

World Journal of *Gastroenterology*

World J Gastroenterol 2021 October 28; 27(40): 6737-7004



FRONTIER

- 6737** Hepatocellular carcinoma risk after viral response in hepatitis C virus-advanced fibrosis: Who to screen and for how long?

Ahumada A, Rayón L, Usón C, Bañares R, Alonso Lopez S

OPINION REVIEW

- 6750** Higher doses of ascorbic acid may have the potential to promote nutrient delivery *via* intestinal paracellular absorption

Sequeira IR

EVIDENCE REVIEW

- 6757** Venous and arterial thromboembolism in patients with inflammatory bowel diseases

Stadnicki A, Stadnicka I

REVIEW

- 6775** Understanding the immune response and the current landscape of immunotherapy in pancreatic cancer

Ostios-Garcia L, Villamayor J, Garcia-Lorenzo E, Vinal D, Feliu J

- 6794** Artificial intelligence in gastroenterology: A state-of-the-art review

Kröner PT, Engels MM, Glicksberg BS, Johnson KW, Mzaik O, van Hooft JE, Wallace MB, El-Serag HB, Krittanawong C

MINIREVIEWS

- 6825** Emerging artificial intelligence applications in liver magnetic resonance imaging

Hill CE, Biasioli L, Robson MD, Grau V, Pavlides M

- 6844** Role of human nucleoside transporters in pancreatic cancer and chemoresistance

Carter CJ, Mekawaty AH, Morris DL

- 6861** Management of hepatitis B and C in special population

Kulkarni AV, Duvvuru NR

- 6874** Endoscopic ultrasound-guided vascular interventions: Current insights and emerging techniques

Mann R, Goyal H, Perisetti A, Chandan S, Inamdar S, Tharian B

ORIGINAL ARTICLE

Basic Study

- 6888 Metabolomics of *Fuzi-Gancao* in CCl₄ induced acute liver injury and its regulatory effect on bile acid profile in rats

Wang MF, Zhao SS, Thapa DM, Song YL, Xiang Z

- 6908 Transforming growth factor beta-1 upregulates glucose transporter 1 and glycolysis through canonical and noncanonical pathways in hepatic stellate cells

Zhou MY, Cheng ML, Huang T, Hu RH, Zou GL, Li H, Zhang BF, Zhu JJ, Liu YM, Liu Y, Zhao XK

Retrospective Cohort Study

- 6927 Serum hepatitis B core-related antigen as a surrogate marker of hepatitis B e antigen seroconversion in chronic hepatitis B

Chi XM, Wang XM, Wang ZF, Wu RH, Gao XZ, Xu HQ, Ding YH, Niu JQ

- 6939 Long-term follow-up of liver alveolar echinococcosis using echinococcosis multilocularis ultrasound classification

Schuhbauer J, Schweizer M, Philipp J, Schmidberger J, Schlingeloff P, Kratzer W

Observational Study

- 6951 Hepatic and gastrointestinal disturbances in Egyptian patients infected with coronavirus disease 2019: A multicentre cohort study

Shousha HI, Afify S, Maher R, Asem N, Fouad E, Mostafa EF, Medhat MA, Abdalazeem A, Elmorsy H, Aziz MM, Mohammed RS, Ibrahim M, Elgarem H, Omran D, Hassany M, Elsayed B, Abdelaziz AY, El Kassas M

- 6967 Factors affecting anxiety, depression, and self-care ability in patients who have undergone liver transplantation

Akbulut S, Ozer A, Saritas H, Yilmaz S

META-ANALYSIS

- 6985 Prophylactic transcatheter arterial embolization reduces rebleeding in non-variceal upper gastrointestinal bleeding: A meta-analysis

Boros E, Sipos Z, Hegyi P, Teutsch B, Frim L, Váncsa S, Kiss S, Dembrovsky F, Oštarijaš E, Shawyer A, Erőss B

LETTER TO THE EDITOR

- 7000 Gastrointestinal and hepatic involvement during COVID-19 pandemic: A focus on pediatric population and possible future implications

Sica R, Pennoni S, Penta L, Riccioni S, Di Cara G, Verrotti A

ABOUT COVER

Editorial Board Member of *World Journal of Gastroenterology*, Pietro Fusaroli, MD, Associate Professor, Chief, Gastrointestinal Unit, University of Bologna at the Hospital of Imola, Via Montericco 4, Imola 40026, Italy. pietro.fusaroli@unibo.it

AIMS AND SCOPE

The primary aim of *World Journal of Gastroenterology* (WJG, *World J Gastroenterol*) is to provide scholars and readers from various fields of gastroenterology and hepatology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online. WJG mainly publishes articles reporting research results and findings obtained in the field of gastroenterology and hepatology and covering a wide range of topics including gastroenterology, hepatology, gastrointestinal endoscopy, gastrointestinal surgery, gastrointestinal oncology, and pediatric gastroenterology.

INDEXING/ABSTRACTING

The WJG is now indexed in Current Contents®/Clinical Medicine, Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports®, Index Medicus, MEDLINE, PubMed, PubMed Central, and Scopus. The 2021 edition of Journal Citation Report® cites the 2020 impact factor (IF) for WJG as 5.742; Journal Citation Indicator: 0.79; IF without journal self cites: 5.590; 5-year IF: 5.044; Ranking: 28 among 92 journals in gastroenterology and hepatology; and Quartile category: Q2. The WJG's CiteScore for 2020 is 6.9 and Scopus CiteScore rank 2020: Gastroenterology is 19/136.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Jia-Hui Li; Production Department Director: Yu-Jie Ma; Editorial Office Director: Ze-Mao Gong.

NAME OF JOURNAL

World Journal of Gastroenterology

ISSN

ISSN 1007-9327 (print) ISSN 2219-2840 (online)

LAUNCH DATE

October 1, 1995

FREQUENCY

Weekly

EDITORS-IN-CHIEF

Andrzej S Tarnawski, Subrata Ghosh

EDITORIAL BOARD MEMBERS

<http://www.wjgnet.com/1007-9327/editorialboard.htm>

PUBLICATION DATE

October 28, 2021

COPYRIGHT

© 2021 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Gastrointestinal and hepatic involvement during COVID-19 pandemic: A focus on pediatric population and possible future implications

Rossella Sica, Serena Pennoni, Laura Penta, Sara Riccioni, Giuseppe Di Cara, Alberto Verrotti

ORCID number: Rossella Sica 0000-0002-3990-4117; Serena Pennoni 0000-0002-4238-436X; Laura Penta 0000-0003-0945-2997; Sara Riccioni 0000-0003-1989-9549; Giuseppe Di Cara 0000-0002-7632-6774; Alberto Verrotti 0000-0001-6323-4187.

Author contributions: Sica R drafted the manuscript; Sica R, Pennoni S, Penta L, Riccioni S, Di Cara G and Verrotti A edited and revised the manuscript; Verrotti A supervised and approved the final version of the manuscript; all authors have read and agreed to the published version of the manuscript.

Conflict-of-interest statement: The authors declare no conflict of interest.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Rossella Sica, Serena Pennoni, Laura Penta, Sara Riccioni, Giuseppe Di Cara, Alberto Verrotti, Department of Pediatrics, University of Perugia, Perugia 06132, PG, Italy

Corresponding author: Alberto Verrotti, MD, PhD, Chief Doctor, Professor, Department of Pediatrics, University of Perugia, Piazza L Severi 1, Perugia 06132, PG, Italy.
alberto.verrottidianella@unipg.it

Abstract

Since the coronavirus disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has rapidly spread worldwide, there is still limited knowledge about this condition and its natural history. Children have been relatively spared during COVID-19 pandemic but a novel syndrome known as multisystem inflammatory syndrome (MIS-C) has emerged, following a SARS-CoV-2 infection in children and adolescents. This syndrome can lead to shock and multiple organ failure requiring intensive care. Although COVID-19 clinical research focuses on respiratory symptoms, extrapulmonary involvement such as gastrointestinal (GI) and hepatic manifestations should also be considered. In fact, GI and hepatic involvement play an important role among the most common presenting symptoms of both pediatric and adult COVID-19 and MIS-C. This involvement can not only be one of the most common presenting clinical features but also one of the sequelae of these syndromes. Abdominal ultrasonography monitoring could be very useful to identify a potential involvement of the GI tract and liver. Moreover, long-term follow-up is needed and would be essential to define the long-term outcomes of these patients.

Key Words: SARS-CoV-2; COVID-19; Multisystem inflammatory syndrome; Gastrointestinal tract; Liver; Ultrasonography

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Gastrointestinal and hepatic symptoms are a common clinical feature of the coronavirus disease 2019 (COVID-19). Moreover, a novel syndrome known as multisystem inflammatory syndrome (MIS-C) associated with COVID-19 in children

[p://creativecommons.org/licenses/by-nc/4.0/](https://creativecommons.org/licenses/by-nc/4.0/)

Manuscript source: Unsolicited manuscript

Specialty type: Medicine, research and experimental

Country/Territory of origin: Italy

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C, C

Grade D (Fair): 0

Grade E (Poor): 0

Received: August 5, 2021

Peer-review started: August 5, 2021

First decision: August 19, 2021

Revised: August 30, 2021

Accepted: September 15, 2021

Article in press: September 15, 2021

Published online: October 28, 2021

P-Reviewer: Freij BJ, Nabil A

S-Editor: Gao CC

L-Editor: A

P-Editor: Li JH



and adolescents has emerged. Among the most common presenting symptoms of MIS-C, we found gastrointestinal and hepatic involvement. As gastrointestinal and hepatic involvement might play a major role in the clinical spectrum and possible sequelae of this novel condition, physicians should not underestimate these clinical manifestations. Therefore, abdominal ultrasonography monitoring and long-term follow-up could be useful to evaluate this potential damage and the possible outcome of these patients.

Citation: Sica R, Pennoni S, Penta L, Riccioni S, Di Cara G, Verrotti A. Gastrointestinal and hepatic involvement during COVID-19 pandemic: A focus on pediatric population and possible future implications. *World J Gastroenterol* 2021; 27(40): 7000-7004

URL: <https://www.wjgnet.com/1007-9327/full/v27/i40/7000.htm>

DOI: <https://dx.doi.org/10.3748/wjg.v27.i40.7000>

TO THE EDITOR

We read with great interest the review by Mohamed *et al*[1] about manifestations, mechanisms and management of the gastrointestinal (GI) and hepatic diseases during the coronavirus disease 2019 (COVID-19) pandemic. Although the large majority of concern about COVID-19 and its outcomes is centered on pulmonary manifestations and sequelae, we must be aware that GI and hepatic involvement could play a major role in the clinical spectrum of this novel disease as well as in virus transmission *via* the fecal-oral route. Hence, we agree with the authors' purpose that physicians should not underestimate digestive symptoms during COVID-19. In fact, GI manifestations in COVID-19 patients, including diarrhea, nausea, vomiting, anorexia and abdominal pain are common features of the disease with diarrhea being the most common among these symptoms[2,3].

The pathophysiologic mechanism of GI and hepatic injury during COVID-19 is still debated. Mohamed *et al*[1] reported that GI damage might be due to direct infection of GI cells. We appreciate the great relevance the authors gave to angiotensin-converting enzyme 2 (ACE2) receptors' expression over the small intestine cells, cholangiocytes and hepatocytes and the role it plays in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and in the pathophysiology of both GI and hepatic injury. Also, SARS-CoV-2 can induce cells expressing ACE2 to release inflammatory cytokines leading to a cytokine storm and multiple organ failure[4]. As Mohamed *et al*[1] well reported, SARS-CoV-2 binding to ACE2 receptor can lower the critical receptor level, reducing the absorption of tryptophan on the lumen surface of intestinal epithelial cells. It is known that tryptophan is absorbed on the lumen surface of intestinal epithelial cells *via* the B0AT1/ACE2 transport route inducing the mammalian target of rapamycin which controls the appearance of antimicrobial peptides influencing the components of gut flora. Therefore, the reduced absorption of tryptophan caused by SARS-CoV-2 can ultimately unbalance the gut flora resulting in diarrhea. The changings in the GI flora also stimulate the polarization of T helper 17 cells, and eventually, interleukin 17A induces the recruitment of neutrophils[1]. Moreover, changes in intestinal flora might affect the respiratory tract and *vice versa via* the gut-lung axis, subsequently enhancing the inflammatory and immune-mediated damage in the small intestine.

A study by Pirola and Sookoian[5] demonstrates that gene expression levels for ACE2 are highest in cholangiocytes compared to alveolar type 2 cells, followed in turn by sinusoidal endothelial cells and hepatocytes, thus supporting the possibility that SARS-CoV-2 may cause direct liver injury through a viral cytopathic effect. Nevertheless, GI mucosal damage and unbalance in the gut flora may lead to liver dysfunction through the gut-liver axis.

However, we should not forget that GI tract symptoms and liver injury may also be due to cytokine storm, hypoxic-shock conditions due to acute respiratory distress syndrome and drug-induced injury[6,7].

It is generally accepted that the existence of comorbidities in COVID-19 patients can dramatically increase the risk of poor outcome. Besides, the impact of the COVID-19 pandemic on preexisting GI, liver and pancreatic diseases is still under investigation. We appreciate the importance the authors gave to patients affected by inflammatory bowel diseases (IBD). Actually, these patients are more at risk for infectious diseases

due to the immunosuppressive therapy they undergo. Thus, IBD patients may potentially be more at risk for SARS-CoV-2 infection and severe COVID-19. The prognostic value of the elevation of liver enzymes and indices of cholestasis reflecting hepatic injury and cholangiocellular damage respectively, is still debated. Conversely, pre-existing chronic liver diseases seem to be independent risk factors for poor outcome in COVID-19, and cirrhosis grade has been defined as a predictor of mortality in SARS-CoV-2 infected patients[6].

We are thankful to the authors for their contribution to current literature and we would like to implement the authors' excellent work by reporting our experience with SARS-CoV-2 infection in the Pediatric population.

We would like to emphasize that COVID-19 in children and adolescents may often be asymptomatic or cause only mild symptoms. The most prevalent symptom of COVID-19 in children and adolescents is fever, followed by cough, upper respiratory tract symptoms, diarrhea and nausea/vomiting. In a multinational, multicenter cohort study, 22% of patients had GI symptoms and 7% of those had no respiratory symptoms[8]. Also, neurological manifestations must be considered as they might be a direct result of central nervous system viral invasion or post-infection immunomediated disease[9]. Interestingly, in the latter half of April 2020 a previously unknown SARS-CoV-2-related clinical syndrome emerged. Initially this novel entity was named pediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS) by the European Centre for Disease Prevention and Control and then multisystem inflammatory syndrome in children (MIS-C) by the Centers for Disease Control and Prevention (CDC) in the United States and by the World Health Organization. This syndrome can lead to shock and multiple organ failure requiring a Pediatric Intensive Care Unit. Its features resemble those of known entities such as Kawasaki Disease, toxic shock syndrome, and macrophage activation syndrome. The CDC issued a case definition of MIS-C specifying that the patient should be < 21-year-old, have fever, laboratory evidence of inflammation, and evidence of a clinically severe illness requiring hospitalization, with multisystem (> 2) organ involvement (cardiac, renal, respiratory, hematological, GI, dermatological, or neurological), in the absence of an alternative plausible diagnosis, and evidence of SARS-CoV-2 infection or exposure[10]. It was initially thought that this syndrome was specific of children, but recent reports have shown that it can also occur in adults. In a case series comparing children and adolescents with MIS-C *vs* those with severe COVID-19, MIS-C was distinguished by having a more severe cardiovascular and mucocutaneous involvement and a worse inflammation with a higher neutrophil/Leukocyte ratio, higher c-reactive protein level and lower thrombocytopenia compared to patients with COVID-19[11].

The pathophysiology of this syndrome is under intense investigation but so far it remains unclear. It is believed that this syndrome results from an abnormal immune response to the virus. Interestingly, among the most common presenting symptoms of MIS-C from reports worldwide we found GI involvement, including vomiting, abdominal pain, and/or diarrhea. Moreover, there are reports in literature reporting cases of MIS-C presenting with acute abdomen and pseudo appendicular syndrome with shock, clinical symptoms suggestive of appendicitis, functional intestinal obstruction and ischemic bowel lesions[12,13]. Furthermore, abdominal imaging findings such as hepatomegaly, nephromegaly, gallbladder wall edema, ascites, intestinal inflammation and mesenteric lymphadenopathy are very common[14]. The role of SARS-CoV-2 in some of these clinical presentations seems more likely to be temporal rather than causative but it causes diagnostic and management dilemmas for treating physicians.

Regarding the experience of our Department of Pediatrics, we recently reported the case of a 14-year-old non-obese boy with MIS-C who presented with jaundiced skin, a diffusely painful abdomen and palpable hepatosplenomegaly. He was in a condition of multiorgan failure with a compromised hemodynamic status with reduction of left ventricular ejection fraction and elevated values of alanine aminotransferase, aspartate aminotransferase and indices of cholestasis. Notably, our patient fully recovered from MIS-C, with an excellent cardiac and renal outcome but during the follow-up visit program he was diagnosed with a new onset hepatic steatosis. Therefore, we suggest that hepatic steatosis might be one of the sequelae following SARS-CoV-2 infection, MIS-C or its treatment, mainly due to prolonged use of corticosteroids, probably through an inhibition of mitochondrial fatty acid oxidation[15].

We fully agree with the authors' suggestion that liver function should be monitored during COVID-19, particularly in more severe cases. Furthermore, we think that hepatic involvement after COVID-19 and MIS-C could be underdiagnosed as few patients undergo abdominal ultrasonography monitoring. Diagnosis of hepatic

steatosis is easily accessible through an abdominal ultrasound, which is a low-cost, non-invasive examination. To date, abdominal ultrasound monitoring for these patients is not supported by evidence but we suggest that it could be very useful to identify this potential damage early and evaluate the possible outcome of these patients.

In conclusion, GI and hepatic involvement in COVID-19 and MIS-C should not be underestimated because potential damage could be underdiagnosed. Further studies and long-term follow ups are needed to completely understand the pathophysiology and possible implications that GI and hepatic involvement might have in COVID-19 and MIS-C.

REFERENCES

- 1 **Mohamed DZ**, Ghoneim ME, Abu-Risha SE, Abdelsalam RA, Farag MA. Gastrointestinal and hepatic diseases during the COVID-19 pandemic: Manifestations, mechanism and management. *World J Gastroenterol* 2021; **27**: 4504-4535 [PMID: [34366621](#) DOI: [10.3748/wjg.v27.i28.4504](#)]
- 2 **Wang D**, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao Y, Li Y, Wang X, Peng Z. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* 2020; **323**: 1061-1069 [PMID: [32031570](#) DOI: [10.1001/jama.2020.1585](#)]
- 3 **Huang C**, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; **395**: 497-506 [PMID: [31986264](#) DOI: [10.1016/S0140-6736\(20\)30183-5](#)]
- 4 **Gu J**, Korteweg C. Pathology and pathogenesis of severe acute respiratory syndrome. *Am J Pathol* 2007; **170**: 1136-1147 [PMID: [17392154](#) DOI: [10.2353/ajpath.2007.061088](#)]
- 5 **Pirola CJ**, Sookoian S. SARS-CoV-2 virus and liver expression of host receptors: Putative mechanisms of liver involvement in COVID-19. *Liver Int* 2020; **40**: 2038-2040 [PMID: [32352224](#) DOI: [10.1111/liv.14500](#)]
- 6 **Nardo AD**, Schneeweiss-Gleixner M, Bakail M, Dixon ED, Lax SF, Trauner M. Pathophysiological mechanisms of liver injury in COVID-19. *Liver Int* 2021; **41**: 20-32 [PMID: [33190346](#) DOI: [10.1111/liv.14730](#)]
- 7 **McDermott CV**, Cox EJ, Scanlan JM, Alicie RZ. COVID-19 and Gastrointestinal Tract Symptoms: Recognition, Containment, and Learning From the Past. *Mayo Clin Proc* 2020; **95**: 2320-2324 [PMID: [33153620](#) DOI: [10.1016/j.mayocp.2020.08.023](#)]
- 8 **Göttinger F**, Santiago-García B, Noguera-Julian A, Lanaspá M, Lancella L, Calò Carducci FI, Gabrovská N, Velizarova S, Prunk P, Osterman V, Krivec U, Lo Vecchio A, Shingadia D, Soriano-Arandes A, Melendo S, Lanari M, Pierantoni L, Wagner N, L'Huillier AG, Heininger U, Ritz N, Bandi S, Krajcar N, Roglić S, Santos M, Christiaens C, Creuven M, Buonsenso D, Welch SB, Bogvi M, Brinkmann F, Tebrügge M; ptbnet COVID-19 Study Group. COVID-19 in children and adolescents in Europe: a multinational, multicentre cohort study. *Lancet Child Adolesc Health* 2020; **4**: 653-661 [PMID: [32593339](#) DOI: [10.1016/S2352-4642\(20\)30177-2](#)]
- 9 **Verrotti A**, Mazzocchetti C, Iannetti P. Definitive pathognomonic signs and symptoms of paediatric neurological COVID-19 are still emerging. *Acta Paediatr* 2021; **110**: 1774-1777 [PMID: [33641209](#) DOI: [10.1111/apa.15827](#)]
- 10 **CDC Health Alert Network**. Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with Coronavirus Disease 2019 (COVID-19). [cited 14 May 2020]. In: CDC Health Alert Network [Internet]. Available from: <https://emergency.cdc.gov/han/2020/han00432.asp>
- 11 **Feldstein LR**, Tenforde MW, Friedman KG, Newhams M, Rose EB, Dapul H, Soma VL, Maddux AB, Mourani PM, Bowens C, Maamari M, Hall MW, Riggs BJ, Giuliano JS Jr, Singh AR, Li S, Kong M, Schuster JE, McLaughlin GE, Schwartz SP, Walker TC, Loftis LL, Hobbs CV, Halasa NB, Doymaz S, Babbitt CJ, Hume JR, Gertz SJ, Irby K, Clouser KN, Cvijanovich NZ, Bradford TT, Smith LS, Heidemann SM, Zackai SP, Wellnitz K, Nofziger RA, Horwitz SM, Carroll RW, Rowan CM, Tarquinio KM, Mack EH, Fitzgerald JC, Coates BM, Jackson AM, Young CC, Son MBF, Patel MM, Newburger JW, Randolph AG; Overcoming COVID-19 Investigators. Characteristics and Outcomes of US Children and Adolescents With Multisystem Inflammatory Syndrome in Children (MIS-C) Compared With Severe Acute COVID-19. *JAMA* 2021; **325**: 1074-1087 [PMID: [33625505](#) DOI: [10.1001/jama.2021.2091](#)]
- 12 **Khesrani LS**, Chana K, Sadar FZ, Dahdouh A, Ladjadj Y, Bouguermouh D. Intestinal ischemia secondary to Covid-19. *J Pediatr Surg Case Rep* 2020; **61**: 101604 [PMID: [32839689](#) DOI: [10.1016/j.epsc.2020.101604](#)]
- 13 **Hwang M**, Wilson K, Wendt L, Pohlman J, Densmore E, Kaeppler C, Van Arendonk K, Yale S. The Great Gut Mimicker: A case report of MIS-C and appendicitis clinical presentation overlap in a teenage patient. *BMC Pediatr* 2021; **21**: 258 [PMID: [34074244](#) DOI: [10.1186/s12887-021-02724-x](#)]
- 14 **Morparia K**, Park MJ, Kalyanaraman M, McQueen D, Bergel M, Phatak T. Abdominal Imaging Findings in Critically Ill Children With Multisystem Inflammatory Syndrome Associated With COVID-19. *Pediatr Infect Dis J* 2021; **40**: e82-e83 [PMID: [33298763](#) DOI: [10.1093/pid/piaa333](#)]

[10.1097/INF.0000000000002967](https://doi.org/10.1097/INF.0000000000002967)]

- 15 **Sica R**, Pennoni S, Penta L, Di Cara G, Verrotti A. New Onset of Hepatic Steatosis Post-Severe Multisystem Inflammatory Syndrome in Children (MIS-C): A Case Report. *Int J Environ Res Public Health* 2021; **18** [PMID: [34209719](https://pubmed.ncbi.nlm.nih.gov/34209719/) DOI: [10.3390/ijerph18136961](https://doi.org/10.3390/ijerph18136961)]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

