Surgery 168 (2020) 209–211

Contents lists available at ScienceDirect

Surgery

journal homepage: www.elsevier.com/locate/surg

COVID-19 Pandemic

Surgical outcomes after systematic preoperative severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) screening

Gilles Tilmans, MD, Quentin Chenevas-Paule, MD, Xavier Muller, MD, Antoine Breton, MD, Kayvan Mohkam, MD, PhD, Christian Ducerf, MD, PhD, Jean-Yves Mabrut, MD, PhD, Mickaël Lesurtel, MD, PhD*

Department of Digestive Surgery and Liver Transplantation, Croix Rousse University Hospital, Hospices Civils de Lyon, University of Lyon I, Lyon, France

ARTICLE INFO

Article history:
Accepted 12 May 2020
Available online 18 May 2020

Introduction

International guidelines recommend limiting surgical care in the context of the ongoing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic but most of them are not evidence based.[1] Among those recommendations, preoperative SARS-CoV-2 screening is key to select optimal surgical candidates,[2] but its impact on surgical outcomes is unknown.

The aim of this study was to assess the impact of a systematic preoperative SARS-CoV-2 screening strategy including chest computed tomography (CT) and real-time reverse transcriptase polymerase chain reaction (RT-PCR) on short-term postoperative outcomes at a tertiary care center.

Methods

This is a retrospective analysis of all consecutive patients undergoing elective and emergency digestive surgery at Croix Rousse University Hospital, Lyon, France, during the early phase of the SARS-CoV-2 outbreak in France, beginning from the date of implementation of systematic SARS-CoV-2 screening strategy on March 24, 2020, until April 10, 2020.

Reorganization of surgical ward and preoperative coronavirus disease 2019 screening

Patients scheduled for elective surgery were reassessed during a multidisciplinary team meeting, and treatment decisions were made according to the individual surgical and nonsurgical risk factors. For instance, major interventions such as extended hepatectomy or esophagectomy in frail patients with long expected intensive care unit (ICU) stays were postponed if possible.

The surgical department was substantially reorganized to guarantee optimal control of patient inflow and outflow. Three separate surgical units were established: one unit for all elective surgery in SARS-CoV-2 negative patients, a second unit for SARS-CoV-2 positive patients, and a third unit specifically dedicated to the liver transplantation program. Each of these surgical units was strictly separated and attended by its own medical and paramedical staff.

A cornerstone of the reorganization strategy was the implementation of a systematic SARS-CoV-2 screening by three different tests: (1) a questionnaire on symptoms that may have occurred before hospitalization and a clinical examination on arrival at the hospital, (2) nasopharyngeal swabs with an RT-PCR, and (3) a chest CT 24 h before surgery. Surgery was only performed if all 3 tests were negative. Patients who were admitted through the emergency department were screened in the emergency room, using the same protocol. Patients with unknown SARS-CoV-2 status were admitted to the SARS-CoV-2 positive surgery unit and, if surgery could not be delayed, patients were operated on in a dedicated operating room.

No routine postoperative SARS-CoV-2 screening was performed, and testing was only guided by clinical symptoms. Follow-up calls after hospital discharge were performed by one of the study investigators to screen for coronavirus disease 2019 (COVID-19) occurrence after hospital discharge.

T.G. and C.P.Q. are first co-authors. J.Y.M and M.L. share senior authorship.

* Reprint requests: Mickaël Lesurtel, MD, PhD, Department of Digestive Surgery and Liver Transplantation, Croix Rousse University Hospital, Hospices Civils de Lyon, 103, grande rue de la Croix Rousse, 69004 Lyon, France.
E-mail address: mickael.lesurtel@chu-lyon.fr (M. Lesurtel).

https://doi.org/10.1016/j.surg.2020.05.006
0039-6060/

Table I
Preoperative patient characteristics

	Patients ($N = 31$)
Age (y)	64 (58–70)
Comorbidities	
BMI (kg/m^2)	26 (22–29)
Smoker (*n*, %)	19 (61)
Cardiovascular disease (*n*, %)	6 (19)
Hypertension (*n*, %)	22 (71)
Diabetes (*n*, %)	8 (26)
Chronic kidney disease (*n*, %)	1 (3)
COPD (*n*, %)	3 (9)
Severe asthma (*n*, %)	0 (0)
Cirrhosis (*n*, %)	5 (16)
Immunosuppressive treatment (*n*, %)	2 (7)
Chemotherapy (*n*, %)	5 (16)
ASA 1 (*n*, %)	6 (19)
ASA 2 (*n*, %)	14 (45)
ASA 3 (*n*, %)	11 (36)
Patient status	
Home (*n*, %)	18 (58)
Hospital ward (*n*, %)	5 (16)
ICU (*n*, %)	1 (3)
Emergency admission (*n*, %)	3 (10)
Transfer from another hospital (*n*, %)	4 (13)
Surgical setting	
Emergency (*n*, %)	8 (26)
Elective oncologic (*n*, %)	18 (58)
Elective nononcologic (*n*, %)	5 (16)
Preoperative screening	
Fever (*n*, %)	0 (0)
Cough (*n*, %)	1 (3)
Anosmia (*n*, %)	0(0)
RT-PCR and chest CT-scan (*n*, %)	30 (97)
RT-PCR only (*n*, %)	1 (3)

ASA, American Society of Anesthesiologists scoring of operative risk.

Study end points and definitions

The primary study end point was major postoperative complications assessed by the Clavien-Dindo classification. Secondary outcomes included preoperative SARS-CoV-2 screening results, hospital stay, COVID-19 occurrence after hospital stay, and assessment of reduction in operative room capacity. RT-PCR testing was performed on nasopharyngeal swabs. Chest CTs were interpreted according to the guidelines of the European Society of Radiology and the European Society of Thoracic Imaging.

Results

A total of 31 patients were admitted predominantly from home (59%) for elective and emergency surgery during the study period, with a median age of 64 y (range, 58–70 y). Except for a history of smoking, patients' respiratory comorbidities were rare; whereas 19% of patients had a history of cardiovascular disease. Detailed characteristics are presented in Table I.

Preoperative SARS-CoV-2 screening

One patient with mild cough presented signs of COVID-19 pneumonia at chest CT, and diagnosis of SARS-CoV-2 was confirmed on RT-PCR. The patient had already received a biliary drainage and the initially planned pancreaticoduodenectomy could thus be safely delayed. A second patient presented to the emergency room for a perianal abscess and underwent nasopharyngeal swab. He then refused to stay at the hospital and was discharged without chest CT. With a negative RT-PCR, he was operated on the next day in the same-day surgery setting with.

Perioperative and postoperative outcomes

The main surgical indication in our cohort was oncologic (58%) (Table II). Only 4 patients required ICU surveillance after surgery as preoperatively planned. Overall median hospital stay was 6 days (range, 3–14 days). During hospital stay, 3 (10%) patients developed a severe complication (Clavien-Dindo >II). In detail, 1 patient developed a retrogastric abscess on postoperative day 7, which was drained radiologically (Clavien-Dindo IIIa). Two other patients developed multiorgan failure with the need of ICU treatment because of hemorrhage and septic shock (Clavien-Dindo IVb). No patient showed COVID-19 symptoms or tested positive for SARS-CoV-2 after hospital discharge (median follow-up 15 days [range, 9–22 days]).

Discussion

We report outcomes in 31 patients admitted to our surgical department of a tertiary care center during the early phase of the SARS-CoV-2 outbreak in France, showing feasibility and safety of surgical interventions in the setting of systematic preoperative screening for SARS-CoV-2.

By following a strict screening protocol based on clinical assessment, chest CT and RT-PCR, 1 SARS-CoV-2 positive patient could be identified, and surgery was postponed. The other 30 patients underwent successful surgery and no occurrence of COVID-19 nor COVID-19-related morbidity were noted. The screening and organizational strategy outlined in this study was applicable to both emergency and elective oncologic surgery.

The number of hospitalizations attributable to SARS-CoV-2 in France increased three-fold during March 2020, putting hospitals under great pressure. Given that Croix Rousse University Hospital is the referral hospital in a region with one of the highest numbers of hospitalized SARS-CoV-2 positive patients in France, rapid measures to reorganize surgical care had to be taken. The cornerstone of this strategy consisted of a systematic screening for SARS-CoV-2 before surgery.

The incubation period of the SARS-CoV-2 is 5 days (range, 4.5–5.8 days) and the majority of infected patients only develop symptoms within 11.5 days (CI, 8.2–15.6 days).[3] In this context, preoperative identification of SARS-CoV-2 positive patients by symptoms only seems insufficient to prevent contamination of hospital staff and reduce individual patient risk. Although there are no clear recommendations on preoperative screening, we implemented a broad and systematic preoperative screening, based on a combination of patient history, chest CT, and RT-PCR.

Several studies support the importance of chest CT to identify SARS CoV-2 infected patients in addition to RT-PCR.[4,5] A recent study showed that, in 601 patients with a positive RT-PCR, the sensitivity of chest CT was 97%.[4] In addition, 93% of patients with initially negative RT-PCR already showed signs of COVID-19 pneumonia on chest CT and were later confirmed SARS CoV-2 on RT-PCR.[4] In a retrospective study analyzing 120 cases with confirmed COVID-19, we identified 16 asymptomatic patients with signs of SARS CoV-2 pneumonia on chest CT and were later confirmed SARS CoV-2 positive on RT-PCR.[5] Of note, by applying this strategy, we were able to diagnose 1 SARS-CoV-2 positive patient and consequently safely postpone surgical intervention.

This retrospective analysis has inherent limitations. First, the sample size is small, and more data are required to confirm our results. Second, no routine postoperative screening by RT-PCR or chest CT was performed. However, no patient reported symptoms or adverse outcomes during the median follow-up of 15 days (range, 9–22 days), which is longer than the expected incubation period of SARS-CoV-2. Implementing routine postoperative RT-PCR

Table II
Operative details of 30 patients undergoing surgery after SARS-CoV-2 screening

Age (y)	Indication	Intervention	Surgical approach	Operation duration (min)	Intensive care unit stay
47	Acute cholecystitis	Cholecystectomy	Laparoscopy	120	No
90	Acute cholecystitis	Cholecystectomy	Laparoscopy	87	No
62	Acute cholecystitis	Cholecystectomy	Laparoscopy	100	No
46	Acute cholecystitis	Cholecystectomy	Laparoscopy	100	No
36	Anal abscess	Drainage	-	10	No
91	Biliary peritonitis	Laparoscopic drainage	Laparoscopy	85	No
68	Cholangiocarcinoma	Bisegmentectomy	Laparotomy	246	Yes
62	Cholangiocarcinoma	Exploration, no resection	Conversion to Laparotomy	235	No
63	Cholangiocarcinoma	Nonanatomic liver resection	Laparotomy	350	No
64	Colorectal adenocarcinoma	Right colectomy	Laparotomy	215	No
55	Colorectal adenocarcinoma	Left colectomy	Laparoscopy	185	No
61	Colorectal adenocarcinoma	Transverse colectomy	Laparoscopy	180	No
66	Colorectal adenocarcinoma	Colostomy	Laparotomy	74	No
66	Colorectal adenocarcinoma	Left colectomy	Conversion to laparotomy	375	No
67	Colorectal adenocarcinoma	Left colectomy	Conversion to laparotomy	333	Yes
57	Colorectal adenocarcinoma	Total coloproctectomy	Laparotomy	580	No
72	Ovarian carcinomatosis	Colostomy	Laparoscopy	70	Yes
63	Congenital bile dilatation (Todani IV)	Main bile duct resection	Laparotomy	355	No
53	Colorectal liver metastases	Laparoscopy and focal destruction	Laparoscopy	105	No
72	Gallbladder tumor	Bisegmentectomy	Conversion to Laparotomy	299	No
59	Gallbladder tumor	Cholecystectomy	Laparotomy	170	No
69	Gastric adenocarcinoma	Gastrectomy	Laparotomy	245	No
71	Hepatocellular carcinoma	Bisegmentectomy	Laparotomy	265	No
58	Hepatocellular carcinoma	Cholecystectomy-focal ablation	Laparoscopy	176	No
61	Umbilical hernia	Umbilical hernia repair	Laparotomy	112	No
84	Inguinal hernia	Inguinal hernia repair	Laparotomy	108	No
37	Liver adenoma	Segmentectomy	Laparoscopy	277	Yes
69	Liver adenoma	Segmentectomy	Laparoscopy	200	No
73	Common bile duct stone	Cholecystectomy	Laparoscopy	124	No
70	Common bile duct stone	Cholecystectomy	Laparoscopy	265	No

and chest CT may additionally help to formally exclude postoperative infection with SARS-CoV-2.

In conclusion, our preliminary data show feasibility and efficacy of systematic preoperative screening for SARS-CoV-2 by chest CT and RT-PCR on nasopharyngeal swabs. This screening strategy allowed the safe performance of the majority of scheduled oncologic interventions.

Funding/Support

The authors report no sources of funding for this work.

Conflict of interest/Disclosure

The authors declare no conflicts of interest.

References

1. American College of Surgeons, American Society of Anesthesiologists, and Association of periOperative Registered Nurses. Create a surgical review committee for COVID-19-related surgical triage decision making. American College of Surgeons Web site. https://www.facs.org/covid-19/clinical-guidance/review-committee. Accessed April 16, 2020.
2. Lei S, Jiang F, Su W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection [e-pub ahead of print]. EClinicalMedicine. https://doi.org/10.1016/j.eclinm.2020.100331. Accessed April 30, 2020.
3. Lauer SA, Grantz KH, Bi Q, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Ann Intern Med*. 2020;172:577–582.
4. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases [e-pub ahead of print]. Radiology. https://doi.org/10.1148/radiol.2020200642. Accessed April 30, 2020.
5. Zhang R, Ouyang H, Fu L, et al. CT features of SARS-CoV-2 pneumonia according to clinical presentation: a retrospective analysis of 120 consecutive patients from Wuhan city. *Eur Radiol*. 2020:1-10.