



The real-word impact of breast and colorectal cancer surgery during the SARS-CoV-2 pandemic

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Abstract

The postponing of screening and the health care system reorganization, due to the Covid-19 pandemic and lockdown, could led to a concerning decline in breast and colorectal cancer diagnoses. This monocentric retrospective analysis has compared the pre-Covid period (March 2019 to March 2020) to the Covid period (April 2020 to April 2021) in terms of screening programs, clinical, surgical and pathological. A total of 799 patients diagnosed with Breast Cancer (BC) and Colorectal Cancer (CRC) underwent surgery during the two periods. In FVG in 2020 a decrease in mammography screening of 17.1% has been registered compared to 2019; this reduction has been higher for CRC screening, which summed up to 24.5%. As far as BC is concerned, screening-detected tumours rose significantly from 18 to 28%, mastectomies decreased from 40 to 31% and advanced tumours treated surgically decreased from 12 to 6%. Concerning CRC, a significant increase in admissions through the Emergency Department has been registered in spite of a stable percentage of urgent surgery performed, proving that severely symptomatic patients have been treated adequately. Open surgery has significantly decreased, whereas the tumoral stage and complications have remained constant in the two periods. This study has proved that maintaining standards of care and validated protocols during emergency is the most adequate and winning strategy: impact on BC and CRC has been less important than expected. These results support the recommendations for immediate and rapid screening program resumption at operating speed, using prioritization strategies to make up for the diagnostic delays.

Keywords Breast cancer · Colorectal cancer · SARS-CoV-2 · Breast cancer screening · Colorectal cancer screening

Introduction

An outbreak of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), has rapidly spread from China to the whole world [1, 2]. The World Health Organization declared a public health emergency in late January 2020 and characterized it as a pandemic in March 2020, and the Italian lockdown started on 9th of March.

Due to lockdown, hospitals were put under emergency state and only oncologic elective surgery and life-saving surgery were performed.

Worldwide, measures to alleviate the burden on health-care systems, such as the suspension of elective surgeries, were implemented [3]. If possible, elective surgeries were postponed, and the national screening programs for breast and colorectal cancer were temporarily halted starting March 16, 2020.

Screening has been proven to reduce both incidence and mortality of cancer [4, 5].

The two major national screening programs, respectively, for colorectal cancer (CRC) and breast cancer (BC), were mostly affected by the reorganization of the Italian health system.

As known, breast and colorectal cancer are two of the most common cancer and the leading cause of cancer death in women and men, respectively, worldwide [6, 7].

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For these reasons, the postponing of screening and the health care system reorganization, could led to a concerning decline in breast and colorectal cancer diagnoses.

This retrospective single-institution study aimed to evaluate the consequences on CRC and BC diagnosis and surgery during the pandemic lockdown in a region of Northern Italy highly affected by the severe acute respiratory syndrome-related coronavirus-2 (SARS-CoV-2) virus.

Methods

Study design

We consecutively enrolled and retrospectively analyzed a total of 799 patients in our prospective institutional database created with data extracted from “Data-Breast” database of the “Eusoma certified SSD Breast Unit of Trieste and from the Surgical Department of DAI Chirurgia Generale—ASUGI. Of those, 413 underwent surgery from March 2019 to March 2020 and 380 patients underwent surgery from April 2020 till April 2021.

All patients who underwent breast surgery or colorectal surgery from March 2019 to April 2021 were evaluated in our study and investigated separately as the Breast Cancer group (BC group) and the Colorectal Cancer group (CRC group).

Both populations (BC and CRC) were then divided into 2 subgroups: the *pre-Covid* subgroup (March 2019 and March 2020) and the *Covid* subgroup (April 2020 and April 2021). March 2020 has been included in the pre-Covid group because patients who underwent surgery during this month had been taken in charge previously and their surgery had already been planned.

Screening program in FVG region

The current screening program in the Friuli Venezia Giulia region is recommended for all women and men aged 50–69 both for breast [8, 9] and colorectal cancer [10, 11].

gFOBT is the most basic type of test for CRC screening and became the test of choice in the Friuli Venezia Giulia region after a cost-effectiveness analysis demonstrated its advantages in a mass-screening setting. If positive, gFOBT is followed by a colonoscopy for the final diagnosis [4, 10].

Regarding breast cancer screening, a mammography is the international gold standard. A positive mammography is followed by a second mammography, an ultrasound with

fine-needle aspiration cytology (FNAC) or Tru-cut biopsy and a clinical visit [8, 12].

Variable and clinical assessment

For each BC patient, data of diagnosis (mammography, ultrasound, cytological examination and magnetic resonance), admission and surgery were collected. Surgical procedures were distinguished between breast conservative surgery and breast invasive surgery.

Patients without clinical or radiological evidence of lymph nodes involvement underwent sentinel lymph node biopsy (SLNB). Otherwise, patients with axillary involvement or SLNB positivity underwent axillary lymph node dissection (ALND) [13].

Data from surgical specimens were included in the study according to Pathological staging based on recommendations from AJCC 2018 (edition VIII) for TNM classification [14] and according to the Nottingham Histologic Score system [15].

For each CRC patient, the date of surgery and discharge were collected. Data regarding diagnostic procedures were included: screening program, out of screening FOBT, colonoscopy, Emergency Department admission were the possible alternatives as first diagnostic procedures that were carried out. Strictly connected to this was the evaluation of the surgical regimen: either elective or urgent.

Data from surgical specimens were included in the study. Pathological staging was based on recommendations from AJCC 2018 (edition VIII) for TNM classification [16].

Finally, patients whose diagnosis was changed to non-tumoral after histological analysis were ruled out, for a total of 13 out of 263.

Statistical analysis

Descriptive statistics were used to describe the patient and treatment characteristics. Continuous variables distribution was checked for normality with the Shapiro–Wilk test, then data were presented as mean and standard deviations (SD) if normally distributed, or median and range (minimum–maximum) if not. Categorical variables were summarized with absolute frequencies and percentages. Clinical and pathological characteristics were compared between two times periods (March 2020 to March 2021 vs April 2020 to April 2021): continuous variables were analyzed through Mann–Whitney nonparametric test, while qualitative variables by means of Chi-squared test or Fischer-exact test when appropriate. Percentage variation between months was investigated with the proportion test. Two-sided p values < 0.05 were considered statistically

significant and all calculations were performed using R software version 4.0.3 (2020).

Results

Characterization of patients enrolled on cancer screening and surgical activity

Globally, in Table 1 (column A) we report a reduction of 17.1% of breast cancer screening in the FVG region with 57 missed diagnosis of breast cancer.

Regarding colorectal cancer, we report a reduction of 24.5% of CRC screening in our region, 24 missed diagnoses of cancer and 100 missed diagnoses of advanced adenomas (Table 1 column B).

Starting from March 2020, the next five months had a reduction in activity as far as General Surgery is concerned which saw less than 115 patients undergoing surgery and other 5 months saw an even more drastic reduction, as less than 100 procedures were performed (Table 2).

Overall, 1723 surgical procedures were performed from March 2019 to March 2020 and 1420 were performed from April 2020 to April 2021, with a total reduction of 17.6%, not considering day surgery (Table 2).

Breast cancer

Screening activity

Mammography tests saw a reduction of 17.1% in 2020 as far as FVG’s Regional organised screening is concerned. This brings to an estimated reduction in the diagnosis of 57 breast cancers, which is far better than overall Italian regions’ median data (Table 1 column A).

51 individuals out of 281 (18.2%) in the pre-Covid period and 76 out of 264 (28.4%) in the Covid period took the screening test out of patients operated for breast cancer (*p* value 0.005).

Impact of Covid era in the breast cancer surgery

As disclosed in Table 3, we reported a reduction of 4.6% in terms of BC surgery. 281 patients underwent surgery from March 2019 to March 2020, as opposed to 268 from April 2020 to April 2021.

Comparing stage’s distribution between pre- and Covid periods, less stage III and IV (advanced stage) breast cancers were diagnosed in the COVID period (6.3 vs 12.4%, *p*=0.02).

There are significant data regarding changes in type of surgery during the Covid period as opposed to the pre-Covid period (Table 3). During the pre-Covid period conservative

Table 1 Breast and colorectal cancer screening in Italy vs Friuli Venezia Giulia Region (FVG)

	Breast cancer screening n. and % of examined women				Colorectal cancer screening n. and % of tested individuals					
	Jan–May 2019 vs Jan–May 2020	June–Sep 2019 vs June–Sep 2020	Oct–Dec 2019 vs Oct–Dec 2020	Jan–Dec 2019 vs Jan–Dec 2020	Jan–May 2019 vs Jan–May 2020	June–Sep 2019 vs June–Sep 2020	Oct–Dec 2019 vs Oct–Dec 2020	Jan–Dec 2019 vs Jan–Dec 2020	n. of not diagnosed cancers (Jan–Dec 2020)	n. of not diagnosed advanced adenomas (Jan–Dec 2020)
FVG	–15.144 (–53.6%)	+7103 (+51.4%)	–1.987 (–11.9%)	–10.028 (–17.1%)	–15.584 (–38.6%)	–7.282 (–24%)	–998 (–3.7%)	–23.854 (–24.5%)	24	100
ITALY	–454.625 (–53.6%)	–156.178 (–28.1%)	–135.196 (–23.7%)	–751.879 (–37.6%)	–601.862 (–57.8%)	–365.603 (–46.1%)	–140.938 (–23.8%)	–1.110.414 (–45.5%)	1.299	7.474

Modified from Osservatorio Nazionale Screening (<https://www.osservatorionazionale screening.it>)

Table 2 General surgical activity

Month	n. of surgical procedures	Month	n. of surgical procedures	Variation in %	Month	n. of surgical procedures
March 2019	127	March 2020	113	− 11.0%	March 2021	124
April 2019	129	April 2020	95	− 26.4%	April 2021	83
May 2019	140	May 2020	111	− 20.7%		
June 2019	138	June 2020	108	− 21.7%		
July 2019	146	July 2020	139	− 4.8%		
August 2019	124	August 2020	83	− 33.1%		
September 2019	136	September 2020	137	0.7%		
October 2019	127	October 2020	130	2.4%		
November 2019	126	November 2020	99	− 21.4%		
December 2019	140	December 2020	113	− 19.3%		
January 2020	133	January 2021	106	− 20.3%		
February 2020	144	February 2021	92	− 36.1%		

Values are % monthly variation in surgical activity

surgery made up 60.5% of all the surgical operations, with 39.5% of mastectomies (p value 0.03).

In the Covid period instead, conservative surgery arouses to 69.0% and mastectomies decreased to 31.0% (p value 0.03).

No statistically significant changes were observed in terms of reconstruction and axillary dissection.

Colorectal cancer

Screening activity

gFOBT and subsequent colonoscopies saw a reduction of 24.5% in 2020 as far as FVG's Regional organised screening is concerned. This brings to an estimated reduction in the diagnosis of 24 colorectal cancers and 100 advanced adenomas, which is still much better than the overall Italian region's median data (Table 1 column B).

As reported in Table 4, FOBT and colonoscopies performed out of the screening regimen were much higher in number in both the first and second period of interest.

Respectively, 42/132 FOBT tests (33.1%) and 37/118 (31.9%) were performed during the first and second period, with a slight and not significant decrease.

Colonoscopies were performed in even more cases, as expected: respectively 112/132 (86.2%) and 100/118 (84.5%) were performed, respectively, during the first and second period, with a slight decrease.

Patients' characteristics

Our data (Table 4) show that out of all the patients operated for colorectal cancer, 22 individuals out of 132 (17.5%) in

the pre-Covid period and 18 out of 118 (15.8%) in the Covid period took the screening test.

132 cases underwent surgery from March 2019 to March 2020, as opposed to 118 from April 2020 to April 2021. This sums up to a total reduction of 10.6% of CRC surgery comparing pre-Covid and Covid period.

During the Covid period, more than 20% of patients with colorectal cancer as opposed to the pre-Covid period were admitted in an emergency through the Emergency Department (33.3 vs 53.4%; p value = 0.001).

A borderline significant increase from 6.8 to 10.2% of left hemicolectomy surgery has been observed, compared to a decrease from 56.1 to 50.0% of right hemicolectomy surgery.

Regarding surgical treatment, in the Covid period a not significantly changes in the surgical approach was reported.

We noticed a 7% decrease of reinterventions (from 12.9% in the pre-Covid period to 5.9% in the Covid period, p value = 0.06) and non-significant data concerns terminal ostomies and Dindo–Clavien classification.

Tumour characteristics

There is a trend towards greater lymph node involvement in the Covid period ($p = 0.096$). This is also confirmed by observing the stages: II, III, IV stages (which are N+) have seen an increase in a number of cases in the Covid period as opposed to the previous one.

The comparison between early stages (0–I–II) and advanced stages (III–IV) resulted in a decrease in early stages (59.1–49.1%) and an increase in advanced stages (40.9–50.9%).

Lastly, T0, T1 and T2 have decreased in number as opposed to T3 and T4. The greatest change is to be seen

Table 3 Characterization of patients with breast cancer

Variables	Pre Covid: Mar 2019–Mar 2020 (<i>n</i> = 281)	Covid period: Apr 2020–Apr 2021 (<i>n</i> = 268)	<i>p</i> value
General characteristics			
Age			0.25
Median (min–max)	65 (35–90)	63 (30–97)	
Symptomatic (<i>N</i> , %)			0.17
Yes	164(58.4%)	141 (52.6%)	
Screening (<i>N</i> , %)			0.005*
Yes	51 (18.2%)	76 (28.4%)	
Pre-surgery			
Diagnostic exam (<i>N</i> , %)			0.17
Only FNAC	67 (23.8%)	59 (22.0%)	
Only core biopsy	91 (32.4%)	71 (26.5%)	
FNAC + core biopsy	123 (43.8%)	138 (51.5%)	
Neoadjuvant CT (<i>N</i> , %)			0.11
Yes	12 (4.3%)	20 (7.5%)	
Surgery outcomes			
Type of surgery (<i>N</i> , %)			0.03*
Conservative	170 (60.5%)	185 (69.0%)	
Mastectomy	111 (39.5%)	83 (31.0%)	
Immediate reconstruction after MT	60 (54.1%)	48 (57.8%)	
Sentinel lymph node biopsy	230 (81.9%)	235 (87.7%)	0.05
Axillary dissection	47 (16.7%)	39 (14.6%)	0.48
Tumor characteristics			
Type of tumor:			0.19
Invasive	242 (87.2%)	243 (90.7%)	
In situ	36 (12.8%)	25 (9.3%)	
Histology	175 (71.4%)	174 (71.9%)	0.9
Ductal	40 (16.3%)	41 (16.9%)	
Lobular	9 (3.7%)	6 (2.5%)	
Ductal–Lobular	21 (8.6%)	21(8.7%)	
Other			
pT (<i>N</i> , %)			0.32
pTis	36 (12.8%)	25 (9.3%)	
1	165 (58.7%)	164 (61.2%)	
2	59 (21.0%)	49 (18.3%)	
0 3-Apr	9(3.2%)	10 (3.7%)	
ypT	12(4.3%)	20 (7.5%)	
pN (<i>N</i> , %)			0.05
N0–N1mi	213 (78.9%)	222 (84.7%)	
N1	34 (12.6%)	30 (11.5%)	
N2–N3	23 (8.5%)	10 (3.8%)	
Stage (<i>N</i> , %)			0.02
Early (0–I–II)	205 (87.6%)	222 (93.8%)	
Advanced (III–IV)	29 (12.4%)	15 (6.3%)	
Molecular subtype			0.5
Luminal A	100 (41.0%)	112 (46.7%)	
Luminal B Her2–	88 (36.1%)	77 (32.1%)	
Her2+	31 (12.7%)	24 (10.0%)	
Triple negative	25 (10.3%)	27 (11.3%)	

Values are mean SD, %, or median [interquartile range]

*Statistically significant difference between pre-covid and covid period for BC

Table 4 Characterization of patients with colorectal cancer

Variables	Pre Covid: Mar 2019–Mar 2020 (<i>n</i> = 132)	Covid period: Apr 2020–Apr 2021 (<i>n</i> = 118)	<i>p</i> value
General characteristics			
Age			0.71
Median (min–max)	77.0 (47–94)	77.5 (32–93)	
Sex (<i>N</i> , %)			0.58
M	68 (51.5%)	57 (48.3%)	
Screening (<i>N</i> , %)			0.73
Yes	22 (17.5%)	18 (15.8%)	
SOF (<i>N</i> , %)			0.85
Yes	42 (33.1%)	37 (31.9%)	
Colonscopy (<i>N</i> , %)			0.75
Yes	112 (86.2%)	100 (84.5%)	
ER admission (<i>N</i> , %)	44 (33.3%)	63 (53.4%)	0.001*
Pre-surgery			
CA.19.9.preop			0.58
Median (min–max)	11.8 (0.8–1902.0)	10.6 (0.8–1310.1)	
CEA preop			0.75
Median (min–max)	2.5 (0.4–634.0)	2.5 (0.6–913.9)	
Charlson score (<i>N</i> , %)			0.43
Median (min–max)	6 (2–16)	6 (2–11)	
ASA score (<i>N</i> , %)			0.99
01-Feb	91 (68.9%)	81 (68.6%)	
03-Apr	41 (31.1%)	37 (31.4%)	
Neoadjuvant CT (<i>N</i> , %)			0.05*
Yes	2 (1.5%)	8 (6.8%)	
Neodjuvant RT (<i>N</i> , %)			0.56
Yes	5 (3.8%)	7 (5.9%)	
Surgery outcomes			
Emergency/urgency setting (<i>N</i> , %)	24 (18.1%)	25 (21.2%)	0.55
Site of surgery (<i>N</i> , %)			0.05
Right hemicolectomy	74 (56.1%)	59 (50.0%)	
Left hemicolectomy	9 (6.8%)	12 (10.2%)	
Rectal resection	27 (20.5%)	30 (25.4%)	
Segmentary resection	12 (9.1%)	4 (3.4%)	
Transverse resection	4 (3.3%)	9 (7.6%)	
Hartmann	6 (4.6%)	1 (0.9%)	
Transverse ostomy	0 (0.0%)	2 (1.7%)	
Colostomy	0 (0.0%)	1 (0.9%)	
Access (<i>N</i> , %)			0.003*
Open	52 (39.4%)	42 (35.6%)	
Laparoscopic	80 (60.6%)	66 (55.9%)	
Robotic	0 (0.0%)	10 (8.5%)	
Anastomosis (<i>N</i> , %)			0.42
Yes	122 (92.4%)	112 (94.9%)	
Type of anastomosis (<i>N</i> , %)			0.08
Manual	49 (40.2%)	32 (28.6%)	
Mechanic/semi-mechanic	73 (59.8%)	80 (71.4%)	

Table 4 (continued)

Variables	Pre Covid: Mar 2019–Mar 2020 (<i>n</i> = 132)	Covid period: Apr 2020–Apr 2021 (<i>n</i> = 118)	<i>p</i> value
Intra–extra corporea (<i>N</i> , %)			0.65
Extra	70 (57.4%)	61 (54.5%)	
Intra	52 (42.6%)	51 (45.5%)	
ICG (<i>N</i> , %)			0.13
Yes	72 (54.6%)	75 (64.1%)	
Reintervention (<i>N</i> , %)			0.06
Yes	17 (12.9%)	7 (5.9%)	
Stomia di Protezione (<i>N</i> , %)			0.76
Yes	15 (11.4%)	12 (10.2%)	
Stomia Terminale (<i>N</i> , %)			0.98
Yes	9 (6.9%)	8 (6.8%)	
Wound classification (<i>N</i> , %)	86 (65.2%)	68 (57.6%)	
Clean/contaminated	30 (22.7%)	23 (19.5%)	
Contaminated	13 (9.9%)	20 (17.0%)	
Dirty/infected	3 (2.3%)	7 (5.9%)	
Drenaggio (<i>N</i> , %)	67 (51.2%)	62 (53.0%)	0.77
Yes			
Duration of surgery (min)			0.22
Median (min–max)	180 (70–480)	205 (50–430)	
Dindo–CLavien (<i>N</i> , %)			0.23
I	82 (62.1%)	83 (70.3%)	
II	28 (21.2%)	23 (19.5%)	
III	16 (12.1%)	6 (5.1%)	
IV–V	6 (4.6%)	6 (5.1%)	
Number of positive nodes			0.29
Median (min–max)	4 (1–51)	2 (1–18)	
Stage			
pT (<i>N</i> , %)			
0–1	18 (13.6%)	13 (11.0%)	0.28
2	28 (21.2%)	16 (13.6%)	
3	61 (46.2%)	59 (50.0%)	
4	25 (18.9%)	30 (25.4%)	
pN (<i>N</i> , %)			0.23*
N0	82 (62.1%)	61 (51.7%)	
N1	28 (21.2%)	34 (28.8%)	
N2	22 (16.7%)	23 (19.5%)	
pM (<i>N</i> , %)			0.7
1	20 (15.2%)	20 (17.0%)	
Stage (<i>N</i> , %)			0.35
0–I	39 (29.6%)	25 (21.2%)	
II	39 (29.6%)	33 (27.0%)	
III	34 (25.8%)	40 (33.9%)	
IV	20 (15.2%)	20 (17.0%)	
Stage (<i>N</i> , %)			0.09
Early (0–I–II)	78 (59.1%)	58 (49.1%)	
Advanced (III–IV)	54 (40.9%)	60 (50.9%)	

Values are mean SD, %, or median [interquartile range]

*Statistically significant difference between pre-covid and covid period for CRC

in the T2s (−6.6%) and in the T4s (+6.5%): in the Covid period an increase of 10.2% was registered in T3 and T4 tumours, respectively, to the pre Covid period (75.4 vs 65.2%, $p=0.079$).

Discussion

COVID-19 has dramatically impacted medicine and surgery, including surgical oncology. A cross-sectional study included patients across the United States demonstrated a 46% decrease in new cancer diagnoses during March and April 2020 among 6 common malignancies, including breast and colorectal cancer [17].

It has been observed internationally that COVID-19 had a great impact on cancer screening rates, reduced health service use and a consequent delay in diagnoses.

Several published papers, report a decrease in total and new cancer patient, due to the screening, during the COVID-19 period. In particular, decreases in cancer screening have been reported for lung [18], breast [19] and colon cancer [20, 21].

The Netherlands Cancer Registry noted an almost 30% decrease in new cancer diagnoses in all primary cancer sites [22]. New cancer diagnoses remained low, despite a national public awareness campaign to increase cancer diagnoses by encouraging patients to discuss new symptoms with their primary care provider, encouraging primary care providers to refer patients to oncology specialist, and resuming cancer screening operations [22].

The aim of this study was to evaluate the overall impact of the COVID-19 pandemic lockdown on the diagnosis and surgery of BC and CRC after the disruption of the screening programs and health care system reorganization in our region.

Day surgery activity for benign pathologies was stopped, completely, with a reduction of 100% since March 2019.

Overall, a reduction of 17.6% was noticed, but even if less cancer patients underwent surgery, relatively speaking, the percentage, as opposed to the year before, was higher, both for BC and CRC.

Scuola Superiore Sant'Anna and AGENAS published a study [17] on the 29th of May regarding regional Resilience towards COVID-19 pandemic concerning the oncological (screening and surgery) and cardiological pathologies. As far as programmed surgical volumes are concerned comparing the periods March 2019 to June 2019 and March 2020 to June 2020, this study observed a decrease of 50% in FVG, which, compared to other Italian regions, is lower than the average.

As far as the breast cancer regional screening program is concerned, a reduction of only 17.1% was registered in 2020 as opposed to 2019. Between June and September, a

great number of mammography tests was performed due to the change in recruitment: 76 phone calls a day were made to arrange mammography and for each patient three phone calls are provided: if they do not answer the first and second call, a third one is done to make sure recruitment is done efficiently.

In the same study [17] mentioned above, FVG was reported to be the best Italian region in terms of making up for the delay. This analysis has been done comparing January 2019 to September 2019 to January 2020 to September 2021, which is not scientifically correct, considering COVID-19 aroused in our State in March 2020.

The median percentage of adhesion to the colorectal screening program in FVG is 65%, to which we have to add a 5% of privately performed colorectal tests. Colorectal regional screening has always been less considered from the general population, even if FVG has one of the highest rates of participation as far as Italian regions are concerned. The annual difference between 2019 and 2020 saw a reduction of 24.5%. Starting from a lower percentage of adhesion (partially due to a less active campaign to raise awareness and to do the more invasive tests), a greater reduction as opposed to mammography tests was noticed and this is due to various factors:

1. Suspension of the regional screening program (first level test-gFOBT) for a longer period;
2. Longer suspension of second-level test because of fear of infection due to the invasive procedures
3. Greater fear of more invasive second-level tests that require a longer stay in the hospital (which means a longer possible exposure to the Covid-19 virus);
4. Worse organisation in the regional screening service: not all who didn't receive the invitation to perform the test have been called back.

Regarding BC surgery in the COVID-19 period we saw an increase in conservative surgery and decrease in mastectomies; a higher percentage of screening-detected BC is compliant with less invasive surgery and reflects the effectiveness of the screening program.

Lastly, being a Eusoma (European Society of Breast Cancer Specialists) certified center [23, 24], it is interesting to observe how quality indicators (data not showed) have not changed from 2019 to 2020, confirming the quality of Trieste's Breast Unit and its resilience to the COVID-19 pandemic [25].

In relation to the CRC surgery, there was a total reduction of 10.6% of activity if compared to the pre-Covid period. A significantly greater number of patients with CRC underwent urgent surgery in the COVID-19 period compared to the pre-COVID era (p value = 0.001).

As far as the second point is concerned, the second possibility to come to an early CRC diagnosis after screening tests is to give value, recognize and refer to mild symptoms such as constipation and asthenia. In a pandemic reality, General practitioners could not receive patients in a visit as frequently and securely as before and patients themselves preferred not to go to the hospital, being afraid of being infected. This led to an increase of more severely symptomatic patients, which also borderline statistically correlates to a higher volume of cancer mass and infiltration.

Even though only borderline significant, advanced stages grew from 40.9 to 50.9%, with a symmetrical decrease in early stages, from 59.1 to 49.1%.

Finally, in the Scuola Superiore Sant'Anna and AGE-NAS' study [17], a comparison between March 2019-June 2019 and March 2020-June 2020 as far as Colon cancer and Rectal cancer has been made and, in both cases, surgical volume was higher than the Italian average.

More severe presentations, more advanced CRCs, higher patients' fear and scepticism and greater difficulties given by Covid-19 protocols (swaps, appropriate dressings, Covid-positive dedicated operating theatres) all made ordinary procedures slower and more intricate.

Overall CRC patients have suffered disadvantages from the Covid pandemic in terms of late diagnosis and more severe presentation, along with more advanced tumours, but the application of protocols and a good surgical performance have avoided greater hardships.

A not controllable factor, by national or regional health care system, has been and is up to today the fear of the general population to access health structures for follow-up visits and screening tests [26].

A large, published UK national population-based modelling study, showed that fear related to contracting COVID-19 has caused patients to be more apprehensive to seek medical care for routine or emergent issues [27].

This is proved by lower screening tests performed even when the service had reopened and by a higher number of patients referring to the emergency department with more severe symptoms as the first diagnostic approach [26, 27].

This should be kept into consideration for the future to have backup plans to guarantee prevention tests, visits and procedures to take place and not be suspended if new emergencies were to come.

Conclusion

Maintaining standards of care and validated protocols in emergency situations has proven to be the best decision: immediate reconstruction after BC surgery, laparoscopic and robotic access preferred to open and GI anastomosis performance were kept as first-line choices when possible.

As clearly comes out from our data and underlined once again in Sant'Anna's study [17], our region has managed to confirm a well-organised screening program, effective diagnosis and good surgical practice in critical conditions. We demonstrated to have solid and well-designed BC and CRC diagnostic and treatment protocols which can be applied and prove effective, whatever the emergency conditions.

The system held.

Despite these results, of a virtuous Italian region, the consequences of the diagnostic delay and the closure of the operating theatres could be catastrophic in terms of mortality and morbidity.

More research is needed to assess if the decreased screening rate during the SARS-CoV-2 pandemic resulted in delayed or missed diagnosis, different clinical management, or poorer outcomes.

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Declarations

Conflict of interest There is no conflict of interest for all authors regarding the publication of this manuscript and no financial issues to disclose.

Ethics approval The manuscript reports an observational retrospective study, so, on the basis of the resolution of the Authority for the Protection of Personal Data (Gazzetta Ufficiale N° 72; <http://www.garanteprivacy.it/garante/doc.jsp?ID=1878276>). This study was conducted in accordance with the ethical standards of the Declaration of Helsinki. The institutional ethical board approved the study and the informed consent was obtained under the institutional review board policies of hospital administration.

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Consent to participate Not applicable.

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