 12.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Open Peer Review

Current Peer Review Status:

Version 1

Reviewer Report 23 February 2022

<https://doi.org/10.5256/f1000research.54536.r122200>

© 2022 Frediansyah A. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Andri Frediansyah

¹ National Research and Innovation Agency (BRIN), Jakarta, Indonesia

² Indonesian Institute of Sciences (LIPI), Wonosari, Indonesia

Two COVID-19 cases (aged 74 and 75 years) were treated at Sudan's Imperial Hospital, and the authors conducted a case series study to assess remdesivir's efficacy. According to two case series, adverse events such as elevated liver enzymes and hypoalbuminemia were observed in patients with severe COVID-19 infection who were admitted to the intensive care unit. Due to the limited number of case studies in this study, conclusions about remdesivir's efficacy in the general population are impossible. However, the case series report is interesting and well-presented, making it worth reading during this period of emergencies. The following points, however, should be consider:

- Please write IRB in full name with no abbreviation.
- Please include the number of the ethical approval.
- Kindly explain Figure 1 in the paragraph that follows.
- Is there any laboratory or computed tomography data available in case 2? Is it still possible to present if the response is negative?

Is the background of the cases' history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Partly

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?

Yes

Is the conclusion balanced and justified on the basis of the findings?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmacology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 04 Mar 2022

Ghada Abd El-Raheem, Imperial Hospital, Military Hospital, Soba University Hospital, Khartoum, Sudan

Dear Reviewer,
Thank you for your valuable comments. I have fulfilled them all.
Thank you again for your precious time.

Competing Interests: No competing interest

Reviewer Report 03 December 2021

<https://doi.org/10.5256/f1000research.54536.r99911>

© 2021 Alsiddig Yousef B. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Bashir Alsiddig Yousef

Department of Pharmacology, Faculty of Pharmacy, University of Khartoum, Khartoum, Sudan

Authors performed a case series study to assess the use of remdesivir among two COVID-19 cases in Imperial Hospital, Khartoum, Sudan. Generally, the study is interesting and well presented. However, some points which should be reconsidered in this study:

- As the study focused on the adverse events related to the use of remdesivir, I think the authors need to change the title to highlight the adverse events of remdesivir.
- Is it conducted in two or three patients? Please correct the number in the methodology section.
- Authors need to cite the guidelines for using the medications for treating COVID-19 cases.

Is the background of the cases' history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Yes

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?

Partly

Is the conclusion balanced and justified on the basis of the findings?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmacology, Clinical Pharmacy, Clinical Pharmacology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 04 Mar 2022

Ghada Abd El-Raheem, Imperial Hospital, Military Hospital, Soba University Hospital, Khartoum, Sudan

Dear Reviewer,
Thank you for your valuable comments. I have fulfilled them all in the updated version.
Thank you again for your precious time.

Competing Interests: No competing interest.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research