

Case Series

Postoperative Evolution of Asymptomatic Covid-19 Patients Not Recognized Preoperatively: A Case Report of 12 Patients

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Introduction

As part of the management of the health problems caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and to better manage patients with coronavirus disease 2019 (COVID-19), the majority of elective surgeries were postponed to restrict access to the operating theatre and a specific COVID-19 care pathway was generated, divided into medical wards

and the emergency ward for possible emergency surgery; This has consequently affected surgical activity worldwide and led to blockages in the management of other health problems. Nevertheless, as the epidemiological curve flattened, surgeons and anesthetists began to gradually resume scheduled surgeries on a case-by-case basis for non-COVID-19 related conditions in or

Abstract

Background: In order to ensure better management of patients with coronavirus disease 2019 and to reduce disease transmission, all scheduled surgeries were postponed. However, with the flattening of the epidemiological curve, surgical activity was gradually resumed which was responsible for increasing the rate of postoperative complications and mortality for undiagnosed asymptomatic patients operated on during the incubation period. The aim of our study was to evaluate the postoperative evolution of asymptomatic undiagnosed patients who developed COVID-19 after scheduled surgery.

Materials and Methods: This is a retrospective monocentric observational study of 12 initially asymptomatic patients who were operated on during their COVID-19 incubation period in the operating theatres of Mohamed V military training hospital of rabat during the period from April 1 to September 30, 2020.

Results: 4638 patients were operated on. Only 12 patients developed COVID-19 infection after confirmation by a reverse transcriptase Polymerase Chain Reaction test postoperatively. The most common symptom was fever (91.6%). The postoperative course was marked by the development of several complications such as secondary superinfection (66.6%), acute respiratory distress syndrome (58.3%), and shock (50%). Seven of the 12 (58.3%) patients were admitted to intensive care and 5/12 (41.6%) required invasive ventilation and subsequently died. Acute respiratory distress syndrome was the main complication in all patients who died.

Conclusion: Many challenges are encountered when performing surgical activity during the pandemic period. Nevertheless, knowledge of the patient's COVID-19 status prior to any surgical procedure should be considered in order to reduce and control the risk of postoperative morbidity and mortality.

Keywords: COVID-19; Asymptomatic; Postoperative; Surgery

Abbreviations: COVID-19: Coronavirus Disease 2019; MVMTH: Mohamed V Military Training Hospital; RT-PCR: Reverse Transcriptase Polymerase Chain Reaction; ARDS: Acute Respiratory Distress Syndrome; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; ICU: Intensive Care Unit; VHA: Veterans Health Administration

der not to further delay surgery, especially carcinological surgeries, which posed new challenges for patients on the one hand and health care staff on the other and resulted in unexpected postoperative complications. Patients with COVID-19 may be asymptomatic carriers or they may develop symptoms ranging from mild to respiratory failure and multivisceral failure. [1,2]

Asymptomatic carriers account for 17.9-33.3% of those infected with SARS-CoV-2 [3] and have a longer and variable incubation period between individuals of up to 19 days, resulting in more rapid and uncontrollable transmission of the virus [1,4] and more difficult identification of the disease.

Few reports have been published on the post-operative outcome of patients diagnosed as COVID-19 positive and even fewer on the post-operative outcome of patients with asymptomatic, pre-operatively undiagnosed virus. The impact of unintentionally scheduled surgery during the incubation phase of asymptomatic preoperative patients on the postoperative course has not been sufficiently studied, but these existing data should not be overlooked as a means of reducing morbidity and mortality. Indeed, surgery leads to an immediate alteration of the cell-mediated immunity which represents the main mechanism of the fight against viral infections, which explains the unfavourable evolution of the patients in question [5].

However, recent data suggest an increase in perioperative respiratory complications and a perioperative mortality rate of 19% in people with concurrent COVID-19 infection undergoing scheduled or urgent surgery [6].

Objectives

To assess the postoperative course of asymptomatic patients who underwent scheduled surgeries and were ultimately found to be infected with COVID-19 but not diagnosed preoperatively. To highlight through a review of the literature the question of whether all asymptomatic surgical candidates of COVID-19 status should be tested preoperatively and the new surgical recommendations.

Materials and Methods

We conducted a retrospective monocentric observational study of patients scheduled for surgery or who underwent urgent surgery in the operating rooms of the Mohamed V Military Training Hospital (MVMTH) of Rabat between April 1 and September 30, 2020. The start date of the study corresponds to the date of resumption of surgical activity in most hospitals after the suspension of this activity due to the COVID-19 pandemic. Since the resumption of surgical activity and following the hospital protocols and recommendations of the Ministry of Health and learned societies Moroccan Society of Anesthesia, Analgesia and Resuscitation and Moroccan Society of Emergency Medicine in Morocco, in particular, did not include mandatory screening for COVID-19 in asymptomatic patients considered to be at low risk when screening before scheduled surgery. We retrospectively analyzed the clinical data of 12 asymptomatic patients who developed symptoms after surgery and were diagnosed as COVID-19 positive after laboratory confirmation of SARS-CoV-2 by RT-PCR testing of nasopharyngeal specimens; these patients had undergone scheduled and urgent surgeries during the incubation period of COVID-19.

Study Site: The Operating Theatre Department of MVMTH Rabat - Services and Intensive Care Unit (ICU) COVID-19.

We retrospectively analysed the clinical data of patients who

underwent elective surgery during the incubation period of COVID-19 MVMTH in Rabat during the study period. We examined epidemiological, clinical, biological, and radiological characteristics as well as treatment and outcome data. The information included demographics, contact with a suspected or confirmed COVID-19 subject that was discovered postoperatively, comorbidities, type of surgery, surgical time, signs and symptoms, time of surgery until first symptoms of COVID-19 onset, admission to intensive care and resuscitation if any, treatments and complications. All missing or uncertain records were eliminated.

Definitions: The time of onset of COVID-19 was defined as the date when the first sign or symptom was detected. Acute Respiratory Distress Syndrome (ARDS) was defined according to the Berlin definition [13]. Patients were admitted and transferred to the ICU based on the progression of organ failure or the need for mechanical ventilation.

Overall Results

Number of patients operated on

During the study period, we recorded 4638 patients operated on. These were scheduled and emergency surgeries performed in the four operating theatres of the Mohammed V Military Training Hospital in Rabat (Table 1).

Type of surgery: (Table 2).

Postoperative Covid-19 Patients

Prevalence

12 out of 4638 initially asymptomatic patients developed symptoms and were confirmed to have COVID-19 postoperatively, a prevalence of 0.25%.

Features

The age range of the patients was 28-74 years with a mean age of 58 years.

8 patients (66.6%) were male and 4 (33.3%) were female.

7 patients (58.3%) were admitted to intensive care due to progression of organ failure or the need for mechanical ventilation.

8 patients (66.6%) had 1 or more comorbidities such as hypertension (3 [25%]), malignancy (6 [50%]) and diabetes (8 [66.6%]) (Table 3).

Table 1: Total number of patients operated on during the study period.

Year	Total Number of Patients
2020	4638

Table 2: Type and percentage of surgeries performed.

Surgery	Urgent	Programmed
Total	653	3985
Percentage	14 %	86 %

Table 3: Characteristics of surgical patients with SARS-CoV-2 infection.

	Total (n=12)	Resuscitation (n=7)	No Resuscitation (n=5)
Average age	58	64	50
Women	4(33,3 %)	1(14,2%)	3(60%)
Men	8(66,6%)	6(85,7%)	2(40%)
Comorbidities	8(66,6%)	6(85,7%)	2(40%)
Hypertension	3(25%)	2(28,5%)	1(20%)
Malignancy	6(50%)	6(85,7%)	-
Diabetes	8(66,6%)	6(85,7%)	2(40%)

Compared with patients who were not admitted to the ICU, patients who required admission to the ICU were older (mean age 64 years vs. 50 years) and were more likely to have associated comorbidities (6 [85.7%] vs. 2 [40%]), especially neoplastic disease (6 [85.7%]) and diabetes (6 [85.7%] vs. 2 [40%]) (Table 3).

In our study, most patients underwent scheduled surgery (8 [66.6%]) while 4 patients ([33.3%]) underwent emergency surgery. It should also be noted that 3 of the 4 patients who underwent emergency surgery were admitted to the intensive care unit following the development of COVID-19-related severity signs (Table 4).

The most common symptoms since the onset of COVID-19 disease were fever (11 patients [91.6%]), fatigue (9 [75%]), dry cough (6 [50%]), dyspnoea (7 [58.3%]) and pharyngalgia (7

Table 4: Type and nature of surgery for patients operated on during unrecognised SARS-CoV-2 infection.

Type of surgery	Age (years)	Gender	Nature of the surgery
Gastric adenocarcinoma	76	Male	Scheduled
Laminectomy for herniated disc	52	Male	Scheduled
Caesarean section	28	Woman	Emergency
Debridement for necrotizing fasciitis	52	Male	Scheduled
Radical prostatectomy	74	Male	Scheduled
Appendectomy	38	Woman	Emergency
Sigmoidal occlusion	77	Male	Emergency
Left hemi colectomy	68	Male	Scheduled
Thyroidectomy	52	Woman	Scheduled
Cervical cancer	62	Woman	Scheduled
Biliary endoprosthesis	72	Male	Scheduled
Centromedullary nailing of the femur fracture	48	Male	Emergency

Table 5: Postoperative symptoms consistent with SARS-CoV-2 infection.

	Total (N=12)	Admitted to ICU (n=7)	Not admitted to the ICU (n =5)
Fever	11(91,6%)	7(100%)	4(80%)
Fatigue	9(75%)	6(85,7%)	3(60%)
Dry cough	6(50%)	4(57,1%)	2(40%)
Dyspnea	7(58,3%)	6(85,7%)	1(20%)
Myalgias or arthralgias	4(33,3%)	3(42,8%)	1(20%)
Headaches	3(25%)	2(28,5%)	1(20%)
Nausea and vomiting	5(41.6%)	3(42.8%)	2(40%)
Diarrhoea	2(16.6%)	1(14,2%)	1(20%)
Abdominal pain	1(8,3%)	1(14,2%)	0

Table 6: Post-operative complications in patients with COVID-19.

	Total (N=12)	Resuscitation (n=7)	No Resuscitation (n=5)
Complications			
ARDS	7(58,3%)	7(100%)	0
State of shock	6(50%)	6(85,7%)	0
Superinfection	8(66,6%)	6(85,7%)	2(40%)
Rhythm disorders	3(25%)	3(42.8%)	0
Renal failure	4(33,3%)	4(57,1%)	0

[58.3%]). The least common symptoms were nausea and vomiting ([41.6%]), headache (5[25%]), diarrhoea ([16.6%]) and abdominal pain ([8.3%]). Table 5

All patients had developed SARS-CoV-2 infection postoperatively. The most common complications in the 12 patients included ARDS (7 [58.3%]), shock (6 [50%]), superinfection (8 [66.6%]), rhythm disturbance (3 [25%]) and renal failure (4 [33.3%]). Patients admitted to the ICU were more likely to experience these complications than patients not admitted to the ICU (Table 6).

Indeed, in the ICU, only 2 patients (28.5%) received high-flow oxygen or non-invasive ventilation while the other 5 patients (71.4%) required invasive mechanical ventilation. It was these 5 patients who died.

All patients who were admitted to the ICU and received invasive ventilation (5 [71.4%]) had the notion of COVID-19 contact which was discovered postoperatively. Four of these five patients had one or more risk factors, mainly malignancy, and diabetes, and fever was the most common presenting sign of the disease, which appeared between D1 and D5 postoperatively.

The diagnosis of COVID-19 was confirmed by an RT-PCR test after the onset of symptomatology. The clinical course of these patients.

was marked by the development of respiratory failure, ARDS and shock. Rhythm disturbances, secondary superinfection and renal failure were among the most frequent complications with poor prognosis. The time to death was between 6 and 11 days postoperatively (Table 7).

Table 7: Clinical characteristics of the 5 patients with COVID-19 who died postoperatively.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age	28	76	72	52	77
Gender	Female	Male	Male	Male	Male
Notion of COVID contact	Yes	Yes	Yes	Yes	Yes
Comorbidities					
Malignancy	No	Yes	Yes	Yes	Yes
Hypertension	No	Yes	No	No	No
Diabetes	No	Yes	Yes	Yes	Yes
Surgery	Caesarean section	Gastrectomy	Biliary endoprosthesis	Necrotizing Fasciitis	Occlusion
1st sign	Fever	Fever	Cough	Fever	Fever
Onset time	J1	J5	J3	J1	J3
Confirmation by RT-PCR	J3	J8	J5	J4	J6
Respiratory failure	Yes	Yes	Yes	Yes	Yes
ARDS	Yes	Yes	Yes	Yes	Yes
Shock	Yes	Yes	Yes	Yes	Yes
Rhythm disorders	No	Yes	Yes	No	No
Superinfection	Yes	Yes	Yes	Yes	No
Renal failure	No	Yes	Yes	Yes	Yes
Time to death postoperatively	J6	J11	J10	J8	J7

Table 8: Comparative table of prevalence of SARS-COV-2 infection in asymptomatic COVID-19 patients preoperatively.

AUTHORS	Country	Period of the study	Patients operated on	Covid patients19	Prevalence
Singer J [9]	USA	7 April - 21 May 2020	4751	6	0,13%
Hendrickson NR [11]	USA	7 April - 21 May 2020	1997	26	0, 35%
GutmanMJ [10]	USA	27 April - 12 June 2020	1276	7	0,5%
Our series	Morocco	1 April - 30 September 2020	4638	12	0,25%

Table 9: Time to postoperative death in patients with COVID-19.

AUTHORS	Country	Number of Patients	Deadline
Lei [12]	China	34	8.7 days
Huang* [16]	China	41	10,5
Our series	Morocco	12	8.5 days

Discussion

All non-emergency medical and surgical activities have been suspended by the health authorities since the arrival of the first confirmed COVID-19 case in Morocco in March 2020 in order to reorganize medical and surgical services and operating theatres and to orient all health personnel to the care of COVID-19 patients hospitalized in these circuits. A study has been done assessing the impact of the COVID-19 pandemic on surgical activity at the Mohamed V Military Training Hospital (HMIM-V) in Rabat in 2020 [7], showing a 60.5% decrease in surgical activity during the second quarter (April-May-June) compared to 2019 due to total containment and postponement of all elective surgeries. In addition, a decrease in urgent surgical activity of 22% compared to 2019 was recorded which can be explained by the total confinement that was put in place since the beginning of the pandemic and the fear of patients to consult the emergency room, which was responsible for several complications. After the first wave and as soon as the epidemiological curve began to flatten, the HMIMV began to resume elective surgical activity gradually and cautiously, but with a decrease of 20% compared to 2019 during the 3rd and 4th quarters. In fact, carcinological surgical activity regressed by 40% during the 3 months of March-April and May 2020 compared to 2018 and 2019, On the other hand, non-cancer surgical activity fell by 70% during the same period [8]. This is explained by the non-availability of ICU beds for heavy surgery requiring post-operative care in the intensive care unit and the lack of staff and resources, which is the cause of a deterioration in the health of patients, especially cancer patients. Thus, carcinological pathology was the main concern during this period of health crisis.

12 out of 4638 initially asymptomatic patients developed SARS-CoV-2 infection postoperatively, a prevalence of 0.25%. All 12 patients in our study had contact with a COVID-19 infected person prior to admission to hospital (which we learned afterwards) and none of them had any signs or symptoms of COVID-19 prior to surgery or at the pre-anesthetic consultation. In the literature, this prevalence is around 0.13% according to an American study by Singer JS [9], to 0.5% according to another American study by Gutman MJ [10]. Table 8

It should be noted that none of our patients had any symptomatology related to COVID-19 before their admission and surgical planning.

Our review of the literature found only one study [12] that described the clinical characteristics and postoperative course of patients with asymptomatic COVID-19 in the incubation phase. All patients in this series had direct contact with a subject with COVID-19 prior to hospital admission, and none had any signs or symptoms of COVID-19 prior to surgery.

The average age of the patients included in our study was 58

years. We found that this age was higher (64 years) in patients admitted to the ICU than in less severe cases not admitted to the ICU (50 years).

In his series, Lei [12] found a mean age of 55 years for all patients as well as for patients who were admitted to the ICU (55 years), whereas it was only 47 years for less severe patients not admitted to the ICU [12]. Advanced age is a risk factor for ICU admission [9,13,14,12,15].

In our study, 66.6% of patients (8/12) had at least one comorbidity, 6 of whom (85.7%) were admitted to the ICU. Among the main comorbidities found were neoplasia and diabetes in 85.7% of patients admitted to the ICU. This is also in contrast to the study by Lei [12], where patients who were admitted to the ICU had more comorbidities (80%) than those not admitted to the ICU (42.1%).

It is noteworthy that COVID-19 symptoms developed rapidly after surgery, and SARS-CoV-2 infection was confirmed in the laboratory (by RT-PCR) shortly thereafter. Indeed, our patients developed symptoms in favour of COVID-19 very shortly (24 hours-5 days) postoperatively as in the results of Lei [12] who found a mean time from surgery to the onset of the first symptoms of 2.6 days. Our review of the literature finds that surgery caused COVID-19 symptoms to progress rapidly and worsen. In his study, Lei [12] found that dyspnoea appeared after 3.5 days from the first symptom. This time is shorter in non-operated patients as reported in Huang's study in China which was 8 days [16] and is also shorter than the 5 days reported in Wang's study [17].

The COVIDSurg Collaborative [18] reported in an international cohort study that 23.8% of patients who develop SARS-CoV-2 infection die within 30 days of surgery; 51.2% develop a pulmonary complication of which 38% eventually die. These mortality rates are mostly in males, patients aged 70 years or older, and patients with comorbidities with an ASA score between 3 and 5. Heavy, malignant and urgent surgery increases the risk of mortality in these patients.

During emergency or scheduled surgery asymptomatic patients are capable of developing major postoperative complications related to COVID-19 such as ARDS, septic shock, cardiac rhythm disturbances and acute cardiac injury up to and including cardiac arrest [19]. Similarly, 3 studies have reported the perioperative prognosis of asymptomatic carriers of SARS-CoV-2 who were not initially diagnosed and who underwent surgery during the incubation period. ARDS, shock and superinfection were the main postoperative complications in our study, which is in agreement with the series by Lei [12].

Lei in this retrospective cohort study in China is to our knowledge the largest series of asymptomatic patients operated on (34 patients). Of these patients, 15 (44.1%) required postoperative ICU hospitalisation due to the development of SARS-CoV-2-related symptoms, and these patients had several risk factors such as advanced age, a combination of several comorbidities and a more invasive and lengthy surgical procedure, of which 7 (20.6%) died. Four cases of preoperatively asymptomatic

matic patients have been reported in Iran [20], who developed various complications postoperatively related to COVID-19 involvement. Three of these four patients underwent abdominal surgery (hernia repair, laparoscopic cholecystectomy and cholecystectomy with hysterectomy) and developed fever with respiratory and gastrointestinal symptoms at D18, D14 and D2 postoperatively, respectively, in relation to SARS-CoV-2 infection documented by RT-PCR and chest CT. The evolution was marked by the occurrence of ARDS and death of 2 of these 3 patients at D20 and D24 postoperatively respectively and clinical improvement of the 3rd patient. The 4th patient, not known to have symptoms suggestive of COVID-19, was a candidate for gastric bypass surgery but presented one day before surgery with severe acute respiratory distress which rapidly progressed to cardiorespiratory arrest and death. In Greece, a 70 year old female patient underwent knee replacement surgery, the course of which was marked by the onset of cough with fever in the immediate postoperative period complicated by COVID-19 disease and which improved after a few days [21]. These results were surprising leaving surgeons wondering when these patients contracted the virus: before hospitalisation, during the perioperative period or postoperatively after discharge [22].

Of the 12 patients operated on in our study, 7 (58.3%) were admitted to the ICU, of which 5 (71.4%) required invasive ventilation and the other 2 (28.5%) required non-invasive ventilation. Similarly, in the Chinese series by Lei et al [12] where 44.1% (15/34) were admitted to the ICU, 7 patients (46.7%) received non-invasive ventilation while invasive ventilation was required for 5 patients (33.3%). The majority of published series [9,12,13,14,15] agree that patients admitted to the ICU for severe disease tend to be older and have more comorbidities, suggesting that the combination of age, comorbidities and especially malignancy is a risk factor for ICU admission.

Five of the 12 patients (41.6%) who underwent surgery in our series died postoperatively due to COVID-19-related complications. This mortality rate is much higher than that revealed in the study by Lei [12] which is 20.6% and especially much higher than that reported by Wu Z [15] which is 2.3% in patients with COVID-19 but not operated, and also higher than the case fatality rate of 7.9% described in an Indian study by Kumar [23] in operated patients without cardiac history and without COVID-19 involvement and who were hospitalised in the intensive care unit.

We found a time to death between 6 and 11 days with an average of 8.5 days. This average time is almost equal to that found by Lei [12] which is 8.7 days. In the report by Huang and colleagues [16], they found an estimated average of 10.5 days. In other words, surgery performed during the incubation period of SARS-CoV-2 infection likely precipitated the progression to aggravation and death (Table 9).

The latest published reports highlight a worrying finding that, apart from pre-operative screening for COVID-19, there is still a risk of disease within 30 days of surgery. This risk is increased for patients with high comorbidity (including heart failure, neoplasia, cirrhosis, chronic obstructive pulmonary disease, and end-stage renal disease) as well as for patients who have undergone neurosurgical procedures. Therefore, more rigorous pre-operative screening and closer postoperative follow-up are warranted in these patients as they are at significantly higher risk of postoperative morbidity and mortality. In a large multicentre US study that included all patients scheduled for surgery in 170 Veterans Health Administration (VHA) hospitals

[24], patients were divided into different groups according to RT-PCR positivity within 30 days of scheduled surgery (COVID[-before/+after]), before surgery (COVID[+before/after]) or negative before and after surgery (COVID[-before/after]). Indeed, the cumulative incidence of having a positive RT-PCR test after scheduled surgery was very low (0.5%) when COVID-19 status was already identified preoperatively, but it can be as high as 3.2% in the absence of screening, and this explains why patients assumed to be negative and asymptomatic preoperatively were in the incubation period of SARS-CoV-2. Thus, patients with risk factors for having COVID-19 postoperatively have a higher rate of major complications such as revision surgery, readmission to the ICU and death, pulmonary complications (pneumonia, ARDS or prolonged mechanical ventilation), myocardial infarction, stroke, septic shock, deep vein thrombosis and pulmonary embolism and consequently a longer hospital stay compared to other patients who tested negative for COVID-19 [24]. According to Bhangu et al. In their international cohort study, a positive COVID-19 test 7 days before and 30 days after surgery resulted in a 32% risk of pulmonary complications and a 38% risk of mortality [25].

Since the beginning of the health crisis, scheduled surgeries have been postponed due to the large number of healthy carriers during the epidemic and the rapid progression of the virus with the unavailability of hospital resources. Some semi-urgent surgeries have been maintained such as oncological interventions, depending on the patient's state of health and the stage of the disease. Hence, new recommendations have been established to clarify the management of patients in case of postponement of elective surgery during the pandemic period.

Oncological surgery is the cornerstone of cancer therapy, playing a very important role in determining the patient's survival prognosis by allowing the definitive resection of the tumour, limiting the evolution of certain tumours, delaying metastases or preventing them and thus improving the patient's quality of life. Therefore, with the current pandemic, it has been necessary to postpone certain carcinological surgical procedures and to propose other therapeutic alternatives depending on the available hospital resources and the patient's state of health and to avoid the risk of contracting SARS-CoV-2 intraoperatively.

- Liang et al. reported that cancer patients are more likely to be infected with SARS-CoV-2 and to develop severe forms, especially Acute Respiratory Distress Syndrome (ARDS), than other patients (13 days vs. 43 days) because of their immunosuppression, which is enhanced by cancer treatment. Indeed, 39% of cancer patients developed severe forms of COVID-19 requiring hospitalization in an intensive care unit compared to 8% of non-cancer patients. Furthermore, and after confirmation by logistic regression, 75% of patients who had undergone surgery or chemotherapy one month prior to SARS-CoV-2 infection had a higher risk of developing severe forms than those who had not undergone chemotherapy or recent surgery (43%) [26]. Thus the decision to delay or cancel elective oncological surgery during this health crisis is very difficult and should not be taken lightly, requiring a multidisciplinary approach in a PCR weighing the risks and benefits of performing the surgery against postponing it and the postoperative morbidity and mortality that may be caused by COVID. Including 71 countries in a Bayesian regression model, it was estimated that 23.4% to 77.1% of oncological surgeries were postponed during the 12-week containment period [27]. In addition to the postponement of surgery, most management protocols were changed, which se-

verely impacted some types of oncology surgery. It has been recommended [28,2] Postpone elective surgery for stable cancer while ensuring patient safety through monitoring.

- Consider neoadjuvant chemotherapy if surgical treatment is delayed.
- Do not postpone and perform emergency surgery for complicated, life-threatening cancers with the use of telemedicine for post-operative follow-up.
- Replace scheduled consultations with telephone consultations to limit travel and hospital visits during the epidemic crisis.
- Reinforce individual protection measures (wearing and changing masks regularly, applying hydroalcoholic gel, etc.) and strictly respect physical distancing and containment measures for cancer patients and their families.
- Consider strict surveillance or more intensive treatment in case of SARS-COV-2 infection and especially for patients who are older or have other comorbidities in addition to cancer. In addition, a study of 3,672,561 patients worldwide reported that delaying oncological surgery increased the risk of mortality in early stage cancer by 1.2 to 3.2% per week of delay [31].

Another UK study estimated that there could be at least 6270 new deaths (a 20% increase) of newly diagnosed cancer patients in the UK over the next year due to the COVID-19 pandemic and its significant impact on patient outcomes [28]. Thus, carcinological surgery has been severely impacted by the COVID-19 pandemic and this has created several challenges for surgeons.

Conclusion

COVID-19 disease may have other serious negative impacts on the postoperative course and may result in unexpected mortality. The literature review found only a few small sample series of patients that did not allow a definite finding. Nevertheless, preoperative screening of candidates for planned surgery on the basis of symptoms alone is not sufficient because of the high rate of positive COVID-19 tests in asymptomatic patients. Therefore, further research is needed to elucidate a better method for preoperative screening of asymptomatic patients as well as for monitoring the postoperative course and complications.

Depending on the severity of an outbreak and the availability of resources, the risk and benefit of performing scheduled surgery must be carefully assessed in this context. Further in-depth research with larger sample sizes needs to be conducted investigating risk factors for poor prognosis including age, comorbidities, and surgical complexity in postoperative COVID-19 patients.

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