

Gastrointestinal symptoms among COVID-19 patients presenting to a primary health care center of Nepal: A cross-sectional study

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Abstract

Background and Aim: Coronavirus disease 2019 (COVID-19) is a major public health problem causing significant morbidity and mortality worldwide. Apart from respiratory symptoms, gastrointestinal symptoms like nausea, vomiting, diarrhea, and abdominal discomfort are quite common among COVID-19 patients. The gastrointestinal tract can be a potential site for virus replication and feces a source of transmission. Thus, ignorance of enteric symptoms can hinder effective disease control. The objective of this study is to see the gastrointestinal manifestation of the disease and its effect on morbidity and mortality.

Methods: This observational cross-sectional retrospective study was carried out among 165 laboratory-confirmed COVID-19 patients in primary health care of Gorkha, Nepal from March 1, 2021 to March 1, 2022. A systematic random sampling method was adopted while data were entered and analyzed by Statistical Package for Social Sciences version 21.

Results: Of 165 patients, 97 patients (58.78%) had enteric involvement. Among gastrointestinal symptoms, diarrhea in 67 patients (40.6%) and nausea and/or vomiting in 66 patients (40%) were the most common symptoms, followed by abdominal pain in 27 patients (16.4%) and anorexia in 19 patients (11.5%). Of the majority of cases with gastrointestinal involvement, 63 (63%) were below 50 years of age. Many of the patients who received vaccination had gastrointestinal symptoms (79%). Complications like acute respiratory distress syndrome, shock, and arrhythmia developed in 9.7% of patients, with the death of eight patients. COVID-19 vaccination was associated with 4.32 times higher odds of having gastrointestinal involvement in subsequent COVID-19 infection.

Conclusions: Diarrhea followed by nausea/vomiting was among the most common gastrointestinal symptoms affecting younger age groups in our study. Enteric symptoms were more common among vaccinated people rather than among nonvaccinated ones.

KEYWORDS

infectious diseases, gastroenterology/hepatology, virology

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1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged as a major challenge to public health globally, causing significant mortality and morbidity. The total number of cases and deaths in Nepal was 702,933 and 8931, respectively, during our study. SARS-CoV-2 is the third coronavirus identified to cause severe respiratory illness in humans, after SARS-CoV and MERS-CoV. The most common symptoms in COVID-19 patients are fever, dry cough, myalgia, and shortness of breath (SOB).^{1,2} Gastrointestinal (GI) symptoms like nausea, vomiting, diarrhea, and abdominal discomfort were also common during the SARS-CoV-2 infection. Some individuals developed these symptoms without any respiratory involvement. Gastric infection increases the risk of peptic ulcer in cirrhotic patients by 2.7-fold, and this group of patients sometimes has more GI symptoms.³⁻⁵ GI symptoms sometimes preceded respiratory symptoms and were seen in 20%–50% of patients.⁶

SARS-CoV-2 is found to infect the host tissue by binding to the angiotensin-converting enzyme 2 (ACE2) receptor in respiratory epithelial cells, which are also found in the kidneys and GI tract, particularly small intestinal epithelial cells.⁷⁻¹⁰ As a result, virus transmission occurs through feces and urine, and the GI system and kidneys may serve as possible extrapulmonary sites for virus replication.^{10,11} The virus can be eliminated through the urine and fecal routes and can remain alive for a prolonged time even after the throat swab turns negative; thus, there could be a fecal-oral route of transmission, particularly in areas with improper hygiene and a lack of healthier sanitation practices.^{4,9}

Studies have reported that the duration of hospital stay and mortality in patients with respiratory and GI symptoms are higher than in those with respiratory symptoms alone.¹² However, a study by Livanos et al. showed some reduction in mortality among patients with GI involvement. It was believed to be due to reduced inflammatory mediators, particularly interleukin-6 (IL-6), IL-8, IL-17A, C-X-C chemokine 8, and chemokine C-C ligand 8, following GI involvement.^{13,14} Hence, we are conducting this descriptive cross-sectional study to see the GI manifestations of the disease and its effect on morbidity and mortality.

2 | METHODOLOGY

2.1 | Study design and participants

In this observational cross-sectional retrospective, single-center study, we reviewed the record of 165 laboratory-confirmed COVID-19 patients including age, sex, comorbidities, signs and symptoms at presentation, chest X-ray findings, and COVID-19 vaccination status presenting to Aruchanaut primary health care center (PHC) located in a remote region of Gorkha district, Nepal from March 1, 2021 to March 1, 2022. The laboratory-confirmed cases of age more than 18 years with pharyngeal swab specimen test results positive using real-time reverse transcription PCR (rRT-PCR) for SARS-CoV-2 and with complete information in the record were included in our study. Cases less than

the age of 18 years and with incomplete information were excluded from our study. A systematic random sampling method was adopted.

Semistructured questionnaire (proforma) prepared by the investigators themselves through a rigorous literature review was used as a data collection tool. All the required information was filled in by seeing the health records of each subject. Variables of our study were age, sex, comorbidities, signs, and symptoms at presentation. (For full-length questionnaire, see Supporting Information: File 1.)

2.2 | Sample size

The sample size was calculated with standard Cochran's sample size formula taking the prevalence of GI symptoms at 12% based on the study by Sravanthi Parasa et al. and 4.96% absolute precision at 95% confidence interval (CI) and 5% significance level.¹⁵

The sample size is calculated as follows:

$$n = Z^2pq/e^2 = (1.962 \times 0.12 \times 0.88)/0.04962 = 165,$$

where n is the sample size, $Z = 1.96$ at 95% CI, $p = 0.12$ is the prevalence of enteric symptoms taken as 12% from a study by Sravanthi Parasa et al., $q = 1 - p = 0.88$, and e the standard error (taking 4.96%).

The calculated sample size was 165 considering the level of confidence as 95% with a 5% margin of error.

2.3 | Research ethics

The study was conducted in accordance with the protocol and approved by the ethical review board of the Nepal Health Research Council; protocol registration number: 152/2022P; submitted date: March 28, 2022.

2.4 | Statistical analysis

Data were entered into and analyzed using IBM SPSS[®] v21 (IBM). Descriptive statistics like frequency, percentages, mean \pm SD, and/or median (minimum–maximum) were calculated wherever required and depicted accordingly in bar diagrams. The association of the GI involvements with selected background characteristics was assessed using the χ^2 test and binary logistic regression. A p value less than 0.05 was considered significant. The 95% CI of prevalence was estimated using OpenEpi[®] v3.

3 | RESULTS

3.1 | Baseline characteristics of the symptomatic and rRT-PCR-positive COVID-19 participants

A total of 165 patients with confirmed COVID-19 infection were included in our study. Out of 165 cases, 86 (52.1%) were male and

79 (47.9%) were female. The mean age of the patients was 45.02 ± 15.82 (mean \pm SD) with a range of 18–83 years (Table 1). Only 22 patients (13.3%) had comorbidities; among these, the majority of patients suffered from hypertension (7.3%), followed by chronic obstructive pulmonary disease (4.8%), diabetes mellitus (2.4%), and others (1.2%) (Figure 1). On COVID-19 vaccination status, only 62 patients (37.6%) were vaccinated against COVID-19, with the majority by Verocell at 20%, followed by Covishield/AstraZeneca at 12.7%, Johnson & Johnson at 3.6%, and Moderna at 1.2% (Figure 2).

TABLE 1 Background characteristics of the symptomatic and rRT-PCR-positive COVID-19 participants (N = 165).

	Frequency	%	Mean \pm SD [median (min–max)]
Age (years)			45.02 ± 15.81 [43 (18–83)]
<50	100	60.6	
≥ 50	65	39.4	
Gender			
Male	86	52.1	
Female	79	47.9	
Comorbidities			
No	143	86.7	
Yes	22	13.3	
COVID-19 vaccines received			
No	103	62.4	
Yes	62	37.6	

Abbreviations: COVID-19, coronavirus disease 2019; min, minimum; max, maximum; rRT-PCR, real-time reverse transcription PCR.

3.2 | Proportion of enteric involvement

Our study found that more than half of the patients confirmed with COVID-19 infection had enteric involvement in 97/165 patients (58.78%). Among GI symptoms, diarrhea in 67 patients (40.6%) and nausea and/or vomiting in 66 patients (40%) were the most common symptoms, followed by anorexia in 19 patients (11.5%) and abdominal pain in 27 patients (16.4%) (Table 2). Among non-GI symptoms, cough was present in majority of patients 124 (75.2%), followed by fever in 118 (71.5%), SOB in 84 (50.9%), fatigue in 76 (46.1%), chest pain in 59 (35.8%), other nonspecific symptoms in 50 (30.3%) and palpitation in 4 patients (2.4%).

3.3 | Imaging, treatment, complications, and mortality in COVID-19 cases

Nearly two-fifths of the patients, 70 (42.4%), developed consolidation in a chest X-ray. Sixty-one out of 165 patients (37%) required supportive oxygen, of these 16 patients (26.2%) needed mechanical ventilation. Treatment with steroids was given to 73 patients (44.2%). The duration of stay in the PHC was 6.69 ± 2.90 [7.0 (0–15)] days {mean \pm SD [median (min–max)]}. Complications like acute respiratory distress syndrome (ARDS), shock, and arrhythmia developed in 16 patients (9.7%), with the death of eight patients (4.8%) (Table 3).

3.4 | Association of GI involvement with baseline characteristics

Binary logistic regression analysis was performed among variables like age, gender, comorbidities, and COVID-19 vaccination status with GI involvement. Receiving COVID-19 vaccination was associated with 4.32 times higher odds of having GI involvement in

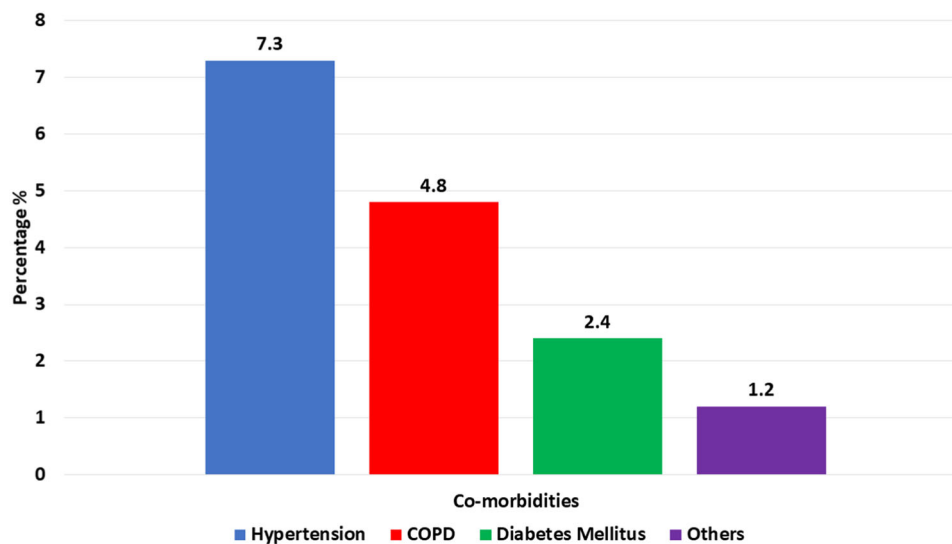


FIGURE 1 Proportion of different comorbidities (N = 165). COPD, chronic obstructive pulmonary disease.

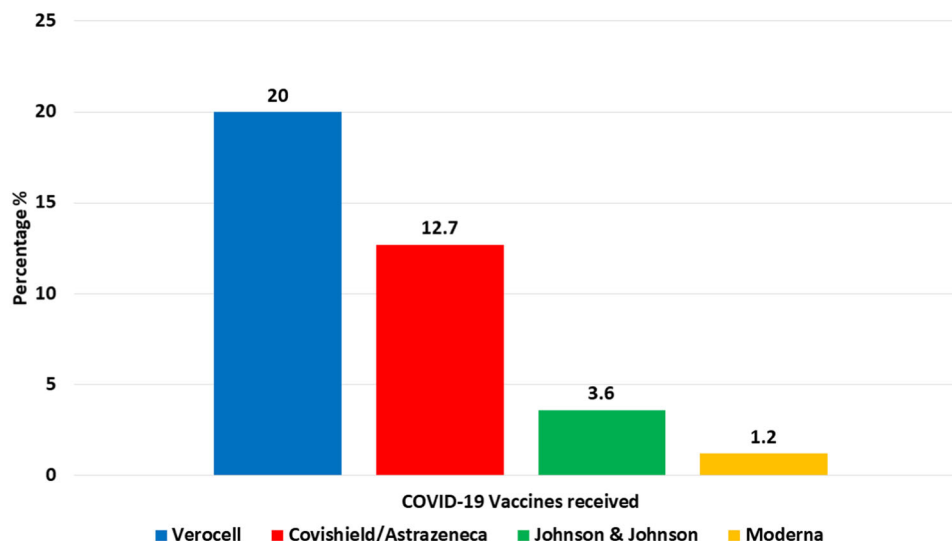


FIGURE 2 Proportion of coronavirus disease 2019 (COVID-19) vaccines received (2 doses) (N = 165).

TABLE 2 Symptoms of the symptomatic and rRT-PCR-positive COVID-19 participants (N = 165).

Variables	Frequency	%
Gastrointestinal symptoms (n = 97)		
Diarrhea	67	40.6
Nausea and/or vomiting	66	40.0
Anorexia	19	11.5
Pain abdomen	27	16.4
Nongastrointestinal symptoms (n = 159)		
SOB	84	50.9
Sore throat	79	47.9
Chest pain	59	35.8
Cough	124	75.2
Palpitation	4	2.4
Fatigue	76	46.1
Fever	118	71.5
Others nonspecific	50	30.3

Abbreviations: COVID-19, coronavirus disease 2019; rRT-PCR, real-time reverse transcription PCR; SOB, shortness of breath.

subsequent COVID-19 infection (95% CI, 2.09–8.91; $p \leq 0.001$; Table 4).

4 | DISCUSSION

Early studies from 2019 and 2020 have shown that the proportion of COVID-19 patients presenting with enteric symptoms was low. However, with time and more studies, evidence of enteric involvement was increasing, and GI symptoms were common in patients

with COVID-19. Shreds of evidence of feco-oral transmission of COVID-19 are also on the rise.^{11,15,16} The importance of understanding the various organs and systems involved in COVID-19 is unparalleled. Still, there have been very few studies in Nepal reporting such issues. Thus, we aimed to study how COVID-19 had affected the enteric system in COVID-19 patients presenting to a PHC in Nepal.

In this single-center, cross-sectional study, we found that more than half of the patients had at least one GI symptom on presentation. The prevalence of GI symptoms in our study group appears to be comparable with those noted in prior studies.^{17–22} However, many studies reported GI symptoms in less than 30% of patients infected with COVID-19, ranging from 12.1% to 29.9%.^{23–29} A higher prevalence of GI symptoms could be due to the tendency to admit as many RT-PCR-positive patients as possible in our study center to isolate and prevent the spread of infection during the study period.

Among GI complaints, diarrhea was the most common complaint that was reported in 40.6% of our patients, followed by nausea/vomiting in 40%. Similar findings have been reported in different parts of the world by different investigators.^{19,20,23–25} However, a meta-analysis conducted by Dong et al.²⁰ reported anorexia at 17% as the most common symptom in COVID-19 patients, followed by diarrhea at 8%, nausea, and vomiting at 7%, and abdominal pain at 3%. Studies done in Arab and Turkish countries reported similar incidences of GI symptoms as reported by Dong and co-workers.^{20,21,28} Abbasinia et al. reported anorexia as the most common complaint of presentation to GI clinics and noted increased GI manifestations in a later stage of the COVID-19 pandemic than in the early stage.³⁰

Infection and inflammation of intestinal epithelial cells by SARS-CoV-2 through ACE2 receptors have been implicated in the pathogenesis of GI symptoms. With the severity of the disease, there is an increase in total leukocyte count and absolute neutrophil count while there is a decrease in absolute lymphocyte count, eosinophils, basophils, hemoglobin, and platelets count.^{31,32} Likewise,

TABLE 3 Lung changes on chest X-ray, steroids treatment, oxygen therapy, duration of stay, complications, and mortality of the symptomatic and rRT-PCR-positive COVID-19 participants.

Variables	Frequency	%
Chest X-ray consolidation		
No	95	57.6
Yes	70	42.4
Treatment with steroids		
No	92	55.8
Yes	73	44.2
Supportive oxygen		
No	104	63.0
Yes	61	37.0
Means of oxygen therapy ^a		
Nasal cannula	38	62.3
Face mask	23	37.7
Need for mechanical ventilation		
No	149	90.3
Yes	16	9.7
Duration of stay (days)		
Mean ± SD [median (min–max)]	6.69 ± 2.90 [7.0 (0–15)]	
Complications ^b		
No	149	90.3
Yes	16	9.7
Mortality		
No	157	95.2
Yes	8	4.8

Abbreviations: COVID-19, coronavirus disease 2019; min, minimum; max, maximum; rRT-PCR, real-time reverse transcription PCR.

^aOut of those who received oxygen therapy ($n = 61$).

^bComplications: ARDS, shock, and arrhythmia.

serum levels of erythrocyte sedimentation rate and C-reactive protein (CRP) were also increased and CRP could be used as an indicator of progression and severity of COVID-19 infection.³³ The fecal shedding of viral RNA for a prolonged duration, even up to 4 months (12.7%), would explain the prolonged morbidity of COVID-19 infection with GI involvement.^{16,34}

The younger population (age <50 years) had more GI symptoms than the elderly population (63% vs. 52%) in our study. Our findings were similar to those reported by Leal et al.²⁵ and Bukum et al.²¹ GI involvement in both males and females was found to be nearly equal (58% vs. 59%) in our study. Dolu et al. reported similar GI involvement in both sexes.²⁷ In contrast, Han et al. (65.7% vs. 51.1%) and Montazeri et al. (28% vs. 23%) reported more GI involvement in females than males.^{26,35}

A prospective study in India stated more frequent GI symptoms in severe COVID-19 patients with comorbidities than in patients

without comorbidities (34.18% vs. 23.68%).³⁶ In contrast, an equal prevalence of GI symptoms in COVID-19 patients with or without comorbidities was noted in our study. This disparity might be due to the fact that severe COVID-19 patients have usually already been treated with antivirals. In our study, COVID-19 patients with vaccinated status had a 4.32-fold higher risk of having GI symptoms than those without vaccination. This is quite an interesting finding of our study, which needs further confirmation and study.

A total of 42.4% of patients with COVID-19 infection had consolidation in the chest radiograph at the time of diagnosis or sometime during the disease course in our study, which is comparable to the findings reported by Sadiq et al. (30 of 64; 47%) and Wong et al. (28%, 95% CI: 8–54).^{37,38} Ground-glass opacities were the second most common abnormalities reported in COVID-19-infected patients (10%–53%), contrary to the fact that pleural effusion and pneumothorax were rare findings.³⁸

Mechanical ventilation was done in 16 (9.7%) patients in our study. This rate of mechanical ventilation is similar to that of the study by Dolu et al.²⁷ (9.9%) but less than that of the study by Montazeri et al.²⁶ (16.7%). Our study reported a mortality rate of 4.8%, which was less than that of studies in China and Turkey.^{1,27} Schettino et al.¹⁷ and Livanos et al.¹³ found a lower mortality rate in COVID-19 patients with GI symptoms, which is quite controversial as another study conducted in Wuhan reported more mortality in patients with GI symptoms along with respiratory symptoms.¹² A study in the United States by Song et al. suggested that patients with isolated GI symptoms without extra GI symptoms had significantly higher mortality rates and higher intensive care unit requirements.³⁹ ARDS, shock, and arrhythmia were the common causes of mortality in our study.

The mean hospital stays of the patients, regardless of GI involvement, in our study were 6.69 ± 2.9 days. Similar hospital durations were reported by Montazeri et al.²⁶ at 6.03 days and by Leal et al.²⁵ at 7 days. On the contrary, the hospital stay of patients was longer in an American study (13.5 days).¹⁹

To the best of our knowledge, this was the first study carried out in Nepal to assess the GI involvement of COVID-19 infection. Insights into GI symptoms as presenting complaints of COVID-19 infection help in reaching an early diagnosis and taking measures to control transmission in future outbreaks or pandemics. However, the retrospective design, single primary care center study site, and small sample size are the major limiting factors of this study. Also, similar side effects may occur in persons using antivirals and other medications. As a result, it can be challenging to distinguish between symptoms brought on by viruses and those brought on by drugs.

5 | CONCLUSIONS

Acute GI symptoms were highly prevalent in COVID-19 patients in our study. Diarrhea and nausea/vomiting were the most common GI symptoms affecting younger patients more than older patients. COVID-vaccinated patients were more likely to have enteric symptoms than nonvaccinated patients.

TABLE 4 Association of GI involvement with background characteristics of the participants.

Variables	N (%)	GI involvement			Binary logistic regression		
		%	Yes (%)	%	OR	95% CI	p Value
Age (years)							0.173
<50	37	37.0	63	63.0	1 (ref.)		
≥50	31	47.7	34	52.3	0.64	0.34–1.21	
Gender							0.889
Male	35	40.7	51	59.3	1 (ref.)		
Female	33	41.8	46	58.2	0.96	0.51–1.78	
Comorbidities							0.975
No	59	41.3	84	58.7	1 (ref.)		
Yes	9	40.9	13	59.1	1.02	0.41–2.53	
COVID-19 vaccines received							<0.001
No	55	53.4	48	46.6	1 (ref.)		
Yes	13	21.0	49	79.0	4.32	2.09–8.91	

Abbreviations: COVID-19, coronavirus disease 2019; GI, gastrointestinal; ref., reference; rRT-PCR, real-time reverse transcription PCR.

AUTHOR CONTRIBUTIONS

Shekhar Gurung: Conceptualization; data curation; investigation; methodology; project administration; resources; writing—review and editing. **Saurab Karki:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; supervision; writing—original draft; writing—review and editing. **Bishnu Deep Pathak:** Conceptualization; data curation; methodology. **Gopal K. Yadav:** Conceptualization. **Gaurab Bhatta:** Conceptualization; formal analysis; methodology. **Sumin Thapa:** Methodology. **Sabin Banmala:** Writing—original draft; Writing—review and editing. **Anil J. Thapa:** Writing—original draft; writing—review and editing. **Kumar Roka:** Writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The complete data of this research is fully available on request made to the corresponding author.

ETHICS STATEMENT

The study was approved by the Nepal Health Research Council Board. The consent was taken in written format, all the patient's details were kept confidential, and no information revealing the patient's identity was disclosed in the article.

TRANSPARENCY STATEMENT

The lead author Saurab Karki affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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REFERENCES

- Cao J, Tu W, Cheng W, Yu L. Clinical features and short-term outcomes of 102 patients with corona virus disease 2019 in Wuhan, China 2. *Clin Infect Dis*. 2020;71(15):748-755.
- Tsai PH, Lai WY, Lin YY, et al. Clinical manifestation and disease progression in COVID-19 infection. *J Chin Med Assoc*. 2021;84:3-8.
- Li LY, Wu W, Chen S, et al. Digestive system involvement of novel coronavirus infection: prevention and control infection from a gastroenterology perspective. *J Dig Dis*. 2020;21:199-204.
- Pamplona J, Solano R, Soler C, Sabat M. Epidemiological approximation of the enteric manifestation and possible fecal-oral transmission in COVID-19: a preliminary systematic review. *Eur J Gastroenterol Hepatol*. 2021;33:e21-e29.
- Rahimkhani M, Ghofrani H. *Helicobacter pylori* and peptic ulcer in cirrhotic patients. *Pak J Med Sci*. 2008;24(6):849-852.
- Lin L, Jiang X, Zhang Z. *Gastrointestinal Symptoms of 95 Cases With SARS-CoV-2 infection*. *Gastroenterological Endoscopy*. BMJ Publishing Group; 2020:1686.
- Almaro CV, Chey WD, Spiegel BMR. Increased risk of COVID-19 among users of proton pump inhibitors. *Am J Gastroenterol*. 2020;115:1707-1715.

8. Araújo-Filho I, Vianna Bocchese N, Gurgel Dávila N, et al. Covid-19: gastroenterology perspectives. *Clin Med Rev Rep.* 2020;2:01-07.
9. Ye Q, Wang B, Zhang T, Xu J, Shang S. The mechanism and treatment of gastrointestinal symptoms in patients with COVID-19. *Am J Physiol.* 2020;319:G245-G252.
10. Zhang L, Tian M, Song Y, et al. Urinary SARS-CoV-2 RNA is an indicator for the progression and prognosis of Covid-19. *Diagnostics.* 2021;11:2089.
11. Chen L, Lou J, Bai Y, Wang M. COVID-19 disease with positive fecal and negative pharyngeal and sputum viral tests. *Am J Gastroenterol.* 2020;115(5):790.
12. Shang H, Bai T, Chen Y, et al. Outcomes and implications of diarrhea in patients with SARS-CoV-2 infection. *Scand J Gastroenterol.* 2020;55:1049-1056.
13. Livanos AE, Jha D, Cossarini F, et al. Gastrointestinal involvement attenuates COVID-19 severity and mortality. *medRxiv.* Preprint posted online November 11, 2020. doi:10.1101/2020.09.07.20187666
14. Rahimkhani M, Mordadi A, Varmazyar S, Tavakoli A. Evaluation of urinary interleukin-8 levels in patients with spinal cord injury. *Recent Pat Antiinfect Drug Discov.* 2015;9:144-149.
15. Parasa S, Desai M, Thoguluva Chandrasekar V, et al. Prevalence of gastrointestinal symptoms and fecal viral shedding in patients with coronavirus disease 2019: a systematic review and meta-analysis. *JAMA Network Open.* 2020;3:e2011335.
16. Natarajan A, Zlitni S, Brooks EF, et al. Gastrointestinal symptoms and fecal shedding of SARS-CoV-2 RNA suggest prolonged gastrointestinal infection. *Med.* 2022;3:371-387.e9.
17. Schettino M, Pellegrini L, Picascia D, et al. Clinical characteristics of COVID-19 patients with gastrointestinal symptoms in Northern Italy: a single-center cohort study. *Am J Gastroenterol.* 2021;116:306-310.
18. Marasco G, Cremon C, Barbaro MR, et al. Prevalence of gastrointestinal symptoms in severe acute respiratory syndrome coronavirus 2 infection: results of the prospective controlled multinational GI-COVID-19 study. *Am J Gastroenterol.* 2022;117:147-157.
19. Hasel K, Salim A, Verma S, et al. Prevalence of gastrointestinal symptoms, hepatic dysfunction, and outcomes in hospitalized patients with COVID-19 infection: an early experience. *Cureus.* 2022;14(2):e22152.
20. Dong Z, Xiang BJ, Jiang M, Sun M, Dai C. The prevalence of gastrointestinal symptoms, abnormal liver function, digestive system disease and liver disease in COVID-19 infection: a systematic review and meta-analysis. *J Clin Gastroenterol.* 2021;55:67-76.
21. Bukum E, Ayarci AO, Guler K. Are gastrointestinal symptoms important in patients with COVID-19? *Turk J Gastroenterol.* 2023;34:203-210.
22. Jin X, Lian JS, Hu JH, et al. Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (COVID-19) with gastrointestinal symptoms. *Gut.* 2020;69:1002-1009.
23. Ferm S, Fisher C, Pakala T, et al. Analysis of gastrointestinal and hepatic manifestations of SARS-CoV-2 infection in 892 patients in Queens, NY. *Clin Gastroenterol Hepatol.* 2020;18:2378-2379.e1.
24. Al Argan R, Ismail M, Alkhafaji D, et al. Gastrointestinal manifestations of COVID-19 in a single center in the Eastern Province of Saudi Arabia. *Saudi J Gastroenterol.* 2022;28:218.
25. Leal T, Costa E, Arroja B, Gonçalves R, Alves J. Gastrointestinal manifestations of COVID-19: results from a European centre. *Eur J Gastroenterol Hepatol.* 2021;33:691-694.
26. Montazeri M, Maghbouli N, Jamali R, et al. Clinical characteristics of COVID-19 patients with gastrointestinal symptoms. *Arch Iran Med.* 2021;24:131-138.
27. Dolu S, Bengi G, Avkan Oguz V, et al. Prevalence of gastrointestinal symptoms and clinical outcomes in hospitalized coronavirus disease 2019 patients: a single-center study from Turkey. *Turk J Gastroenterol.* 2022;33:955-963.
28. Tarik A, Soukaina R, Samir M, et al. Gastrointestinal manifestations with COVID-19 virus infection: a Moroccan prospective study. *Arab J Gastroenterol.* 2021;22:305-309.
29. Cheung KS, Hung IFN, Chan PPY, et al. Gastrointestinal manifestations of SARS-CoV-2 infection and virus load in fecal samples from a Hong Kong cohort: systematic review and meta-analysis. *Gastroenterology.* 2020;159:81-95.
30. Abbasinia M, Hormati A, Eshagh Hossaini SK, et al. Clinical manifestations of gastrointestinal symptoms in COVID-19 patients: an integrative review. *Gastroenterol Nurs.* 2021;44:E1.
31. Palladino M. Complete blood count alterations in COVID-19 patients: a narrative review. *Biochem Med.* 2021;31:30501.
32. Awale R, Singh A, Mishra P, et al. Routine hematology parameters in COVID-19: a predictor of disease severity and mortality. *J Family Med Prim Care.* 2022;11:3423.
33. Sadeghi-Haddad-Zavareh M, Bayani M, Shokri M. C-reactive protein as a prognostic indicator in COVID-19 patients. *Interdiscip Perspect Infect Dis.* 2021;2021:5557582.
34. Jin Y, Yang H, Ji W, et al. Virology, epidemiology, pathogenesis, and control of COVID-19. *Viruses.* 2020;12:372.
35. Han C, Duan C, Zhang S, et al. Digestive symptoms in COVID-19 patients with mild disease severity: clinical presentation, stool viral RNA testing, and outcomes. *Am J Gastroenterol.* 2020;115:916-923.
36. Singh P, Shivhare A, Rathiswamy MK, et al. Frequency and impact of preadmission digestive symptoms on outcome in severe COVID-19: a prospective observational cohort study. *Indian J Crit Care Med.* 2021;25:1247-1257.
37. Sadiq Z, Rana S, Mahfoud Z, Raoof A. Systematic review and meta-analysis of chest radiograph (CXR) findings in COVID-19. *Clin Imaging.* 2021;80:229-238.
38. Wong HYF, Lam HYS, Fong AHT, et al. Frequency and distribution of chest radiographic findings in patients positive for COVID-19. *Radiology.* 2020;296:E72-E78.
39. Song J, Patel J, Khatri R, Nadpara N, Malik Z, Parkman HP. Gastrointestinal symptoms in patients hospitalized with COVID-19: prevalence and outcomes. *Medicine.* 2022;101:E29374.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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