ORIGINAL ARTICLE

Impact of COVID-19 Pandemic on Management of Colorectal Cancer Patients in the Tertiary Care Hospital in Thailand

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Background: The global healthcare systems have undergone significant changes due to the profound impact of the COVID-19 pandemic, leading to modifications in healthcare delivery, treatment protocols, patient access, and overall outcomes.

Objective: To evaluate the influence of the COVID-19 pandemic on the management of colorectal cancer patients in Thailand.

Materials and Methods: The present study was a retrospective cohort study conducted at a tertiary referral hospital, involving patients diagnosed with colorectal cancer who underwent curative surgery between January 1, 2018, and December 31, 2021. The study period was divided into two phases, pre-COVID-19 outbreak, which was 2018 and 2019, and during the COVID-19 outbreak, which was 2020 and 2021. Retrospective data collection focused on patient demographics, medical outcomes, and a comparative analysis between the pre-COVID and COVID-19 periods was conducted to assess the impact on colorectal cancer management and patient outcomes.

Results: The number of patients studied was 413, showing no significant difference between both periods with 203 pre-COVID and 210 during COVID. During COVID-19, more colorectal cancer patients underwent emergency surgeries at 20% versus 11.3% (p=0.05) and had higher rates of advanced disease staging at 52.9% versus 40.9% (p=0.039) compared to pre-pandemic times. For rectal cancer, the COVID-19 led to prolonged surgery waiting times at 19 weeks versus 13 weeks (95% CI 2.40 to 9.73). This was potentially due to a higher number of patients receiving neoadjuvant treatment, including a larger proportion receiving total neoadjuvant treatment, which extended the overall treatment duration compared to conventional CCRT at 36 weeks versus 22 weeks (95% CI 10.23 to 17.92).

Conclusion: The present study examined the impact of COVID-19 on treating colorectal cancer. The number of surgeries increased in advanced cancer staging, which is Stage III and IV, during the COVID-19 outbreak. This may be due to the reduction in cancer case screenings, leading to patients presenting with emergencies requiring more frequent emergency operations.

Keywords: Colorectal cancer; COVID-19 pandemic; Total neoadjuvant treatment; Concurrent chemoradiation; Surgery wait times

Received 26 December 2024 | Revised 21 March 2025 | Accepted 28 April 2025

J Med Assoc Thai 2025;108(8):613-21

Website: http://www.jmatonline.com

The COVID-19 outbreak in Thailand began in January 2020 and rapidly spread due to inbound travelers and local transmission. The government responded with strict measures, including widespread screening, contact tracing, and restrictions on movement and public gatherings[1]. While these measures were effective in controlling the virus, they also placed significant strain on the healthcare system. Resources were diverted from other medical conditions[2], including colorectal cancer, leading to a decline in screening, delayed diagnoses, and an increase in advanced-stage cases[3].

Beyond delayed screening, the higher proportion of advanced cases during the COVID-19 period may also be attributed to referral bias. Hospitals with limited resources may have transferred complex cases to tertiary centers while managing early-stage cases locally. Additionally, hospitals may have lacked the capacity to manage advanced cases due to the resource-intensive nature of care required. As a result, more advanced cases were referred to tertiary centers, while early-stage patients sought treatment at local hospitals to avoid transfer. Institutional policies restricting patient transfers may have further contributed to the concentration of advanced cases in tertiary care hospitals.

As a result, colorectal cancer patients faced

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How to cite this article:

Chandrachamnong P, Buakhrun S. Impact of COVID-19 Pandemic on Management of Colorectal Cancer Patients in the Tertiary Care Hospital in Thailand. J Med Assoc Thai 2025;108:613-21.

DOI: 10.35755/jmedassocthai.2025.8.613-621-02461

challenges including poorer treatment outcomes, higher recurrence rates, increased mortality, and reduced quality of life. Disruptions in diagnostic services and emergency care further hindered effective disease management[4-6].

In conclusion, the COVID-19 pandemic had profound impact on colorectal cancer care in Thailand, exacerbating existing challenges and highlighting the need for adaptive strategies to ensure timely diagnosis, treatment, and management. The present study aimed to assess the impact of the COVID-19 pandemic on colorectal cancer management and patient outcomes.

Materials and Methods

Study design and population

The present study was a retrospective cohort study conducted at Vajira Hospital, a tertiary medical center in Thailand, focusing on patients diagnosed with colorectal cancer who underwent curative surgery between January 1, 2018, and December 31, 2021. The study period was divided into two phases, the pre-COVID-19 phase, which was between January 1, 2018, and December 31, 2019, and the COVID-19 phase, which was between January 1, 2020, and December 31, 2021. The inclusion criteria included patients diagnosed with colon or rectal cancer who received both diagnosis and treatment at Vajira Hospital during the study period. Exclusion criteria comprised of patients with recurrent colorectal cancer, metastatic cancers involving the colorectal region, other cancers in addition to colorectal cancer, and those with incomplete medical records.

Colon and rectal cancer cases were classified based on hospital records, which documented diagnoses using ICD-10 codes. These records were primarily entered by attending physicians or medical record staff to ensure accurate classification and efficient case management.

Ethical approval for the study was obtained from Vajira Institutional Review Board (VIRB), Faculty of Medicine, Vajira Hospital (Bangkok), number 156/65E.

Data collection and statistical analysis

Data collection included detailed information on patient demographics, medical outcomes, and treatment modalities, allowing for a thorough comparative analysis between the two study periods. Statistical analyses were performed using the Pearson chi-square test and Fisher's exact test for categorical variables, while quantitative variables were presented as mean, standard deviation, or median and interquartile range (IQR). A significant level of p-value of less than 0.05 was applied. All analyses were conducted using PASW Statistics for Windows, version 18.0 (SPSS Inc., Chicago, IL, USA), ensuring accurate and reliable evaluation of the results.

Data terminology

- **Waiting time:**

In the present study, waiting time referred to the period when patients were diagnosed with colorectal cancer until the day they underwent surgery to remove the tumor for patients under the care of Vajira Hospital. In cases where patients were diagnosed at another hospital, the wait time was measured from their first visit to Vajira Hospital for treatment initiation until the day of surgery.

The present study aimed to capture the total time patients spend from the beginning of treatment to surgery. This included waiting periods for various treatment procedures, such as receiving chemotherapy or radiation therapy before surgery.

- **Neoadjuvant treatment:**

In the present study, neoadjuvant treatment referred to therapies given before surgical resection with the goal of improving clinical outcomes. The primary objectives were to shrink tumors, reduce the extent of surgery required, and address any undetected microscopic disease that might contribute to recurrence.

- **Neoadjuvant chemotherapy in colon cancer:**

Neoadjuvant chemotherapy was administered to a small number of colon cancer patients across both study periods. Most of these cases were classified as either unresectable or as clinical stage T4b, where the tumor had invaded adjacent organs. These patients required multi-visceral organ resections during surgery. The standard preoperative chemotherapy regimen typically involved a combination of oxaliplatin and fluoropyrimidine, with treatment spanning three to six cycles[7].

- **Neoadjuvant treatment in rectal cancer:**

1. Concurrent chemoradiation

Neoadjuvant concurrent chemoradiation therapy (nCRT) for rectal cancer involved combining radiation therapy with chemotherapy. The chemotherapy served as a radiosensitizer, enhancing the effectiveness of radiation and promoting tumor shrinkage. This approach was primarily used for locally advanced rectal cancer, particularly in clinical stages T3, T4, or in cases with nodal involvement, especially when

the tumor was not easily resectable or carried a high risk of recurrence[8].

At Vajira Hospital, the standard nCRT regimen included long-course external beam radiation therapy (EBRT), which targets the primary tumor and any potentially involved nearby lymph nodes. This typically consisted of 25 fractions of radiation, delivering a total dose of 48 to 50 Gy. The chemotherapy component used either oral capecitabine or intravenous 5-fluorouracil (5-FU) as radio-sensitizing agents.

2. Chemotherapy

Neoadjuvant chemotherapy alone was not typically used for rectal cancer, as the disease generally responded well to radiation therapy. However, chemotherapy might be considered for patients with multiple comorbidities who were not candidates for radiation therapy. Additionally, chemotherapy might be employed for patients facing extended waiting times for surgery, as it helped control systemic disease during this period.

3. Total neoadjuvant treatment

Total neoadjuvant treatment (TNT) for rectal cancer was a comprehensive approach that combined chemotherapy and radiation therapy before surgery. TNT represented an evolving treatment paradigm for high-risk rectal cancer, particularly in the context of the COVID-19 pandemic. Its aim was to reduce the risk of local recurrence and eliminate micrometastases through systemic chemotherapy. Administering chemotherapy preoperatively improved patient compliance compared to traditional postoperative adjuvant therapy, as it enabled better disease control before surgery. This approach optimized clinical outcomes and enhanced the management of treatment in the pre-surgical phase[9].

At Vajira Hospital, no fixed protocol for TNT was in place. The approach was individualized, with both induction and consolidation TNT protocols being used based on the consensus of the multidisciplinary team. Treatment typically involved standard nCRT combined with oxaliplatin-based chemotherapy, tailored to each patient's specific clinical needs.

- **Pathological stage:**

The pathological stage classified cancer based on histopathological findings from tissue specimens obtained after the surgical removal or resection of the tumor. This classification was determined by evaluating the extent of cancer spread, including depth of invasion of the primary tumor, the degree of lymph node involvement, and the presence of distant metastases. In the present study, cancer staging followed the TNM classification system as described in the 8th Edition of the Asia Joint Conference on Computing (AJCC) Cancer Staging Manual[10]. For patients with colorectal cancer who had received neoadjuvant treatment, the pathological stage was represented as the yp stage, which reflected the cancer's status after neoadjuvant therapy and indicated the tumor's response to preoperative treatment.

Table 1. Comparison of demographic and clinical characteristics between pre-COVID and COVID periods

	Pre-COVID (n=203) n (%)	COVID (n=210) n (%)	p-value
Sex: male	123 (60.6)	114 (54.3)	0.648
Age (years)			0.213
<40	3 (1.5)	3 (1.4)	
40 to 50	33 (16.3)	20 (9.5)	
50 to 60	51 (25.1)	40 (19.0)	
60 to 70	50 (24.6)	63 (30.0)	
>70	66 (32.5)	84 (40.0)	
BMI (kg/m^2)			0.345
<18.5	23 (11.3)	38 (18.1)	
18.5 to 24.9	128 (63.1)	120 (57.1)	
25 to 29.9	42 (20.7)	37 (17.6)	
>30	10 (4.9)	15 (7.2)	
CEA: >5	93 (45.8)	137 (65.2)	<0.001*
Preoperative colonoscopy: incomplete	84 (41.4)	88 (41.9)	0.997
Colon cancer	138 (68.0)	142 (67.6)	0.863
Rectal cancer	65 (32.0)	68 (32.4)	0.912
Emergency case	23 (11.3)	42 (20.0)	0.05*

BMI=body mass index

* Statistical significance

Results

The present study analyzed 413 patients, comprising 203 individuals treated during the pre-COVID-19 period and 210 during the COVID-19 period. The number of patients in each group was comparable, showing no statistically significant differences. Demographic characteristics, as outlined in Table 1, were also largely similar between the two periods. The distribution of male and female patients remained consistent, and although the proportion of patients aged over 70 years increased slightly during the COVID-19 period, this difference was not statistically significant. Similarly, there were no significant variations in the distribution of colon and rectal cancer cases or in the completion rates of preoperative colonoscopies between the two groups.

In contrast, significant differences were observed in certain clinical parameters. A greater proportion

Table 2. Comparison of characteristics of colon cancer patients between pre-COVID and COVID periods

Colon cancer	Pre-COVID (n=138)	COVID (n=142)	p-value
Location; n (%)			0.141
Cecum/ascending	20 (14.5)	24 (16.9)	
Hepatic flexure	11 (7.9)	17 (11.9)	
Transverse	15 (10.9)	5 (3.5)	
Splenic flexure	3 (2.2)	4 (2.8)	
Descending	15 (10.9)	13 (9.1)	
Sigmoid	27 (19.6)	36 (25.4)	
Rectosigmoid	47 (34.0)	43 (30.4)	
Type of surgery; n (%)			0.248
Right/extended right	42 (30.4)	43 (30.3)	
Left/extended left	14 (10.1)	13 (9.2)	
Sigmoidectomy	12 (8.7)	3 (2.1)	
Anterior resection	40 (29.0)	49 (34.5)	
Low anterior resection	15 (10.9)	20 (14.1)	
Subtotal colectomy	10 (7.2)	11 (7.7)	
Hartmann	3 (2.2)	3 (2.1)	
Total protocolectomy	2 (1.5)	0 (0.0)	
Approach: laparoscopic; n (%)	63 (45.7)	60 (42.3)	0.567
Ostomy; n (%)	21 (15.2)	20 (14.1)	0.903
Waiting time (weeks); mean±SD	5.28±5.7	4.36±6.2	0.253
Neoadjuvant treatment; n (%)	5 (3.6)	2 (1.4)	0.235

SD=standard deviation

Table 3. Comparison of characteristics of rectal cancer patients between pre-COVID and COVID periods

Rectum	Pre-COVID (n=65)	COVID (n=68)	p-value
Location; n (%)			0.887
Upper	16 (24.6)	16 (23.5)	
Middle	23 (35.3)	22 (32.4)	
Lower	26 (40.0)	30 (44.1)	
Type of surgery; n (%)			0.863
Anterior resection	2 (3.1)	3 (4.4)	
Low anterior resection	36 (55.4)	38 (55.9)	
Intersphincteric resection	12 (18.5)	11 (16.2)	
APR	12 (18.5)	15 (22.1)	
Hartmann	2 (3.1)	1 (1.5)	
Total proctocolectomy	1 (1.5)	0 (0.0)	
Approach: laparoscopic; n (%)	39 (60.0)	49 (72.1)	0.142
Ostomy (included protective ostomy); n (%)	47 (72.3)	53 (77.9)	0.452
Waiting time (weeks); mean±SD	13.05±9.1	19.12±11.7	0.001*
Neoadjuvant treatment; n (%)	34 (52.3)	44 (64.7)	0.167

APR=abdominoperineal resection; SD=standard deviation
* Statistical significance

of patients during the COVID-19 period had carcinoembryonic antigen (CEA) levels exceeding 5 ng/mL compared to the pre-COVID-19 period ($p<0.001$). Additionally, the proportion of emergency cases showed a significant increase during the COVID-19 period, rising from 13% to 20% ($p=0.05$).

For colon cancer, the present study found no statistically significant differences between the two periods in terms of tumor location, surgical techniques such as open versus laparoscopic, ostomy creation rates, waiting times for surgery, or the use of neoadjuvant therapies, as shown in Table 2. These results indicated that colon cancer management remained stable despite the disruptions associated with the COVID-19 pandemic.

A similar pattern was evident in rectal cancer management. Tumor localization, surgical approaches, and the use of laparoscopic surgery, which is standard for rectal cancer procedures, showed no significant differences between the two periods. Additionally, the rates of abdominoperineal resection (APR) in curative rectal cancer surgeries remained consistent, reflecting stable rates of sphincter-preserving procedures during the pandemic.

One notable finding was the significant prolongation of surgical waiting times of rectal cancer during the COVID-19 period compared to the pre-COVID-19 period at 19.12 weeks versus 13.05 weeks (95% CI 2.40 to 9.73), as summarized in Table 3. This delay was attributable to factors such as reduced operating room availability, staff shortages, and evolving treatment paradigms that emphasize neoadjuvant therapies. During the COVID-19 period, the use of neoadjuvant treatments, including concurrent chemoradiation therapy (CCRT) and TNT, increased. This trend might have been influenced by emerging evidence suggesting better outcomes with neoadjuvant therapy, particularly for patients with locally advanced rectal cancer.

Pathological staging demonstrated minimal differences between the two periods concerning cell types, TNM staging, and overall stage, as detailed in Table 4. However, when combining patients in advanced stages, which is stage III and IV, the proportion was significantly higher during the COVID-19 period compared to the pre-COVID-19 period at 52.9% versus 40.9% ($p=0.039$).

For rectal cancer patients, the prolonged waiting time for surgery during the COVID-19 period was closely associated with the increased use of neoadjuvant therapies, particularly TNT. As presented in Table 5, the time from cancer diagnosis to surgery was significantly longer for patients receiving TNT, averaging 36 weeks, compared to 22 weeks for those who underwent standard CCRT (95% CI 10.23

Table 4. Comparison of pathological characteristics of colorectal cancer between pre-COVID and COVID periods

	Pre-COVID (n=203) n (%)	COVID (n=210) n (%)	p-value
Cell type			0.419
WD	12 (5.9)	19 (9)	
MD	168 (82.8)	176 (83.8)	
PD	7 (3.4)	3 (1.4)	
SRCC	7 (3.4)	7 (3.3)	
T stage			0.648
1	10 (4.9)	10 (4.8)	
2	34 (16.7)	25 (11.9)	
3	111 (54.7)	120 (57.1)	
4a	19 (9.4)	29 (13.8)	
4b	20 (9.9)	21 (10)	
N stage			0.332
0	121 (59.6)	103 (49)	
1a	24 (11.8)	30 (14.3)	
1b	24 (11.8)	32 (15.2)	
1c	1 (0.5)	0 (0)	
2a	15 (7.4)	25 (11.9)	
2b	18 (8.9)	20 (9.5)	
M stage			0.169
0	182 (89.7)	181 (86.2)	
1	21 (10.3)	29 (13.8)	
Stage			0.039*
I	39 (19.2)	29 (13.8)	
II	72 (35.5)	65 (31.0)	
III	62 (30.6)	82 (39.1)	
IV	21 (10.3)	29 (13.8)	
pCR	9 (4.4)	5 (2.3)	

WD=well-differentiated; MD=moderately differentiated; PD=poorly differentiated; SRCC=signet ring cell adenocarcinoma; pCR=pathological complete response

* Statistical significance

to 17.92), as depicted in Table 6. This extended treatment duration was a key factor contributing to the longer surgical waiting times during the pandemic. Therefore, patients who underwent emergency surgery for oncologic resection were excluded from the analysis to ensure that the results accurately reflected the group receiving neoadjuvant treatment. In each period, two such patients were excluded, resulting in a final sample size of 63 patients from the pre-pandemic period and 66 patients from the pandemic period for analysis in Table 5 and 6.

Among the 78 rectal cancer patients who underwent neoadjuvant treatment, 13 patients (16.7%) achieved a pathological complete response (pCR). Stratified by treatment type, pCR rates were similar between CCRT and TNT, with response

Table 5. Comparison of neoadjuvant treatment in rectal cancer patients

Rectal cancer	Pre-COVID (n=63) n (%)	COVID (n=66) n (%)	p-value
Neoadjuvant treatment			0.026*
nCRT	31 (49.2)	36 (54.5)	
nCMT	3 (4.8)	1 (1.5)	
TNT	0 (0.0)	7 (10.6)	

nCRT=neoadjuvant concurrent chemoradiation therapy; nCMT=neoadjuvant chemotherapy; TNT=total neoadjuvant treatment

* Statistical significance

rates of 17.9% (12 out of 67) and 14.3% (1 out of 7), respectively, as shown in Table 6.

Discussion

The COVID-19 pandemic has had a profound and widespread impact on healthcare systems globally, significantly affecting the management of various diseases, including colorectal cancer. This retrospective cohort study, conducted at Vajira Hospital, aimed to assess the pandemic's effects on colorectal cancer management and patient outcomes. The findings reveal critical observations and their implications.

Demographic characteristics of patients showed no significant variation between the pre-COVID and COVID periods, suggesting that the pandemic did not disproportionately affect specific demographic groups in terms of colorectal cancer incidence or presentation. However, a notable increase in the proportion of patients with elevated CEA levels was observed during the COVID period. This elevation in CEA levels was associated with an increased number of patients requiring emergency surgery and a higher proportion of cases diagnosed at more advanced disease stages.

A concerning trend identified in the present study was the increase in emergency cases during the COVID-19 period compared to the pre-COVID period. This suggests that patients may have delayed seeking medical attention or accessing healthcare services for colorectal cancer symptoms, potentially due to fears of COVID-19 exposure or strain on the healthcare system. Delayed presentation often results in more advanced diseases at the time of diagnosis, which is associated with poorer clinical outcomes and greater healthcare resource utilization[11].

Furthermore, the increased proportion of patients with advanced-stage disease requiring adjuvant treatment after surgery during the COVID-19 period highlights the broader impact of delayed diagnosis

Table 6. Waiting time for each type of neoadjuvant treatment

	Neoadjuvant treatment				
	Not received	nCRT	nCMT	TNT	p-value
Number of patients	51	67	4	7	
Mean waiting time (weeks)	4.75	22.21	25	36.29	<0.001*
Range (weeks)	3.89 to 5.60	20.85 to 23.57	12.95 to 37.05	29.86 to 42.71	
Standard deviation	3.052	5.591	7.572	6.945	
pCR cases; n (%)	0 (0.0)	12 (17.9)	0 (0.0)	1 (14.3)	0.128

pCR=pathological complete response; nCRT=neoadjuvant concurrent chemoradiation therapy; nCMT=neoadjuvant chemotherapy; TNT=total neoadjuvant treatment

* Statistical significance

and treatment on disease progression. Addressing the barriers to timely diagnosis and treatment initiation are essential for minimizing the adverse effects of the pandemic on colorectal cancer outcomes.

While the overall management of colon cancer remained consistent between the pre-COVID and the COVID periods, significant delays were observed in the surgical treatment of rectal cancer patients during the pandemic. Prolonged waiting times for surgery were influenced by factors including greater reliance on neoadjuvant treatment, staff shortages, and operational constraints due to the pandemic. Notably, the present study found a significant increase in the use of TNT for rectal cancer patients during the COVID-19 outbreak, leading to longer treatment durations and extended waiting times for surgery. The waiting time for rectal cancer patients receiving nCRT in the present study had a mean duration of 22.2 weeks, whereas the TNT group had a longer mean waiting time of 36.29 weeks. The longer waiting time in the TNT group can be attributed to two primary factors. First, the TNT group included only seven patients, leading to a wide range of waiting times, which was 29.86 to 42.71 weeks. This small sample size increases variability and may not accurately represent the overall patient population. The wide dispersion of data suggests that the mean waiting time in this group may be influenced by outliers or individual variations in treatment schedules. Second, in the present study, most patients in the TNT group underwent induction TNT, where chemotherapy was administered before radiation therapy. During the COVID-19 pandemic, radiotherapy schedules were constrained, leading to the prioritization of chemotherapy before radiation in some patients. Induction TNT generally results in a longer waiting time compared to consolidation TNT or standard nCRT, as chemotherapy cycles must be completed before proceeding with radiation therapy. This shift in treatment sequencing during the pandemic likely contributed to the prolonged waiting time observed in the TNT group. Although no significant differences in the outcomes were observed between patients with varied surgery waiting times, existing literature suggests that delays in surgery after neoadjuvant treatment can have negative consequences. These include more challenging surgeries due to increased pelvic fibrosis, which complicates the identification of the total mesorectal excision (TME) plane and can result in poorer specimen quality. Such complications increase the risk of local recurrence. Additionally, patients who do not respond to neoadjuvant treatment may face a higher risk of disease progression. Long-term follow-up of these patients could provide further insights into these risks[12].

The pCR, defined as the complete absence of detectable cancer cells in tissue specimens after neoadjuvant therapy, serves as a crucial marker of treatment efficacy. Achieving pCR is associated with improved outcomes, including lower recurrence rates and better survival[13-15]. In the present study, the similar pCR rates observed for both nCRT and TNT treatments in rectal cancer patients underscore the importance of individualized treatment strategies. Tailoring therapy based on the specific characteristics of the patient and tumor can enhance treatment efficacy and reduce associated morbidity. As mentioned earlier, the TNT group analyzed in the present study included only seven patients, as TNT was a new treatment approach at the time. Consequently, the number of patients receiving this treatment was limited, and the reliability of the pCR rate may be lower when compared to other studies specifically focusing on TNT patients. Moreover, the patients in the present study received induction TNT, where chemotherapy was administered first while awaiting radiotherapy scheduling. Previous studies have shown that the pCR rate of patients receiving induction TNT is significantly lower than that of those receiving consolidation TNT. According to the CAO/

ARO/AIO-12 trial[16], which compared the pCR rate between induction and consolidation TNT groups, the pCR rates were 17% and 25%, respectively. In comparison, the pCR rate of TNT patients in this study was 14.3%, as shown in Table 6, which is consistent with the findings from the CAO/ARO/AIO-12 trial.

One key observation is the stability in the number of colorectal cancer patients treated before and during the COVID-19 pandemic. Despite the challenges presented by the pandemic, the overall caseload remained consistent. This stability can be attributed to Vajira Hospital's comprehensive approach. In fact, Vajira Hospital provides a range of colorectal medical services, not only colorectal cancer but also other colorectal conditions, including anorectal disorders, benign colorectal issues, and pelvic floor disorders. While surgeries for non-cancerous colorectal conditions were postponed due to the pandemic, the hospital maintained a strong focus on colorectal cancer care, ensuring consistent surgical caseloads for cancer patients. This shift in priorities highlights the institution's ability to adapt and its commitment to providing essential cancer care amid unprecedented circumstances.

Effective pandemic management requires adherence to protocols established by individual institutions and the national guidelines tailored to the specific infectious disease. Adequate preparation, particularly in the context of cancer care, provides valuable insights that can significantly enhance the management of future pandemics.

Conclusion

The present study highlights the significant impact of the COVID-19 pandemic on colorectal cancer management in Thailand, particularly at a tertiary medical center. Although the overall caseload remained stable, challenges emerged, including a notable increase in emergency presentations and delays in surgery for rectal cancer patients. Addressing these barriers to timely care and implementing personalized treatment strategies is crucial. Future research should focus on evaluating the long-term effects of the pandemic on colorectal cancer patients, especially in terms of survival, disease recurrence, and quality of life.

Additionally, there is a need to develop innovative approaches to strengthen healthcare resilience in the face of public health crises like the COVID-19 pandemic. These strategies should focus on maintaining timely and effective cancer care while also ensuring the safety of both patients and healthcare workers. Strengthening healthcare systems' ability to adapt to unforeseen disruptions will not only improve colorectal cancer outcomes but will also enhance overall pandemic preparedness and response for future healthcare challenges.

What is already known about this topic?

Studies have explored the impact of the COVID-19 pandemic on healthcare systems, including the management of cancer patients. The pandemic led to delays in diagnosis, treatment, and surgery for various types of cancer, including colorectal cancer. These disruptions were attributed to factors such as healthcare system overload, reduced capacity for elective procedures, patient reluctance to seek medical care due to fear of infection, and diversion of healthcare resources toward COVID-19 management. Previous research has shown that cancer patients during the pandemic often presented with more advanced stages of the disease, leading to more aggressive treatments and worse outcomes in some cases. Additionally, in some countries, there were delays in cancer screenings, surgical interventions, and post-surgical follow-ups.

In colorectal cancer specifically, there have been reports of increased emergency surgeries and more advanced disease presentations during the pandemic. Studies have also highlighted the increased use of neoadjuvant treatments, especially for rectal cancer, which extended treatment timelines. However, despite these challenges, some studies noted that colorectal cancer surgeries did not decrease significantly, although their nature and timing were impacted. These findings suggest that the full effects of the pandemic on colorectal cancer outcomes are complex and multifaceted, with both delays in care and increased severity of disease observed.

What does this study add?

This study provides valuable insights into the specific impact of the COVID-19 pandemic on the management of colorectal cancer in Thailand, highlighting key findings:

1. Increased emergency surgeries: The study shows a significant increase in emergency surgeries during the COVID-19 outbreak at 20% versus 11.3% pre-pandemic. This reflects a shift towards more urgent and advanced cases, due to delays in diagnosis and treatment during the pandemic.

2. Higher rates of advanced disease: Colorectal cancer patients during the COVID-19 period had

higher rates of advanced disease staging at 52.9% versus 40.9% pre-pandemic. This suggests that delays in screening and diagnosis led to a greater proportion of patients presenting with Stage III or IV cancer, which may have contributed to worse outcomes.

3. Prolonged surgery wait-times for rectal cancer: For rectal cancer patients, the pandemic led to prolonged wait times for surgery at 19 weeks versus 13 weeks pre-pandemic. This was partly due to an increased number of patients receiving neoadjuvant treatments, including total neoadjuvant therapy, which extended treatment durations compared to conventional chemoradiotherapy at 36 weeks versus 22 weeks pre-pandemic.

4. Impact on treatment protocols: The study adds to the understanding of how treatment protocols were altered by the pandemic, particularly in terms of neoadjuvant treatment regimens for rectal cancer, which were more frequently used and led to longer treatment times.

Overall, this study adds detailed, region-specific evidence of how the COVID-19 pandemic affected colorectal cancer management, contributing to an understanding of delays in care, changes in treatment patterns, and a shift toward more advanced disease at the time of diagnosis.

Conflicts of interest

The authors declare no conflict of interest.

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