Review
https://doi.org/10.23934/2223-9022-2023-12-3-458-463

Gastrointestinal Bleeding in Patients with New Coronavirus Infection COVID-19

V.D. Anosov[1], S.A. Domrachev[2], S.V. Ovchinnikov[1], N.O. Solovyov[2] ✉

Surgery Department
[1] O.I. Filatov City Clinical Hospital No. 15
23, Veshnyakovskaya St., 111539, Moscow, Russian Federation
[2] A.S. Loginov Moscow Clinical Scientific and Practical Center
86, Entuziastov Hwy, 111123, Moscow, Russian Federation

✉ **Contacts:** Nikita O. Solovyov, Clinical Resident, A.S. Loginov Moscow Clinical Scientific and Practical Center. Email: niks97@list.ru

ABSTRACT Currently, the issue of coronavirus infection COVID-19 remains extremely relevant, and the SARS-CoV-2 virus also affects the gastrointestinal tract, and in some cases, coronavirus infection can be complicated by gastrointestinal bleeding. Up to 13% of COVID-19 patients have this complication. At the same time, the issue of determining risk factors for the development of gastrointestinal bleeding in patients with COVID-19 remains unresolved in the world literature. There is no single standardized approach to the treatment of gastrointestinal bleeding in patients with COVID-19. The above reasons served as prerequisites for this literature review. The purpose of the literature review is to establish risk factors and groups for gastrointestinal bleeding in patients with a new coronavirus infection, and to determine current and effective methods of treating this disease.

Keywords: gastrointestinal bleeding, coronavirus infection, COVID-19
For citation Anosov VD, Domrachev SA, Ovchinnikov SV, Solovyov NO. Gastrointestinal Bleeding in Patients With New Coronavirus Infection COVID-19. *Russian Sklifosovsky Journal of Emergency Medical Care*. 2023;12(3):458–463. https://doi.org/10.23934/2223-9022-2023-12-3-458-463 (in Russ.)
Conflict of interest Authors declare lack of the conflicts of interests
Acknowledgments, sponsorship The study has no sponsorship

Affiliations

Viktor D. Anosov	Candidate of Medical Sciences, Deputy Chief Physician for Surgery, O.I. Filatov City Clinical Hospital No. 15; https://orcid.org/0000-0002-8486-7159, avsurg@mail.ru; 25%, concept development, editing
Sergey A. Domrachev	Doctor of Medical Sciences, Leading Researcher O.I. Filatov City Clinical Hospital No. 15; https://orcid.org/0000-0001-6759-2491, domra53@list.ru; 25%, concept development, text correction
Sergey V. Ovchinnikov	Surgeon, O.I. Filatov City Clinical Hospital No. 15; https://orcid.org/0009-0006-0265-4659, servio@mail.ru; 25%, literature search, text writing
Nikita O. Solovyov	Clinical resident, O. I. Filatov City Clinical Hospital No. 15; https://orcid.org/0000-0002-1295-8035, niks97@list.ru; 25%, literature search, text writing

GIB – gastrointestinal bleeding
GI-tract – gastrointestinal tract
PPIs – proton pump inhibitors

INTRODUCTION

The first cases of the new coronavirus infection *SARS-CoV*-2 were registered and described in December 2019, in the Chinese city of Wuhan, Hubei province [1]. From that moment on, *COVID-19* spread like lightning across all continents and grew to the scale of a pandemic. As a rule, the manifestations of this infection are accompanied by acute systemic and respiratory symptoms and syndromes: hyperthermia, cough, shortness of breath, pneumonia, up to the development of acute respiratory distress syndrome, systemic inflammatory response syndrome and multiple organ failure [2]. However, *SARS-CoV*-2 can also affect the gastrointestinal tract (GIT), and in addition to the usual manifestations: diarrhea, nausea, vomiting, gastrointestinal bleeding (GIB) often occurs [3–6]. According to world literature, GIB occur in 1–13% of patients hospitalized for this infection [4–8]. Predisposing risk factors for GIB in patients with the new coronavirus infection *SARS-CoV*-2 are the pathogenetic features of the disease, namely the tropism of the SARS-CoV-2 virus to the receptors of angiotensin-converting enzyme 2, which is widely expressed, including in the gastrointestinal tract. Another factor contributing to the occurrence of gastrointestinal bleeding is anticoagulant and antithrombotic therapy, carried out in this group of patients due to the high risk of

thrombotic complications [9, 10]. However, today there is no consensus regarding the treatment tactics of GIB in patients with *SARS-CoV*-2 infection. And the mutually aggravating effect of GIB on the course of the infectious process can negatively affect the effectiveness of treatment. Thus, GIB among patients with *COVID-19* is an extremely urgent and complex problem that requires precision study and a multidisciplinary approach.

DISCUSSION

FREQUENCY AND SOURCES OF GASTROINTESTINAL BLEEDING IN PATIENTS WITH *COVID*-19

The incidence of GIB among patients with *COVID*-19, according to the authors, can reach 13%, while according to the results of the latest meta-analysis, which included 1,481,235 patients, the overall incidence of GIB was 2% of them, and in most cases the source of bleeding is localized in the upper sections of the gastrointestinal tract (76.6%) [4]. Similar data were obtained in another meta-analysis by *Umair Iqbal et al.*: in 76.3% of cases, the source of bleeding was in the upper gastrointestinal tract; in 23.7% the source was in the lower one [5]. *Trindade A.J. et al*. when analyzing data of 339 patients with *COVID-19* with GIB, they also noted a predominant amount of bleeding from the upper gastrointestinal tract [11]. In endoscopic studies performed at 6 academic centers in New York City in March and April 2020, patients with *COVID-19* showed a higher incidence of ulcerations and erosions in the upper gastrointestinal tract (30.1%) compared with uninfected patients (20.8%) [12]. Based on this study, it can be concluded that in patients with *SARS-CoV*-2 infection with gastrointestinal tract bleeding, the source of bleeding in most cases is located in the upper gastrointestinal tract.

The most common source of bleeding, according to the results of a meta-analysis by *Iqbal U. et al*., was peptic ulcer, 47.5% [5]. This is also reported by *Trindade A. J. et al.* — gastroduodenal ulcers were identified in 55% of patients with GIB and *COVID-19* [11]. In a study by *Martin T.A. et al.* gastric and duodenal ulcers were also the most common cause of bleeding from the upper gastrointestinal tract: in 80% of cases [13]. Similar data are presented in many other studies on *COVID-19* and GIB [14–18]. Based on the above data, the source of bleeding during GIB in patients with *SARS-CoV*-2 infection in most cases is located in the upper gastrointestinal tract, and peptic ulcers of the stomach and duodenum are the most common cause of the development of GIB in this group of patients. Therefore, patients with *COVID-19* who have a history of gastric and duodenal ulcers should pay special attention to the prevention and treatment of GIB.

RISK FACTORS

For effective prevention and treatment of GIB in patients with *COVID*-19, it is extremely important to understand comprehensively the risk factors. It is assumed that one of them may be anticoagulant and antithrombotic therapy, which in most cases is necessary to combat the development of thrombotic complications characteristic of *SARS-CoV*-2 infection [10, 19]. When analyzing data from more than 2,455 patients who received antithrombotic therapy from January 2017 to December 2021, during the *COVID-19* pandemic, an almost twofold increase in the incidence of GIB from the upper gastrointestinal tract was revealed. At the same time, the authors noted significantly higher mortality rates among patients with coronavirus infection with GIB who received antithrombotic therapy compared with uninfected patients: 62.5% and 15.52%, respectively [20].

However, with further study of the literature, the assumption about the relation between the risk of GIB and anticoagulant therapy in patients with *COVID-19* began to seem ambiguous. Most publications contain information that patients with GIB associated with *COVID-19* were prescribed anticoagulant and antithrombotic therapy. In a multicenter study conducted in northern Italy, the vast majority, 78% of patients with GIB, received anticoagulant therapy. Of these, 35% of patients received a prophylactic dose, and 44% received a therapeutic dose [14]. In the study *Iqbal U.*, conducted using the case-control method, in the study group of patients with *COVID-19* and gastrointestinal tract, the majority of patients (72.2%) received anticoagulant therapy, 27.8% of patients received a prophylactic dose, 44.4% received a therapeutic dose [18]. *Holzwanger E.A, et al.* also reported that 73% of patients received anticoagulants based on the results of a study of GIB from the lower gastrointestinal tract in patients with *COVID-19* [21].

However, the question arises: is anticoagulant therapy for *COVID-19* a risk factor for the development of gastrointestinal tract? In this regard, it is noteworthy that in a certain part of the studies there was no statistically significant correlation between GIB in patients with *COVID-19* and anticoagulant therapy. Such data were obtained in a pseudo-randomized study by *Trindade A.J. et al.* of case-control type [11]. There was no increase in the risk of

GIB in patients with *SARS-CoV*-2 infection during anticoagulant therapy *Abulawi A. et al.*, in a case-control study [22]. In contrast, in the work of *Martin T.A. et al.* performed according to the same methodological principle, the authors still suggest that the use of anticoagulants may increase the incidence of GIB in patients with *COVID*-19, but the observed relationship was not statistically significant. The above data are consistent with the results of recent meta-analyses, in which the authors also reported that the majority of patients with *SARS-CoV*-2 infection and GIB received anticoagulants [4, 5]. However, *Marasco G. et al.* (based on the results of a meta-analysis) did not reveal a statistically significant effect of anticoagulant therapy on the incidence of GIB in patients with *COVID-19* [4].

Thus, the effect of anticoagulant and antithrombotic therapy on the risk of developing GIB in patients with coronavirus infection remains an extremely controversial and insufficiently studied issue that requires further research, like other risk factors for the development of GIB in *COVID*-19.

Among other statistically significant risk factors for gastrointestinal bleeding in *COVID*-19, the authors identify: blood hemoglobin levels less than 10 g/l, severe abdominal pain, systolic pressure less than 90 mm Hg, long stay in the intensive care unit, as well as score 14 or higher according to *Glasgow–Blatchford* scale [17, 21–23].

However, most of these factors are not highly specific and do not allow us to sufficiently assess the risk of GIB in patients with *COVID*-19. At the same time, assessment of the *Glasgow–Blatchford scale* may be appropriate for risk stratification in cases of suspected GIB in patients with *COVID*-19. The work of *Prasoppokakorn T. et al.* is of interest, in which the following statistically significant correlation was established: the risk of GIB in patients with *COVID-19* was higher if they did not take proton pump inhibitors (PPIs) [24]. Based on the above, we can conclude that reliable risk factors for GIB in patients with *COVID-19* have not been clearly defined today.

TREATMENT METHODS

After performing a multicenter study, *Blackett J. W. et al.* found that the need for endoscopic methods to arrest bleeding (clipping, coagulation, injection with epinephrine) in patients with *COVID-19* arose more than twofold than in uninfected patients (40% and 17.1%, respectively) [12]. *Mauro A. et al.* report on 23 cases of upper GIB, of which 5 patients required endoscopic clipping and injection of epinephrine and in one case endoscopic injection of cyanoacrylate.

In the early postoperative period, repeated bleeding was observed in 3 patients, in 2 of them embolization was performed under X-ray guidance, and in one case, repeated endoscopic intervention was performed. The mortality rate was 21.7% (5 patients) [14]. *Melazzini F. et al.* presented a series of clinical observations of 5 cases of GIB in patients with *COVID*-19. At the time of admission, all patients were receiving anticoagulant therapy and had no history of peptic ulcer disease. The manifestation of GIB on average was noted on the day 9, the major manifestations were severe anemia and characteristic symptoms such as melena and a dramatic decrease in blood pressure. In 4 out of 5 patients, endoscopic examination revealed ulcerative lesions of the stomach and duodenum. However, only in one case surgical intervention was required, so endoscopic clipping and injection with adrenaline were performed. The remaining 4 patients underwent conservative therapy with a positive effect. The authors reported one episode of repeated bleeding that required selective arterial embolization [16]. *Iqbal U. et al.* did not reveal statistically significant differences in the frequency of surgical treatment of GIB in patients with *COVID-19* and a group of uninfected patients, performing case-control study. Among patients with *SARS-CoV-2* infection, interventions were required in 22.2% of cases: endoscopic injection of adrenaline and nebulization of hemostatic spray in two patients for peptic ulcer disease, argon plasma coagulation for arteriovenous malformation of the small intestine, and endoscopic clipping for a single ulcer hepatic flexure of the colon. At the same time, the majority of cases of GIB (66.7%.) in patients with *COVID-19* required only conservative treatment. The authors found statistically significant differences in the number of patients who required treatment in the intensive care unit: 83.3% of patients in the *COVID-19* group and 33.3% in the comparison group. 30-day mortality rates were also higher in the *COVID-19* group, 38.9% and 18.5%, respectively [18]. However, these differences could be associated primarily with *COVID-19* infection, and not with the fact of gastrointestinal tract. *Abulawi A. et al.* report 76 cases of gastrointestinal tract bleeding in patients with *COVID*-19; all patients underwent esophagogastroduodenoscopy, and 28 additionally underwent colonoscopy. In 30% of cases ($n = 26$), surgical endoscopic intervention was required: clipping (11), epinephrine injections (2) and coagulation (3), two patients underwent angiography followed by interventional embolization. The average hospital day was statistically significantly higher in the GIB group: 16 and 7 days, respectively [22].

Thus, endoscopic interventions play an important role in the effective fight against GIB in patients with *COVID-19*. However, independent conservative therapy is also effective in many cases. *Shalimar, Vaishnav M. et al.* report on the successful experience of conservative treatment of 24 patients with *COVID-19* and gastrointestinal tract. Conservative therapy included vasoconstrictors-somatostatins in 17 cases (73.9%) and vasopressin analogues in 4 patients (17.4%). All patients received PPIs and antibiotics. According to indications, red blood cell suspension, fresh frozen plasma and platelet mass were transfused to 4, 3 and 3 patients, respectively. In all observations, effective hemostasis was achieved; not a single patient required emergency endoscopic interventions. Moreover, after 5 days of observation there were no relapses of bleeding or deaths. In the further postoperative period, recurrent bleeding was observed in 2 patients [23]. *Holzwanger A. et al.* in the treatment of 11 patients with GIB located in the lower gastrointestinal tract, effective hemostasis was achieved using conservative therapy in 10 cases; only one patient required interventional embolization. However, the vast majority of patients were treated in an intensive care unit. The authors report that none of the observations required endoscopic interventions. Repeated bleeding was observed in one patient [21]. The effectiveness of embolization for GIB in patients with new coronavirus infection was studied by *Ierardi A.M. et al.* [25]. This intervention was performed in 11 patients, while repeated bleeding was observed in only one, which required additional endoscopic hemostasis. Complications were observed in 2 patients: hematoma of the groin area and ischemic rectal ulcer. In both cases, complications were managed with conservative treatment methods, and no 30-day mortality was recorded [25]. It should be noted that arterial embolization, being an effective method of combating GIB, is a technically complex intervention that also requires specialized equipment. However, this procedure has advantages over endoscopy in patients with *COVID-19* due to the reduced risk of spreading infection among staff and patients of the hospital.

Thus, a review of the literature on gastrointestinal bleeding in patients with *COVID-19* showed that in most cases, internal bleeding can be successfully treated with conservative therapy. If it is ineffective, endoscopic and interventional interventions can achieve reliable hemostasis in this group of patients. X-ray-guided embolization offers some benefits in this group of patients by reducing the risk of spread of infection. In this case, the choice of a specific intervention method depends on many factors: the location and severity of bleeding, the general condition of the patient, as well as the technical equipment and experience of the clinic. Despite the large number of publications about the successful experience of treating GIB in patients with coronavirus infection, today there is no single standardized approach to the treatment of these patients. Risk factors for the development of GIB in patients with *COVID-19* are also not well studied. However, studies on this topic with high statistical reliability, such as randomized controlled trials and meta-analyses, are rare in the world literature.

CONCLUSION

The problem of gastrointestinal bleeding in patients with *COVID-19* is extremely relevant today, and, obviously, will not lose its significance for a long time. Risk factors and methods of combating gastrointestinal bleeding in patients with coronavirus infection have not been sufficiently studied. Among the main risk factors for the development of gastrointestinal bleeding in this group of patients, a history of peptic ulcer disease and previous episodes of gastrointestinal bleeding should be highlighted, while the role of anticoagulant therapy as a risk factor is assessed ambiguously. Prophylactic use of proton pump inhibitors may reduce the risk of gastrointestinal bleeding in patients with *COVID*-19, but this statement requires further study. It is obvious that the pathogenetic features of *SARS-CoV*-2, in particular, tropism for ACE-2 receptors (angiotensin-converting enzyme), are the primary factor leading to damage to the gastrointestinal tract and an increased risk of developing gastrointestinal bleeding. The frequency of gastrointestinal bleeding in patients with *COVID-19* is not so high and on average (according to the literature) is about 2%. Patients with *COVID-19* infection and gastrointestinal bleeding are more likely to require treatment in an intensive care unit. Moreover, according to most authors, conservative therapy, endoscopic and interventional intravascular interventions can effectively combat gastrointestinal bleeding in this group of patients. However, in the world literature there is no consensus and a single standardized approach to the management of this group of patients. Interventional embolization for gastrointestinal bleeding in patients with *COVID-19* is of interest due to the reduced risk of spreading the infection. However, studies examining the effectiveness of this technique in patients with coronavirus infection are few in the world literature. Thus, further study of risk factors and methods of combating gastrointestinal bleeding in patients with *COVID-19* is required, in particular in the framework of scientific studies with high statistical reliability.

REFERENCES

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* . 2020;395(10223):497–506. https://doi.org/10.1016/S0140-6736(20)30183-5 PMID: 31986264
2. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* . 2020;395(10229):1054–1062. https://doi.org/10.1016/S0140-6736(20)30566-3 PMID: 32171076
3. Openshaw PJ. Crossing barriers: GIB of the lung and the gut. *Mucosal Immunol.* 2009;2(2):100–102. https://doi.org/10.1038/mi.2008.79 PMID: 19129753
4. Marasco G, Maida M, Morreale GC, Licata M, Renzulli M, Cremon C, et al. Gastrointestinal Bleeding in COVID-19 Patients: A Systematic Review with Meta-Analysis. *Can J Gastroenterol Hepatol* . 2021;2021:2534975. https://doi.org/10.1155/2021/2534975 eCollection 2021. PMID: 34513750
5. Iqbal U, Anwar H, Siddiqui HU, Khan MA, Kamal F, Confer BD, et al. Acute Gastrointestinal Bleeding in COVID-19 Patients: A Systematic Review and Meta-Analysis. *Clin Endosc* . 2021;54(4):534–541. https://doi.org/10.5946/ce.2021.071 PMID: 34176255
6. Negro A, Villa G, Rolandi S, Lucchini A, Bambi S. Gastrointestinal Bleeding in COVID-19 Patients: A Rapid Review. *Gastroenterol Nurs* . 2022;45(4):267–275. https://doi.org/10.1097/SGA.0000000000000676 PMID: 35833732
7. Yang F, Shi S, Zhu J, Shi J, Dai K, Chen X. Analysis of 92 deceased patients with COVID-19. *J Med Virol.* 2020;92(11):2511–2515. https://doi.org/10.1002/jmv.25891 PMID: 32293741
8. Lin L, Jiang X, Zhang Z, Huang S, Zhang Z, Fang Z, et al. Gastrointestinal symptoms of 95 cases with SARS-CoV-2 infection. *Gut* . 2020;69(6):997–1001. https://doi.org/10.1136/gutjnl-2020-321013 PMID: 32241899
9. Mao R, Qiu Y, He JS, Tan JY, Li XH, Liang J, et al. Manifestations and prognosis of gastrointestinal and liver involvement in patients with COVID-19: A systematic review and meta-analysis. *Lancet Gastroenterol Hepatol* . 2020;5(7):667–678. https://doi.org/10.1016/S2468-1253(20)30126-6 PMID: 32405603
10. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature* . 2020;579(7798):270–273. https://doi.org/10.1038/s41586-020-2012-7 PMID: 32015507
11. Trindade AJ, Izard S, Coppa K, Hirsch JS, Lee C, Satapathy SK; Northwell COVID-19 Research Consortium. Gastrointestinal bleeding in hospitalized COVID-19 patients: a propensity score matched cohort study. *J Intern Med.* 2021;289(6):887–894. https://doi.org/10.1111/joim.13232 PMID: 33341978
12. Blackett JW, Kumta NA, Dixon RE, David Y, Nagula S, DiMaio CJ, et al. Characteristics and Outcomes of Patients Undergoing Endoscopy During the COVID-19 Pandemic: A Multicenter Study from New York City. *Dig Dis Sci* . 2021;66(8):2545–2554. https://doi.org/10.1007/s10620-020-06593-9 PMID: 32930898
13. Martin TA, Wan DW, Hajifathalian K, Tewani S, Shah SL, Mehta A, et al. Gastrointestinal Bleeding in Patients with Coronavirus Disease 2019: A Matched Case-Control Study. *Am J Gastroenterol* . 2020;115(10):1609–1616. https://doi.org/10.14309/ajg.0000000000000805 PMID: 32796176
14. Mauro A, De Grazia F, Lenti MV, Penagini R, Frego R, Ardizzone S, et al. Upper gastrointestinal bleeding in COVID-19 inpatients: Incidence and management in a multicenter experience from Northern Italy. *Clin Res Hepatol Gastroenterol* . 2021;45(3):101521. https://doi.org/10.1016/j.clinre.2020.07.025 PMID: 32888875
15. Cavaliere K, Levine C, Wander P, Sejpal DV, Trindade AJ. Management of upper GI bleeding in patients with COVID-19 pneumonia. *Gastrointest Endosc.* 2020;92(2):454–455. https://doi.org/10.1016/j.gie.2020.04.028 PMID: 32325065
16. Melazzini F, Lenti MV, Mauro A, De Grazia F, Di Sabatino A. Peptic Ulcer Disease as a Common Cause of Bleeding in Patients with Coronavirus Disease 2019. *Am J Gastroenterol* . 2020;115(7):1139–1140. https://doi.org/10.14309/ajg.0000000000000710 PMID: 32618672
17. González González R, Jacob J, Miró Ò, Llorens P, Jiménez S, González Del Castillo J, et al.; Spanish Investigators on Emergency Situations TeAm (SIESTA) Network. Incidence, Clinical Characteristics, Risk Factors, and Outcomes of Upper Gastrointestinal Bleeding in Patients with COVID-19: Results of the UMC-19-S12. *J Clin Gastroenterol* . 2022;56(1):e38–e46. https://doi.org/10.1097/MCG.0000000000001465 PMID: 33252555
18. Iqbal U, Patel PD, Pluskota CA, Berger AL, Khara HS, Confer BD. Outcomes of Acute Gastrointestinal Bleeding in Patients With COVID-19: A Case-Control Study. *Gastroenterology Res* . 2022;15(1):13–18. https://doi.org/10.14740/gr1483 PMID: 35369679
19. Nakamura J, Tsujino I, Yachi S, Takeyama M, Nishimoto Y, Konno S, et al. Incidence, risk factors, and clinical impact of major bleeding in hospitalized patients with COVID-19: a sub-analysis of the CLOT-COVID Study. *Thromb* J. 2022;20(1):53. https://doi.org/10.1186/s12959-022-00414-x PMID: 36127738
20. Popa P, Iordache S, Florescu DN, Iovanescu VF, Vieru A, Barbu V, et al. Mortality Rate in Upper Gastrointestinal Bleeding Associated with Anti-Thrombotic Therapy Before and During Covid-19 Pandemic. *J Multidiscip Healthc* . 2022;15:2679–2692. https://doi.org/10.2147/JMDH.S380500 eCollection 2022. PMID: 36425876
21. Holzwanger EA, Bilal M, Stallwood CG, Sterling MJ, Yacavone RF. Acute lower gastrointestinal bleeding during the COVID-19 pandemic – less is more! *Endoscopy* . 2020;52(9):816–817. https://doi.org/10.1055/a-1194-4864 PMID: 32846443
22. Abulawi A, Al-Tarbsheh A, Leamon A, Feustel P, Chopra A, Batool A. Clinical Characteristics of Hospitalized COVID-19 Patients who Have Gastrointestinal Bleeds Requiring Intervention: A Case-Control Study. *Cureus* . 2022;14(7):e26538. https://doi.org/10.7759/cureus.26538 eCollection 2022 Jul. PMID: 35936188
23. Shalimar, Vaishnav M, Elhence A, Kumar R, Mohta S, Palle C, et al. Outcome of Conservative Therapy in Coronavirus disease-2019 Patients Presenting with Gastrointestinal Bleeding. *J Clin Exp Hepatol* . 2021;11(3):327–333. https://doi.org/10.1016/j.jceh.2020.09.007 PMID: 33519132
24. Prasoppokakorn T, Kullavanijaya P, Pittayanon R. Risk factors of active upper gastrointestinal bleeding in patients with COVID-19 infection and the effectiveness of PPI prophylaxis. *BMC Gastroenterol* . 2022;22(1):465. https://doi.org/10.1186/s12876-022-02568-4 PMID: 36397007
25. Ierardi AM, Del Giudice C, Coppola A, Carnevale A, Giganti M, Renzulli M, et al. Gastrointestinal Hemorrhages in Patients with COVID-19 Managed with Transarterial Embolization. *Am J Gastroenterol* . 2021;116(4):838–840. https://doi.org/10.14309/ajg.0000000000000978 PMID: 33982964

Received on 03/07/2023
Review completed on 05/04/2023
Accepted on 06/27/2023