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Review article

Impact of the temporary suspension of national colorectal carcinoma screening programmes due to the COVID-19 outbreak

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Abstract
Introduction: Colorectal carcinoma (CRCa) is one of the few carcinomas where effective secondary prevention is possible due to the prevalent possibility of early diagnosing, which helps with subsequent and successful treatment. The World Health Organization (WHO) declared the 2019 coronavirus disease (COVID-19) a pandemic in March 2020. Scientific studies have shown that colorectal carcinoma screening decreased or stopped in several European countries (Italy, the Netherlands, Belgium, and Great Britain) during the COVID-19 pandemic. Delaying colon carcinoma screening can have fatal consequences for some individuals.
Goal: The review study aims to map the prevalence of CRCa in individuals in the context of the postponement of colorectal carcinoma screening due to the COVID-19 pandemic.
Methods: The selection of relevant sources was conducted in 2021 using search services and sources in electronic databases (PubMed, BioMed Central, Google Scholar). The analytical review study was processed using the PRISMA and PICO techniques.
Results: By reviewing the available research studies, we found that in several European countries the COVID-19 pandemic decreased or even stopped the CRCa screening programmes. The temporary suspension of screening programmes during the lockdown increased the incidence of CRCa. The detection rate of high-risk adenomas was also significantly higher during the lockdown, and CRCa was diagnosed at an early stage to a lesser extent. Anti-covid measures have markedly affected endoscopy services and histology laboratories, where the number of colon biopsy specimens related to CRCa screening has decreased.
Conclusion: The results of several studies indicate a correlation between the prevalence of CRCa and the lockdown.

Keywords: Colorectal carcinoma (CRCa); COVID-19; Postponement of screening; Screening

Introduction

The severe acute respiratory syndrome of coronavirus caused the pandemic of coronavirus disease 2019 (COVID-19). In addition to the fight the COVID-19 pandemic, we have unfortunately overlooked the prevention of many other diseases, such as colorectal carcinoma (D'Ovidio et al., 2020). We implemented unprecedented public health measures, including social distancing, travel restrictions, and quarantine. Trends observed in colorectal carcinoma (CRCa) prevention indicate a significant decline in colorectal carcinoma screenings due to the pandemic. In several countries, colorectal carcinoma screening programmes have been reduced or completely stopped (Rutter et al., 2021). In Great Britain, the COVID-19 pandemic stopped CRCa screening and reduced the number of patients treated for colorectal carcinoma (Morris et al., 2021). According to Carethers et al. (2020), COVID-19 delayed population-based CRCa screenings and worsened disparities in screening.

In the USA, COVID-19 mainly harmed healthcare and CRCa screening in endoscopic procedures (Balzora et al., 2020), and led to long backlogs in the healthcare system (Issaka and Somsouk, 2020).

CRCa screening in Wales decreased but remained above 60% of the Welsh standard. The observed differences were related to age, gender, economic status, and ethnicity (Bright et al., 2023).

The sudden decline in CRCa screening during the pandemic suggests the possibility of a future increase in the number of late-stage CRCa patients and increased demand for carcinoma screening procedures due to the rescheduling of delayed screening tests (London et al., 2020). The Slovak government and other governments around the world announced a national pandemic emergency plan, which postponed all urgent medical consultations, surgeries, and CRCa screenings. CRCa

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is highly curable if caught early, but unfortunately, the later it is detected, the lower the prognosis for the patient's recovery. Colorectal carcinoma is asymptomatic in its initial stages (in more than half of cases). During this phase, the diagnosis is determined only by random examination, so regular participation in preventive programmes that look for colorectal carcinoma in asymptomatic individuals in the entire population is crucial. Delaying colon carcinoma screening during the COVID-19 pandemic may have fatal consequences for some individuals (Whittaker et al., 2021). As emphasized by Mizuno et al. (2020), adequate reorganization of colon carcinoma screening procedures should have been implemented, even during COVID-19 and before potential future pandemics. Ren et al. (2020) report that the COVID-19 pandemic has brought big challenges in the diagnosis and management of patients with colorectal carcinoma. Therefore, it was necessary to develop detailed clinical diagnostics and treatment guidelines for patients with CRCa during the COVID-19 epidemic. Hamilton et al. (2021) suggested maintaining carcinoma early detection diagnostic services during the COVID-19 pandemic but also targeted public health campaigns to reduce disparities in carcinoma diagnosis as the COVID-19 pandemic continued, proceeded, and the incidence modified.

Based on the mentioned starting points, we conducted an analytical review study to provide a systematic overview of published studies related to the topic. Our study focused on key factors: colorectal carcinoma, COVID-19, screening, and the postponement of screening.

Materials and methods

The analytical review study was processed using the PRISMA and PICO techniques. The presented study provides an assessment of the existing theories in the researched area – the impact of the COVID-19 epidemic on the temporary suspension of national colorectal carcinoma screening programmes.

Secondary analysis and a detailed review of relevant sources using electronic databases (PubMed, BioMed Central, and Google Scholar) were used to define the key terms through the specified keywords: colorectal carcinoma CRCa, COVID-19, screening, and postponement of screening. Studies published in the last three years were reviewed (from 2020 to 2022 included). The logical relationships between individual keywords were defined using the Boolean operators "and" and "or". We sought empirical results and theoretical knowledge in the English language to identify the level of understanding of the variables studied. For the second step of our research, we limited our focus to studies that had free full texts available. We conducted the analytical and research phase between July and October of 2022. The PRISMA literature review flowchart (Diagram 1) displays the search process. The authors conducted a comprehensive evaluation and identified six of the most pertinent studies for analysis (Table 1).

The review study aimed at an in-depth mapping of the prevalence of CRCa in individuals in the context of the postponement of CRCa screening due to the COVID-19 pandemic. A standardized PICO format was utilized to formulate the primary clinical question. It is a simple, intuitive system for the optimal formulation of clinical questions, where the name PICO is an abbreviation of the initials of English keywords, which also represents the phases of the decision-making procedure itself. **P** – means Patient / Problem / Population; **I** – Intervention / Exposure; **C** – Comparison/ Control; **O** – Outcome.

Primary clinical question:

- Did the temporary suspension of CRCa screening due to the COVID-19 epidemic increase the prevalence of CRCa in individuals?

Specific clinical questions:

- Were there innovative methods for detecting CRCa during the COVID-19 pandemic?
- Did the COVID-19 pandemic affect endoscopy services?
- Did anti-covid measures related to CRCa screening affect laboratory workload?

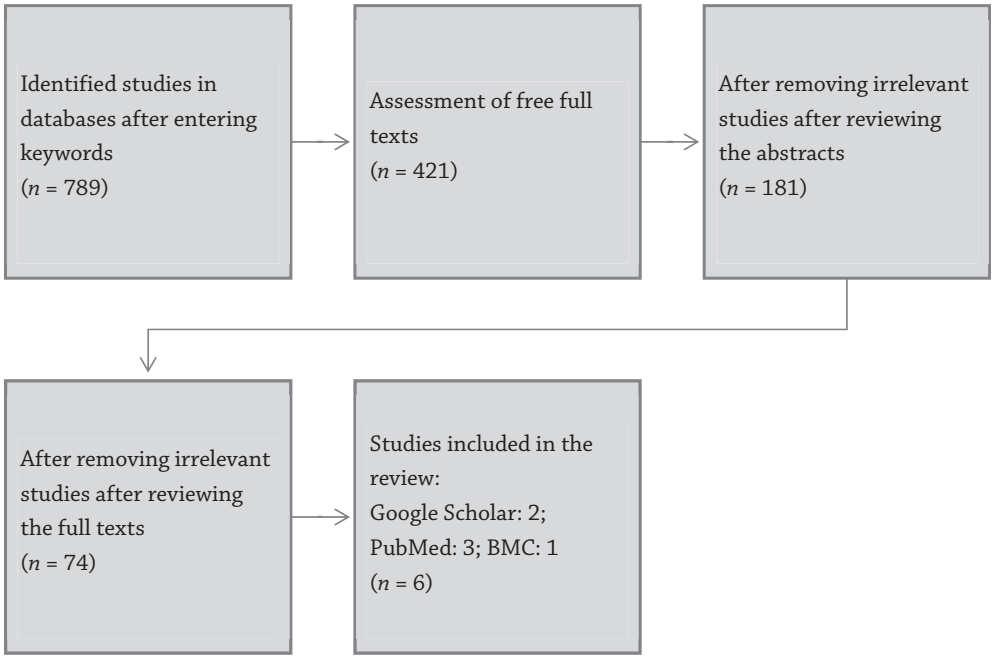

Diagram 1. PRISMA literature review

Table 1. Objectives and results of reviewed studies

Author(s), year, country	Title of the study	Type of study	Objectives	Results
D'Ovidio et al. (2021) Italy	Impact of COVID-19 Pandemic on Colorectal Cancer Screening Program	A retrospective controlled cohort study	To compare data from colonoscopy examinations from the period of the lockdown (March–May 2020) for COVID-19 with colonoscopies from the period before the lockdown (the year 2019) (control group).	During the lockdown, a higher incidence of colon and rectal carcinoma was detected (5 cases; 8% versus 3 cases; 1%; $p = 0.002$). The detection rate of "high-risk" adenomas was significantly higher in the lockdown group than in the control group (47% vs. 25%; $p = 0.001$).
Del Vecchio Blanco et al. (2020) Italy	The impact of COVID-19 pandemic in the colorectal cancer prevention	A retrospective cohort study	To evaluate the impact of COVID-19 on the prevention of colorectal carcinoma (CRCa).	Discontinuation of CRCa prevention may lead to delayed diagnosis of CRCa or a more advanced stage of CRCa.
Dinmohamed et al. (2020) Netherlands	The impact of the temporary suspension of national cancer screening programmes due to the COVID-19 epidemic on the diagnosis of breast and colorectal cancer in the Netherlands	A retrospective cross-sectional study	To evaluate the impact of the temporary suspension of national population-based screening programmes for breast, colon, and rectal cancer diagnosis in the Netherlands during the COVID-19 pandemic.	Fewer breast, colon and rectal cancers were diagnosed in the early stages in the Netherlands. This incidence was most prominent among the age groups for which the screening programmes were intended (50–74 years).
London et al. (2020) Great Britain	Effects of the COVID-19 Pandemic on Cancer-Related Patient Encounters	A cohort study	Find out and compare the impact of the COVID-19 pandemic on patients with carcinoma care. Cohorts were compiled for all patients with neoplasms (malignant, benign, in situ) with new occurrences of neoplasms, and patients with carcinoma screening.	A significant risk was identified in all cohorts studied. The greatest risk was recorded in April 2020. From analysed carcinoma types, the cohorts showed: lung cancer, and CRCa. Screening for CRCa has decreased drastically by –84%.
Rutter et al. (2021) Great Britain	Impact of the COVID-19 pandemic on UK endoscopic activity and cancer detection: a National Endoscopy Database Analysis	A retrospective cross-sectional study	To determine the impact of the COVID-19 pandemic on endoscopic examination and endoscopic diagnosis of CRCa in Great Britain.	The endoscopic services in the period affected by the COVID-19 pandemic were reduced to 12% compared to the pre-COVID period. CRCa detection rate increased significantly (pre-COVID 1.91%; COVID-affected 6.61%; $p = 0.001$).
de Pelsemaeker et al. (2021) Belgium	The Impact of the COVID-19 Pandemic and the Associated Belgian Governmental Measures on Cancer Screening, Surgical Pathology and Cytopathology	Cross-sectional descriptive study	To determine the impact of unprecedented public health measures on cancer screening by evaluating histology and cytopathology laboratory workload.	Globally, the histopathology and cytology workload has decreased. Anti-covid measures have significantly reduced all screening-related samples, such as colon, breast, and cervical cytology biopsies.

Results

We conducted a thorough analysis of six scientific studies that examined the effects of temporarily halting national colorectal carcinoma screening programs during the COVID-19 pandemic. The findings of these studies are summarized in Table 1.

Discussion

During the COVID-19 pandemic, screening programmes to find early forms of colon carcinoma decreased or stopped entirely in several European countries.

Did the temporary suspension of CRCa screening due to the COVID-19 epidemic increase the prevalence of CRCa in individuals?

Dutch authors, Dinmohamed et al. (2020), evaluated the impact of a temporary suspension of national screening programmes for breast, colon, and rectal carcinoma between January 6, 2020, and October 4, 2020, on the observed versus expected numbers of carcinoma diagnoses per calendar week. They found a reduced incidence of breast, colon, and rectal carcinoma in the initial stages of the outbreak of COVID-19. These results were most prominent among the age groups most affected by carcinoma screening programmes (age group 50–74 years). Encouragingly, the study found that the number of cases in the age groups not included in the screening pro-

grammes remained at the expected levels. This finding has subsequently led to the resumption of screening programmes and a wide range of healthcare services in the Netherlands, albeit with limited surgeries and reduced staffing capacity. According to the authors, it would be necessary for future research to focus on assessing whether delaying or reducing the diagnostic control of carcinoma during the COVID-19 pandemic also resulted in worse outcomes for patients. The study conducted by London et al. (2020) delved into the effects of the COVID-19 pandemic on the treatment and care of carcinoma patients. Cohorts were constructed for all patients with neoplasms (malignant, benign, in situ) with new occurrences of neoplasms, and carcinoma screening patients. They identified a significant risk in all studied cohorts. The highest risk was observed in April 2020. Out of all the carcinoma types analysed, as the cohorts indicated, lung carcinoma and CRCa are at the highest risk.

Has the COVID-19 pandemic had an impact on endoscopy services?

Endoscopy services around the world have been greatly impacted by the COVID-19 pandemic. As reported by Rutter et al. (2021), the pandemic has had a significant impact on endoscopic examinations, resulting in their suspension and reduced capacity. This can lead to an increase in mortality due to delayed diagnosis of carcinoma. To analyse the pandemic's impact on endoscopy services and carcinoma diagnosis, the authors conducted the first national study using the UK National Endoscopy Database. They developed a COVID-19 module that contained data on all endoscopic procedures and identified three periods: pre-COVID (January 6, 2020, to March 15), transition period (March 16–22), and affected by COVID (March 23 – May 31). The authors calculated and compared the average weekly numbers of carcinoma types, the proportion of missing carcinoma types, and the carcinoma detection rate during these periods.

They found that 35,478 endoscopy procedures were performed on average per week in the pre-COVID period. During the COVID-affected period, activity decreased to only 12% of pre-COVID levels. At its lowest point, activity dropped to just 5%, but by the end of the study it had recovered to 20% of pre-COVID activity. Although more selective screening significantly increased carcinoma detection rates by procedure (pre-COVID 1.91%; COVID-affected 6.61%; $p < 0.001$), the weekly number of carcinomas detected decreased by 58%. The proportion of missing carcinoma types ranged from 19% (pancreaticobiliary) to 72% (colorectal). This analysis shows how the pandemic has significantly affected endoscopy services, leading to a significant decrease in carcinoma detection. Italian authors, D'Ovidio et al. (2021), have also investigated whether it was safe and essential to maintain selective colonoscopy screening for colorectal carcinoma amidst the COVID-19 pandemic. In a retrospective controlled cohort study, they compared data from colonoscopies from the suspension period for the COVID-19 pandemic (March 9 to May 4, 2020) with data from the same period in 2019 before COVID-19 (control group). They found that in the group with suspended colonoscopies, 60 patients out of the 137 invited patients underwent endoscopy, while in the control group, 238 colonoscopies were performed (3.9 times more). A higher incidence of colon and rectal carcinoma was discovered in fewer examinations during the suspension of colonoscopies (5 cases; 8% versus 3 cases; 1%; $p = 0.002$). The detection rate of "high-risk" adenomas was also significantly higher in the "withheld colonoscopies group" than in the control groups (47% vs. 25%; $p = 0.001$).

Did anti-covid measures related to CRCa screening have an impact on laboratory workload?

A group of Belgian authors, de Pelseameker et al. (2021), reported that their country's government implemented a national emergency plan in response to the COVID-19 pandemic, which postponed all emergency medical consultations and surgeries. The study in question examines, how these measures affected carcinoma screening by evaluating the workload of the histopathology and cytopathology laboratory. The laboratory information system provided data on the monthly amounts of histological and cytological samples, as well as immunohistochemistry and molecular tests. Overall, a significant decrease in the workload for histopathology and cytology was discovered. The impact on oncological surgery was also found to be quite limiting. The measures taken to prevent the spread of COVID-19 have had a significant impact on the number of screening-related samples, including colon, breast biopsies, and cervical cytology. In addition, the number of samples related to "functional" pathology has also significantly decreased. Based on their research, carcinoma screening may be negatively affected. They recommend postponing the consultations instead of cancelling them altogether.

Were there innovative methods for detecting CRCa during the COVID-19 pandemic?

Due to the COVID-19 pandemic, screening programs such as colonoscopies have been postponed or cancelled, resulting in an extensive waiting list for rescheduling once things return to normal.

According to Dockter and Angelos (2020), DNA-based tests of faecal samples can be useful for screening for colorectal carcinoma in situations where a colonoscopy is not an option. The researchers highlighted the usefulness of upgraded DNA-based faecal sample testing for diagnosing and screening colorectal carcinoma, especially in situations like the ongoing COVID-19 pandemic where healthcare resources are limited. The faecal sample tests provided for colorectal carcinoma screening enable a simple diagnosis before colonoscopy procedures. However, the delay of these procedures due to the COVID-19 pandemic creates a significant challenge.

The COVID-19 pandemic has put a strain on healthcare systems in various countries. The NHS encountered a shortage of health resources and had to redistribute them ethically to maintain the best possible care for all patients and ensure the safety of patients and health workers. Vecchione et al. (2020) have suggested a protocol for treating colorectal carcinoma during a pandemic. This prioritizes interventions based on a three-tiered system, which takes into account the expert clinical judgment, the severity of the patient's condition, and the expected benefit of each intervention. To account for the variable availability of resources for diagnostic procedures, surgery, postoperative care, systemic therapy, and radiotherapy, the authors performed separate prioritization analyses. They suggested utilizing a scale with high, medium, or low priority when deciding to suspend or withdraw carcinoma screening interventions. They propose to investigate using telemedicine for health services, which has been proven to be functional and effective in this regard, and can limit patient travel to centres and help prevent the spread of coronavirus-related respiratory illnesses.

A study by MacLeod et al. (2020) found that, in the UK, endoscopic screening was stopped due to the COVID-19 pandemic, causing concern about delays in diagnosing colon carcinoma and an increase in demand for faster recovery. In the article, the authors provide an overview of various examination

methods for a colorectal disease that could replace a colonoscopy during its cessation. They point to capsule colonoscopy of the large intestine and its importance during the COVID-19 pandemic and its ability to effectively triage patients for further endoscopic examinations. Capsule colonoscopy is a safe and innovative technology for examining the colon.

Tests using faecal immunochemical methods have been proven effective in predicting colon pathology with the possibility of their safe use in the colonoscopy stratification of prioritizing. These procedures can be implemented in the community and could be performed safely even during the coronavirus pandemic. This method is highly accurate in detecting colonic neoplasia, potentially reducing the demand for colonoscopy, and easing the burden on colonoscopy services once the restrictions have been eased (Chambers et al., 2016).

Prevention of CRCa

The best way to prevent colorectal carcinoma is through secondary screening. The colonoscopy method is the gold standard for detecting and removing polyps. The effectiveness of this method depends on its quality. A negative colonoscopy can protect for up to 15 years (Quintero et al., 2016).

Conclusion

Researchers have found that the temporary suspension of national colorectal carcinoma screening programs due to the COVID-19 epidemic is a global issue.

The analysis of study results shows a connection between the cessation in screening and the presence of colorectal carcinoma. The prevalence of colon and rectal carcinoma was found to be higher, and the rate of detecting "high-risk" adenomas was also significantly greater. Endoscopy services were also affected globally by the COVID-19 pandemic, and their suspension may result in higher mortality rates due to delayed carcinoma diagnosis. However, one analysis reports a reduction in carcinoma detection due to the pandemic, which had a positive effect on endoscopy services.

As a result of COVID safety measures, the workload for histopathology and cytopathology labs has decreased.

Innovative and simple methods have been shown to effectively detect CRCa during the COVID-19 pandemic. These methods include examining faecal specimens based on DNA, performing capsule colonoscopy of the large intestine to triage patients for further endoscopic examinations, and using faecal immunochemical tests as a reliable predictor of colon pathology. Additionally, the use of telemedicine in the implementation of health services has proven to be functional and practical.

It is important to conduct individual studies to determine the potential risks involved in suspending or cancelling national colorectal carcinoma screening programs because of the COVID-19 pandemic.

Ethical aspects and conflict of interest

The authors have no conflict of interest to declare.

Dopad dočasného pozastavenia národných programov skríningu kolorektálneho karcinómu v dôsledku epidémie COVID-19

Súhrn

Úvod: Kolorektálny karcinóm (KRCa) je jedným z mála karcinómov, kde je možná účinná sekundárna prevencia, pretože tá ho môže vo väčšine prípadov včas odhaliť a tým pomôcť k následnej a úspešnej liečbe. Svetová zdravotnícka organizácia (WHO) vyhlásila koronavírusovú chorobu 2019 (COVID-19) za pandémiu v marci 2020. Vedecké štúdie preukázali, že počas pandémie COVID-19 vo viacerých krajinách Európy – Taliansku, Holandsku, Belgicku, Veľkej Británii došlo k spomaleniu až zastaveniu skríningu kolorektálneho karcinómu. Odklad skríningu karcinómu hrubého čreva môže mať pre niektorých jedincov smrteľné následky.

Cieľ: Cieľom prehľadovej štúdie je zmapovať prevalenciu výskytu KRCa u jedincov v kontexte s odkladom skríningu kolorektálneho karcinómu pre pandémiu COVID-19.

Metodika: Výber relevantných zdrojov bol realizovaný v roku 2021 pomocou vyhľadávacích služieb a zdrojov v elektronických databázach (PubMed, BioMed Central, Google Scholar). Analytická prehľadová štúdia bola spracovaná s využitím techniky PRISMA a PICO.

Výsledky: Analýzou dostupných výskumných štúdií sme zistili, že pandémia – COVID-19 vo viacerých európskych krajinách spomalila až zastavila skríningové programy KRCa. Dočasným pozastavením skríningových programov počas lockdownu sa zvýšil výskyt KRCa, aj miera detekcie „vysoko rizikových" adenómov bola významne vyššia počas lockdownu, KRCa v počiatočných štádiách bol objektivizovaný v menšej miere. Anti-covidové opatrenia významne ovplyvnili endoskopické služby a histologické laboratória, v ktorých sa znížil počet vzoriek biopsií hrubého čreva súvisiacich so skríningom KRCa.

Záver: Z výsledkov viacerých štúdií vyplýva súvislosť medzi prevalenciou KRCa a lockdownom.

Kľúčové slová: Covid-19; kolorektálny karcinóm (CRCa); odklad skríningu; skríning

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