



How should colorectal surgeons practice during the COVID-19 epidemic? A retrospective single-centre analysis based on real-world data from China

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Introduction

Currently, the whole world is facing a big challenge of the novel virus pneumonia known as coronavirus disease 2019 (COVID-19) named officially by World Health Organization. Since it broke out in Wuhan, Hubei Province of China in late December 2019 initially as reported,¹ the COVID-19 has caused hundreds of thousands of people to be infected and resulted in a heavy burden on the global economy. As a result of the rising numbers, verified person-to-person transmission and different health security capacities between countries,²⁻⁴ the World Health Organization has already declared COVID-19 a Public Health Emergency of International Concern.

A nationwide analysis about cancer and COVID-19 in China revealed that patients infected with this virus were more likely to have

a history of cancer and cancer patients had higher risks of COVID-19 and poorer outcomes from it.⁵ Some researchers summarized that for cancer patients who were advised to stay at home during the global COVID-19 pandemic, potential risks existed for lacking early diagnosis, delaying of clinical therapy and further causing potential disease progression and poor prognosis.⁶ Thus, we should pay more attention to those patients with cancer, especially the elderly as some reports have shown that older patients tend to have lower immune functions and worse COVID-19 outcomes.^{7,8}

Researchers from Italy proposed that the COVID-19 epidemic could postpone outpatient visits, early test screening, oncological follow-up and endoscopy examination for patients with colorectal cancer (CRC).⁹ Delay of treatment for cancer was associated with decreasing survival years and increasing medical costs.^{10,11}

Abstract

Background: The coronavirus disease 2019 is currently of global concern. Cancer patients are advised to stay at home in case of potential infection, which may cause delays of routine diagnosis and necessary treatment. How colorectal surgeons should manage this during the epidemic remains a big challenge. The objective of the study is to evaluate the feasibility of routine colorectal surgery during coronavirus disease 2019 and to offer some Chinese recommendations to colorectal surgeons throughout the world.

Methods: A total of 166 patients receiving colorectal surgery from 20 December 2019 to 20 March 2020 at Department of General Surgery in Chinese General Hospital of People's Liberation Army were enrolled, and further divided into two groups based on before or after admission date of 20 January 2020. Clinicopathologic data such as hospital stay and economic data such as total costs were collected and analysed retrospectively.

Results: Longer hospital stay, higher proportion of non-local patients and more hospitalization cost were found in the post-20 January group (special-time group) ($P < 0.001$; $P < 0.05$; $P < 0.05$, respectively). Apart from this, no difference existed with regard to baseline demographical data such as age, sex and height, as well as clinicopathological data such as previous history, surgery time, operation extent and TNM staging.

Conclusions: This real-world study indicated that performing colorectal surgery during coronavirus disease 2019 epidemic might be safe and feasible based on comprehensive screening and investigation. We have summarized several recommendations here, hoping to help surgeons from related departments across the world.

Therefore, it is vital to ensure colorectal surgery is performed safely and effectively during this special time. To date, we have carried out several measures and put forward a Chinese expert consensus on surgical diagnosis and treatment strategies for CRC patients during COVID-19 epidemic.¹² In this retrospective study, we enrolled all those CRC patients receiving surgical treatment in our hospital around this COVID-19 outbreak period, collected and analysed aspects such as safety and costs to conduct surgery for CRC. Meanwhile, we have introduced several precautions based on real-world data and hope to exchange our learning experiences with intestinal surgeons around the world.

Methods

In Beijing, China, the first confirmed case of COVID-19 was officially announced by Beijing government on 20 January 2020, and the number of new cases reached zero on 20 March 2020. Thus, it was considered that the time of the epidemic situation was from 20 January 2020 to 20 March 2020, and we chose period from 20 December 2019 to 20 January 2020 as a control normal time in our study.

CRC patients hospitalized at General Surgery Department of Chinese General Hospital of People's Liberation Army (Beijing, China) from 20 December 2019 to 20 March 2020 were enrolled, and the inclusion criteria were as follows: (i) all patients received surgical treatment, including radical surgery for CRC and other non-radical surgery; (ii) operations were all performed by experienced senior surgeons; (iii) CRC patients were diagnosis based on pathological examination and all clinical data were integral and available. Patients who underwent emergency surgery were excluded. All patients signed informed consent before surgery and this study was approved by ethics committee of Chinese General Hospital of People's Liberation Army.

Since 20 January 2020, we have applied intensified strategies in case of COVID-19 infection, composed of three aspects of outpatient, inpatient, and discharged patient management. After 20 March 2020, the epidemic situation of COVID-19 began to stabilize, and hospital admissions gradually recovered. All the enrolled patients were divided into normal-time group (NTG) and special-time group (STG) based on hospitalization date. Clinical data were collected from those patients meeting inclusive and exclusive criteria above. Measurement data with normal distribution were presented as mean \pm standard deviation and analysed via *t* test. Enumeration data were displayed as *n* (%) and analysed using chi-squared test. $P < 0.05$ was considered statistically significant, and all the statistical analyses were accomplished with IBM SPSS 23.0 (IBM, Armonk, NY, USA).

Results

Study population and baseline demographics

A total of 166 patients were enrolled, with 95 patients into NTG who were hospitalized before 20 January 2020 and the remaining 71 patients in the STG. Patients demographics for NTG and STG are shown in Table 1. The differences between NTG and STG were

similar with regard to age, sex, height and weight ($P > 0.05$). The origin of patients between two groups showed a significant difference, with proportion of non-local patients of NTG significantly higher than that of STG ($P < 0.05$).

Clinicopathological data of all patients enrolled before or after 20th January

Preoperatively, patients had similar characteristics with respect to waiting time for hospitalization, imaging examinations of computed tomography, magnetic resonance imaging or positron emission tomography computed tomography and colonoscopy, previous disease, major admission diagnosis and history of neoadjuvant chemotherapy (NACT) ($P > 0.05$). Compared to STG, patients in NTG had longer length of hospital stay before surgery ($P < 0.05$) (Table 2).

Intraoperatively, no statistically significant differences existed in terms of surgery time, operative method, resection extent, dissection of lymph nodes, combined organ resection or transfusion of blood ($P > 0.05$) (Table 3).

Postoperatively, there were no statistically significant differences for pathological diagnosis, TNM staging, complication including pneumonia and blood transfusion, as well as highest temperature, screening test, and reason for fever between the two groups ($P > 0.05$). Compared to NTG, patients of STG had more fever after surgery, longer length of postoperative stay and total stay ($P < 0.05$) (Table 4).

Health economics data of all patients enrolled before or after 20th January

We analysed health economics data especially and results showed that patients of STG had higher costs of laboratory tests, anaesthesia, total hospitalization expenses and other costs ($P < 0.05$). Other costs include beds, carers, diets and heating bills. Costs were similar concerning medicine, examination, treatment, surgery and medical consumables ($P > 0.05$). The results were shown in Table 5.

Discussion

According to the latest figures by the Center for Systems Science and Engineering at Johns Hopkins University,¹³ there are more than 5 920 000 confirmed cases of COVID-19 throughout the world and over 360 000 deaths from it. Currently, the USA with more than 1 740 000 confirmed cases and over 100 000 deaths, has already surpassed China and ranks first place among all the countries.

CRC, one of the most common malignant tumours, has over 1.8 million new cases and more than 900 000 fatal cases every year, ranking third and second place globally for morbidity and mortality, respectively, and in addition, there is also a younger and increasing trend of CRC in China, which has raised concern both in China and across the world.^{14,15} The outbreak of COVID-19 resulted in potential risks for cancer patients that delays of diagnosis and treatment might cause disease progression and survival shortening.⁶ How to run a colorectal surgery department effectively in this special time remains a big challenge.

Table 1 Baseline demographical data of all patients enrolled

Demographics	NTG (n = 95)	STG (n = 71)	P
Age (years), mean ± SD	60.34 ± 11.30	59.77 ± 12.35	0.757
Sex, n			0.216
Male	70	46	
Female	25	25	
Height (cm), mean ± SD	167.96 ± 7.35	167.54 ± 8.70	0.735
Weight (kg), mean ± SD	70.62 ± 12.91	69.75 ± 12.79	0.664
Origin of patients, n			0.035*
Local	11	17	
Nonlocal	84	54	

*P < 0.05, statistically different.

NTG, normal time group; SD, standard deviation; STG, special time group.

Table 2 Preoperative clinicopathological data of all patients enrolled

Clinicopathologic data	NTG (n = 95)	STG (n = 71)	P
Admission waiting (day), mean ± SD	7.95 ± 13.97	9.59 ± 14.19	0.470
Previous history, n			0.801
Yes	53	41	
No	42	30	
Major diagnosis, n			0.590
Duodenal cancer	1	1	
Colon cancer	43	33	
Rectal cancer	42	28	
Interstitialoma	3	1	
Benign diseases	6	6	
Other	0	2	
CT examination, n			0.158
Plain	9	13	
Enhanced	74	53	
None	12	5	
MRI examination, n			0.374
Plain	2	1	
Enhanced	19	12	
None	74	58	
PET/CT examination, n			0.467
Yes	14	12	
No	81	59	
Enteroscope test, n			0.051
Yes	89	60	
No	5	10	
History of NACT, n			0.739
Yes	2	1	
No	93	70	
Hospital stay before surgery (day), mean ± SD	4.68 ± 5.88	7.42 ± 3.62	0.001*

*P < 0.05, statistically different. CT, computed tomography; MRI, magnetic resonance imaging; NACT, neoadjuvant chemotherapy; NTG, normal time group; PET/CT, positron emission tomography computed tomography; SD, standard deviation; STG, special time group.

In this study, during COVID-19 epidemic, non-local patients visiting our hospital decreased owing to strategies of traffic restriction and reducing movement of people. As Table 2 shows, preoperative examinations including computed tomography, magnetic resonance imaging and positron emission tomography computed tomography were similar, with ongoing screening of patients with suspected symptoms, signs, temperature and epidemiological (COVID exposure) history. Information about operations revealed that conducting

surgery during COVID-19 is feasible. However, lengths of preoperative, postoperative and total hospital stay were all significantly longer and cost of hospitalization and treatment were notably higher, which was related to a three-day observation and isolation before operation. Fever after surgery occurred more often in STG patients, most of which were associated with stress response postoperatively, after comprehensive testing and investigation. And after further grouping and analysing, postoperative fever conditions showed no statistically differences as shown in Table 4.

On behalf of Group of Colorectal Surgery, Society of Surgery, Chinese Medical association, our team drafted and published a Chinese expert consensus on surgical diagnosis and treatment strategies for CRC patients during COVID-19 epidemic.¹² We recommended several strategies, in order to not only accomplish the prevention and control of COVID-19 but also promote diagnosis and treatment for CRC safely and orderly, including three aspects of outpatient, inpatient and postoperative patient management. Flowchart of diagnosis and treatment for CRC patients during COVID-19 is shown in Figure 1.

Firstly, several tips for outpatient management should be addressed: (i) medical staff in outpatient must wear medical surgical mask or N95 mask, as well as disposable helmet, gloves and goggles, to protect them from potential infection; (ii) appointment and triage protocols should be carried out through telephone, smartphone apps or internet service and patients visit the clinic based on reservation number and recommended time, to reduce crowds gathering and lower risks of cross infection; (iii) for primary-care patients, triage nurses need to measure their temperature and investigate epidemiological history including travelling to Wuhan in Hubei Province and nearby cities, meeting with people who have been in those areas, and contact with confirmed or suspected cases within 14 days, as well as clinical manifestations including fever (>37.3°C), fatigue and respiratory symptoms like coughing. For those with history of exposure or symptoms, the fever clinic screening had to be done first. Multidisciplinary team (MDT) meetings with doctors from General Surgery, Medical Oncology, Radiology, Radiotherapy, Respiratory and Epidemiology carried out via internet is recommended, for the sake of working out a personalized plan of diagnosis and treatment.

Secondly, perioperative management varies depending on type of surgical procedure. All hospitalized patients have to be isolated

Table 3 Intraoperative clinicopathological data of all patients enrolled

Clinicopathologic data	NTG (n = 95)	STG (n = 71)	P
Surgery time (min), mean ± SD	157.79 ± 60.51	167.45 ± 83.58	0.389
Operative method, n			0.472
Open	20	10	
Laparoscopic	70	59	
Conversion to open	4	2	
Other	1	0	
Resection extent, n			0.083
Local/non-radical	14	4	
Radical	80	64	
Extended radical	1	3	
Dissection of LNs, n			0.822
D2	76	56	
D3	7	7	
Unclear	4	4	
None	8	4	
Combine organ resection, n			0.420
Yes	4	6	
No	91	65	
Transfusion of blood, n			0.393
Yes	6	8	
No	89	63	

*P < 0.05, statistically different.
LNs, lymph nodes; NTG, normal time group; SD, standard deviation; STG, special time group.

separately for at least 3 days, and only after all-round investigations of clinical symptoms and signs, laboratory test and imaging examinations, should operations be arranged. According to the latest version of the Standard of Diagnosis and Treatment of Colorectal Cancer in China,¹⁶ most CRC patients are diagnosed with advanced tumour. For cT₄ colon cancer, cT₃₋₄/N₊ rectal cancer or CRC patients with resectable metastatic disease, NACT is recommended. FOLFOX and CapeOX both work for those CRC patients when given as NACT or adjuvant chemotherapy.¹⁷⁻¹⁹ We propose CapeOX as first choice during COVID-19 epidemic, on account of its convenient method of taking oral medications for most of the time. Although neoadjuvant radiotherapy (NART) is proposed for rectal cancer patients, some research has showed that outcomes seemed not compromised without routine NART.²⁰ Thus, to some extent, NART could be postponed until COVID-19 epidemic ended. For CRC patients with unresectable metastasis, NACT plus bevacizumab or cetuximab is proposed.²¹ Selective operation strategy is proposed for those CRC patients with locally advanced or metastatic disease. Limited endoscopic therapy should be performed for cT₁N₀M₀ CRC patients, whereas limited operation should be done for cT₂₋₃N₀M₀ colon cancer or cT₂N₀M₀ rectal cancer patients.

Researchers from England put forward that no association existed between delay of treatment and survival of CRC patients, yet advised that for this issue, colon and rectum should be analysed separately.²² Heo and colleagues found that over 30 days of treatment delays was associated with poorer survival for rectum instead of colon cancer.²³ Moreover, waiting about 2 months after NACT and NART for rectal cancer did not increase response rate but

Table 4 Postoperative clinicopathological data of all patients enrolled

Clinicopathologic data	NTG (n = 95)	STG (n = 71)	P
Pathological diagnosis, n			0.370
Primary disease	93	62	
Metastatic disease	2	3	
TNM staging, n			0.241
Stage I	13	9	
Stage II	22	28	
Stage III	41	24	
Stage IV	11	5	
Benign disease	8	5	
Complication, n			0.996
Yes	4	3	
No	91	68	
Fever (≥37.3°C), n			0.006*
Yes	27	35	
No	68	36	
Highest temperature (°C), n			0.119
<37.3	68	36	
37.3–38.5	21	25	
>38.5	6	10	
Screening examination, n			0.192
BRE	10	12	
BRE + CRP	17	17	
BRE + CRP + X-ray + CT	0	1	
~ + Fistulography	0	1	
None	68	40	
Reason of fever, n			0.106
Abdominal infection	7	3	
Pulmonary infection	0	1	
Incision infection	1	0	
Anastomotic leakage	0	2	
Other	18	24	
Unclear	1	1	
None	68	40	
Transfusion of blood, n			0.253
Yes	3	6	
No	92	65	
Hospital stay after surgery (day), mean ± SD	7.02 ± 3.80	9.00 ± 3.78	0.001*
Total hospital stays (day), mean ± SD	11.78 ± 7.43	16.70 ± 5.80	0.000*

*P < 0.05, statistically different. BRE, blood routine examination; CRP, C-reactive protein; CT, computed tomography; NTG, normal time group; SD, standard deviation; STG, special time group.

adversely influenced morbidity from surgery.²⁴ Therefore, for advanced colon cancer patients, the watch and wait strategy could be applied during COVID-19 epidemic. For advanced rectal tumours with demands of limited surgery, as well as other conditions such as haemorrhage, perforation and obstruction in need of emergency surgery, radical operations could be performed.

Thirdly, for postoperative management, the number of caregivers and visitors should be restricted and confined to fixed times for visiting. Further, mask wearing and temperature monitoring are mandatory for all personnel around the ward including medical staff, caregivers, visitors, and cleaners. For adjuvant therapy, a maximum of 60 days' delay is acceptable.²⁵ After being discharged, an appropriate delay is recommended for patients who seek a review and recheck and media like telephone, WeChat or E-mails are preferred for postoperative consultations.

Table 5 Health economics data of all patients enrolled

Health economics data (10 000 RMB)	NTG (n = 95), mean ± SD	STG (n = 71), mean ± SD	P
Medicine	2.40 ± 1.00	2.66 ± 1.18	0.126
Laboratory test	1.04 ± 0.33	1.17 ± 0.40	0.022*
Examination	0.10 ± 0.23	0.11 ± 0.17	0.847
Treatment	0.60 ± 1.02	0.69 ± 1.10	0.581
Surgery	0.44 ± 0.11	0.47 ± 0.12	0.054
Anaesthesia	0.19 ± 0.06	0.21 ± 0.07	0.037*
Consumables	2.90 ± 0.89	3.15 ± 0.95	0.082
Others	0.32 ± 0.46	0.45 ± 0.18	0.021*
Total costs	7.99 ± 2.51	8.91 ± 2.47	0.020*

*P < 0.05, statistically different.

NTG, normal time group; RMB, Renminbi; SD, standard deviation; STG, special time group.

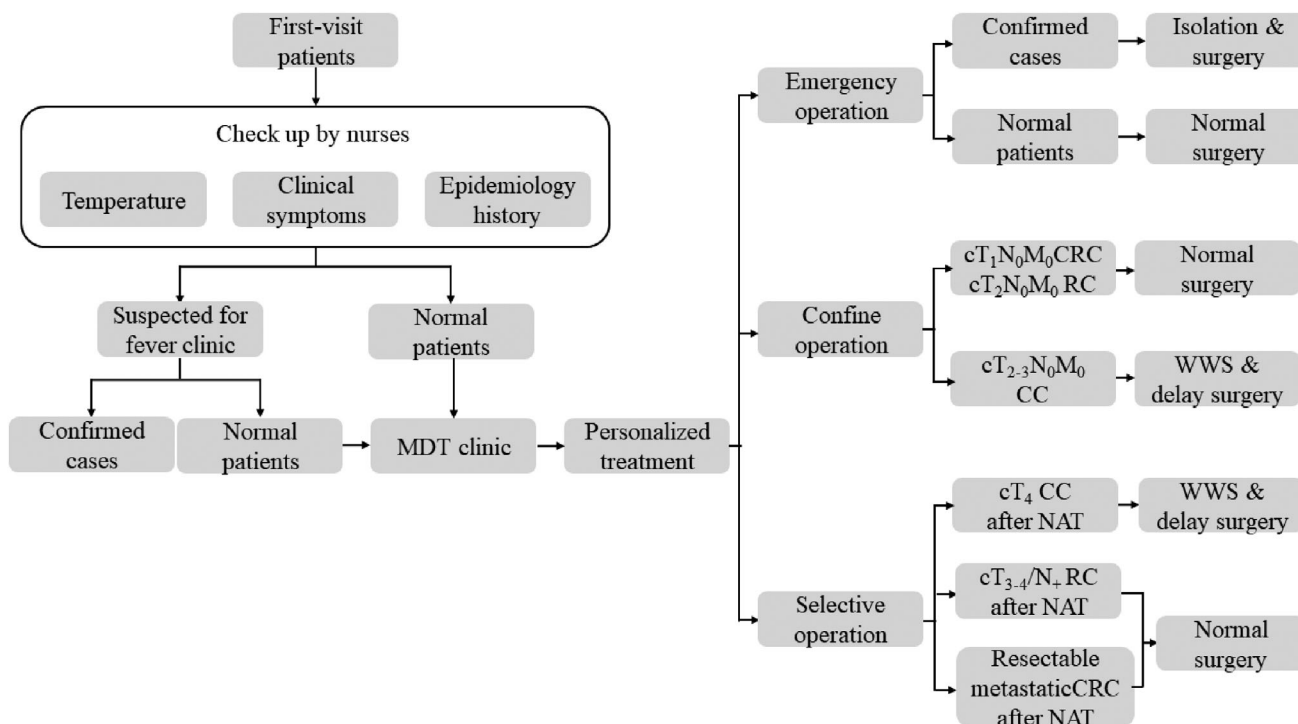


Fig 1. Flowchart of diagnosis and treatment for colorectal cancer patients during COVID-19. CC, colon cancer; CRC, colorectal cancer; MDT, multiple disciplinary treatment; NAT, neoadjuvant therapy; RC, rectal cancer; WWS, watch and wait strategy.

Experts in different areas have also summarized and shared management and working experiences^{26–33} including departments of intensive care unit, urology, colorectal surgery, obstetrics, transplantation, oncology and dermatology. Currently, some countries have suspended all non-urgent surgery during COVID-19 epidemic.³⁴ We believe that all should be cautious about COVID-19, although overcorrecting for the epidemic is inappropriate. The results of our single-centre analysis showed that it is safe to perform colorectal surgery during COVID-19, and what needs to be done careful assessment and screening comprehensively before admission, accepting a longer length of hospital stay and an increased cost.

In this study, the results were based on analysis of real-world data from one single centre, which might lead to some bias. In

addition, COVID-19 in Beijing is not as severe as in some areas like USA, Italy, Spain, France or Wuhan in Hubei Province of China, and the public health resources, hygiene measures, populace obedience and some aspects vary in different regions, for which some of our recommendations might be impractical to imitate.

Conclusion

In conclusion, our study indicated that it might be safe and feasible to perform colorectal surgery during COVID-19 after implementing strategies to lower risks for patients and hospital staff. We do believe this epidemic will end soon after joint efforts, and hope that some of our recommendations would be helpful for experts from other countries.

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Conflicts of interest

None declared.

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