

## Assessment of complications and surgical timing in post-COVID-19 thoracotomy patients: A single-center experience

COVID-19 sonrası torakotomi hastalarında cerrahi zamanlamanın ve ameliyat sonrası komplikasyonların değerlendirilmesi: Tek merkez deneyimi

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### ABSTRACT

**Background:** This study aims to assess the complications in post-novel coronavirus disease 2019 (COVID-19) thoracotomy patients and to evaluate the time interval between infection and surgery and the effect of vaccine timing and vaccine type in these patients.

**Methods:** Between May 2020 and January 2022, a total of 74 patients (34 males, 40 females; mean age: 54.5±13.7 years; range, 22 to 27 years) who had COVID-19 infection and underwent thoracic surgery were retrospectively analyzed. Data including demographic and clinical characteristics, the surgery type, length of intensive care unit and hospital stay, and postoperative complications were recorded. Complications were defined as respiratory, cardiac, thrombotic, and other complications. The time period between COVID-19 infection and surgery was noted. All patients were questioned regarding their vaccination status.

**Results:** Having a symptomatic COVID-19 infection did not significantly affect the development of postoperative complications and length of intensive care unit or hospital stay. Thoracic involvement was the main factor which affected the length of intensive care unit and hospital stay during COVID-19 infection (p=0.004 and p=0.003, respectively).

**Conclusion:** Our study results suggest that the length of hospital and intensive care unit stay is related to the time period between infection and surgery. The longer that the patient waits after COVID-19 infection, the less time that the patient stays in the hospital.

**Keywords:** COVID-19 infection, postoperative complication, thoracotomy.

### ÖZ

**Amaç:** Bu çalışmada torakotomi hastalarında yeni koronavirüs hastalığı 2019 (COVID-19) sonrası komplikasyonlar değerlendirildi ve bu hastalarda enfeksiyon ve cerrahi arasında geçen zaman ve aşı zamanlaması ve aşı türlerinin etkisi incelendi.

**Çalışma planı:** Mayıs 2020 ve Ocak 2022 arasında COVID-19 enfeksiyonu geçiren ve göğüs cerrahisi yapılan toplam 74 hasta (34 erkek, 40 kadın; ort. yaş: 54.5±13.7 yıl; dağılım 22-27 yıl) retrospektif olarak incelendi. Demografik ve klinik özellikler, cerrahi türü, yoğun bakım ünitesi ve hastanede kalış süresi ve ameliyat sonrası komplikasyonlar dahil olmak üzere veriler kaydedildi. Komplikasyonlar solunum, kardiyak, trombotik ve diğer komplikasyonlar olarak tanımlandı. COVID-19 enfeksiyonu ile ameliyat arasında geçen zaman kaydedildi. Tüm hastaların aşı durumu sorgulandı.

**Bulgular:** Semptomatik COVID-19 enfeksiyonu, ameliyat sonrası komplikasyon gelişimi ve yoğun bakım ünitesi veya hastanede kalış süresini anlamlı düzeyde etkilemedi. Yoğun bakım ünitesi ve hastanede kalış süresini etkileyen ana faktör, COVID-19 enfeksiyonu sırasında torasik tutulum idi (sırasıyla p=0.004 ve p=0.003).

**Sonuç:** Çalışma sonuçlarımız hastanede ve yoğun bakım ünitesinde kalış süresinin, enfeksiyon ve ameliyat arasında geçen zamana bağlı olduğunu göstermektedir. Hasta, COVID-19 enfeksiyonu sonrası ne kadar uzun süre beklerse, hastanede kalma süresi de o kadar kısaldı.

**Anahtar sözcükler:** COVID-19 enfeksiyonu, ameliyat sonrası komplikasyon, torakotomi.

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E-mail: drbulent18@hotmail.com

Doi: 10.5606/tgkdc.dergisi.2023.24640

Received: January 17, 2023

Accepted: April 03, 2023

Published online: October 19, 2023

**Cite this article as:** Yıldırım Güçlü Ç, Yenigün BM, Kocaman G, Kahya Y, İbiş C, Baloğlu S, et al. Assessment of complications and surgical timing in post-COVID-19 thoracotomy patients: A single-center experience. Turk Gogus Kalp Dama 2023;31(4):556-560. doi: 10.5606/tgkdc.dergisi.2023.24640.

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The novel coronavirus disease 2019 (COVID-19) pandemic has affected the care of patients during the perioperative period. As the pandemic continues, there has been an increasing number of patients who are currently recovering from COVID-19 and require surgery. The current guidelines are helpful to decide the proper timing of surgery; however, there is still no consensus about the correct timing.

Thoracic surgery has a special place in the patient profile and surgical profile in this pandemic period. Recent evidence about post-COVID-19 surgical patients claims that these patients face a significantly increased risk of morbidity and mortality.<sup>[1,2]</sup>

Several studies analyzing data about surgical timing have shown that surgery within six weeks is related to increased postoperative mortality and morbidity. Therefore, delaying surgery for seven weeks after COVID-19 infection is recommended.<sup>[3-5]</sup>

During the progression of the disease, treatment and prevention have been developed and, therefore vaccination should be taken into account while evaluating preoperative patients. The surgical timing, doses of vaccines, and the last dose of vaccination have become important questions during the preoperative follow-up.

In the present study, we aimed to assess the complications in post-COVID-19 thoracotomy patients and to evaluate the time interval between infection and surgery and the effect of vaccine timing and vaccine type in these patients.

## PATIENTS AND METHODS

This single-center, retrospective study was conducted at Medicine Faculty of Ankara University, Department of Anesthesiology and Intensive Care Unit and Thoracic Surgery between May 2020 and January 2022. Patients who underwent thoracic surgery during the COVID-19 pandemic and had COVID-19 infection before surgery were included. A total of 74 patients (34 males, 40 females; mean age: 54.5±13.7 years; range, 22 to 27 years) were included. Data of the patients were obtained from the hospital database. Demographic and clinical characteristics of the patients were noted. Surgeries having similar characteristics were included in the study, while pneumonectomies, esophagectomies and thoracic outlet syndrome surgeries were excluded.

The COVID-19 infection follow-up data of the patients were also evaluated. The surgery type, intensive care unit (ICU) stay, hospital stay, and postoperative complications were analyzed. Complications were defined as respiratory, cardiac, thrombotic and other

complications. The time period between COVID-19 infection and surgery was recorded. All patients were questioned regarding their vaccination status.

## Statistical analysis

Statistical analysis was performed using the SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation (SD), median (min-max) or number and frequency, where applicable. The significance of the difference in mean values between the groups was analyzed using the analysis of variance (ANOVA) in cases where the number of groups was more than three, while the Kruskal-Wallis test was used to analyze the significance of the difference in the median values. The independent t-test or Mann-Whitney U test was used to compare the groups. Categorical variables were analyzed using the Pearson chi-square or Fisher exact test. A *p* value of <0.05 was considered statistically significant.

## RESULTS

All thoracic operations were included in the study, both open and video-assisted cases. Only surgical operations for thoracic outlet syndrome were excluded at the beginning. The number of cases included in the study is as follows: lobectomy (n=33), wedge resection (n=29), thymectomy (n=5), pneumothorax (n=5), and thoracic wall mass (n=2). Fifty-seven patients were in the American Society of Anesthesiologists (ASA) Class II and 17 of them were in the ASA Class I.

Age was found to be correlated with the length of ICU stay. The statistical analysis showed that as the age increased, the length of ICU stay prolonged ( $r=0.389$ ). However, there was no significant correlation between comorbidities and ICU stay ( $p=0.075$ ). In addition, surgery type (open thoracotomy or video-assisted thoracotomy) did not have a significant effect on the development of complications in post-COVID-19 thoracotomy patients ( $p=0.088$ ).

When the postoperative complications were evaluated in terms of vaccination before surgery, no statistically significant relationship was found between the vaccinated and non-vaccinated patients ( $p=0.488$ ). However, the length of ICU stay showed a statistically significant difference between the vaccinated and non-vaccinated patients ( $p=0.007$ ), indicating that the non-vaccinated surgical patients stayed longer in the ICU.

The type of vaccine did not show a significant correlation with postoperative complications ( $p=0.380$ ).

There was no statistically significant difference in the mean length of ICU stay ( $p=0.354$ ).

The number of doses of vaccine before surgery did not have a statistically significant effect on postoperative complications, and length of ICU stay or hospital stay. Additionally, the last dose timing (the time period between the last dose of vaccine and surgery) did not significantly affect postoperative complications ( $p=0.332$ ).

Postoperative complications did not show a significant correlation with the time period between operation and infection. However, the length of ICU stay and timing of chest tube removal showed a negative correlation, and the length of ICU stay was statistically significant (Table 1).

Having a symptomatic COVID-19 infection did not significantly affect postoperative complications or ICU and hospital stays (Table 2).

**Table 1. The relationship between time period between COVID-19 infection and surgery, and postoperative complications, ICU stay, and chest tube removal time**

	Mean±SD	Correlation coefficient	<i>p</i>
Postoperative complication			
0	226.60±161.81		0.172
1	163.82±146.31		
ICU stay (day)		-0.392	0.001*
Chest tube removal time (day)		-0.131	0.272

COVID-19: Novel coronavirus disease 2019; ICU: Intensive care unit; SD: Standard deviation.

**Table 2. The relationship between symptomatic COVID-19 infection, and postoperative complications, ICU stay, and hospital stay**

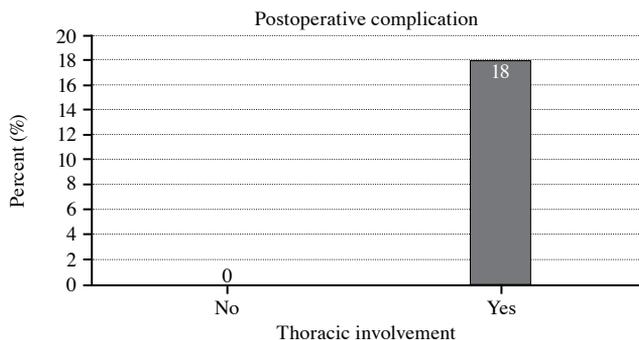
	Symptomatic COVID-19						<i>p</i>
	No (n=66)			Yes (n=7)			
	n	%	Mean±SD	n	%	Mean±SD	
Postoperative complication	9	13.6		2	28.6		0.283
ICU stay (day)			1.94±1.70			2.86±3.67	0.746
Hospital stay (day)			11.76±44.99			11.29±9.99	0.316

COVID-19: Novel coronavirus disease 2019; ICU: Intensive care unit; SD: Standard deviation.

**Table 3. The relationship between thoracic involvement of COVID-19 infection, and postoperative complications, ICU stay, and hospital stay**

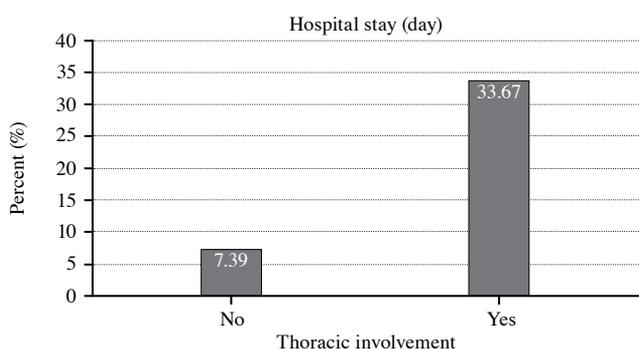
	Thoracic involvements						<i>p</i>
	No (n=66)			Yes (n=7)			
	n	%	Mean±SD	n	%	Mean±SD	
Postoperative complication	0	0		11	18		0.192
ICU stay (day)			1±0			2.23±2.08	0.004*
Hospital stay (day)			7.39±5.51			33.67±15.92	0.003*

COVID-19: Novel coronavirus disease 2019; ICU: Intensive care unit; SD: Standard deviation.



**Figure 1.** Postoperative complication rate in patients who had COVID-19 with or without thoracic involvement.

COVID-19: Novel coronavirus disease 2019.



**Figure 2.** Hospital stay in patients who had COVID-19 with or without thoracic involvement.

COVID-19: Novel coronavirus disease 2019.

The main factor which affected the length of ICU stay and hospital stay was thoracic involvement during a COVID-19 infection (Table 3, Figures 1 and 2).

## DISCUSSION

The world has faced with many challenges, since the COVID-19 pandemic has arisen. During this period, patients who require surgical treatment for their illness have been severely affected. The COVID-19 pandemic has brought incredible challenges in understanding how to decide the most optimal surgical timing for patients. Currently, the relationship between COVID-19 infection and post-thoracotomy complications is a trending question in the minds of surgeons and anesthesiologists.

At the beginning of the pandemic, all elective surgeries were postponed. However, it is not possible to discontinue all types of surgeries, even if they are elective. When the society learned how to protect themselves against the infection, surgeries began to take place again. In our study, the patients were

questioned regarding their vaccination status and in terms of complications. According to the results of this study, neither vaccine type nor vaccination status affected the length of stay in the ICU or hospital for post-thoracotomy patients.

Thoracic surgeries are some of the most challenging surgeries, because they are major surgeries and take place in the thorax, which can be affected by COVID-19. To find answers, we decided to examine our post-COVID-19 thoracotomy patients in terms of the time passed from infection to surgery. In general, it is recommended that patients should wait for a minimum of four weeks before undergoing elective thoracic surgery after a history of asymptomatic COVID-19.<sup>[6]</sup>

Hekimoglu and Beyoglu<sup>[7]</sup> found that the mean duration of COVID-19 infection to lung resection was  $25.79 \pm 15$  weeks and it was  $27.8 \pm 22$  weeks in a previous study.<sup>[7]</sup> The results of this study showed that the period between infection and surgery did not affect postoperative complications. This result may be related to the fact that the mean time was always more than four weeks, which is the recommended time interval. In addition, as the time period between infection and surgery is prolonged, the length of ICU stay shortens, which also has a statistical relevance.

Furthermore, COVID-19 infection may lead to many pulmonary complications, such as a reduction in lung compliance and other sequelae of pneumonia.<sup>[8,9]</sup> Thoracic surgery after COVID-19 infection becomes challenging due to the possible sequelae, particularly sequelae in the respiratory system. Although patients who had symptomatic COVID-19 infection did not show any significant difference in the complications or the length of ICU and hospital stay compared to asymptomatic patients, thoracic involvement during COVID-19 infection exhibited a difference in the ICU and hospital stays. In addition, COVID-19 infection during the perioperative period is known to be a risk factor for prolonged length of stay, morbidity, and mortality.<sup>[10]</sup> Taken together, it can be concluded that when patients' lungs are affected, the length of hospital stay may be prolonged after thoracic surgery. The lack of postoperative complications in our patients may be explained by the time passed between infection and surgery.

In our study, the mean time to chest tube removal was  $6.11 \pm 9.95$  days. This result is similar to the result of another study, which found a mean time to chest tube removal of  $6.36 \pm 2.46$  days.<sup>[7]</sup>

The main limitations to this study are its single-center, retrospective design. As the comparison

between post-COVID-19 and other thoracotomy patients is beyond the scope of our study, further studies are needed.

In conclusion, facing difficulties related to COVID-19 infection seems to affect our perioperative management for a longer time period. There are limited studies about postoperative complications in post-COVID-19 patients, particularly for thoracic surgeries. Our study results suggest that the length of stay is related to the time period between infection and surgery. The longer that the patient waits, the less time that the patient stays in the hospital. Another important finding is thoracic involvement during infection, which has a strong correlation with the intensive care unit and hospital stay. These results alert us to be more careful attention about post-COVID-19 patients while planning surgery, particularly thoracic surgery. Further studies are needed to understand post-COVID-19 effects and to decide the most optimal timing of surgery.

**Ethics Committee Approval:** The study protocol was approved by the Ankara University Faculty of Medicine Ethics Committee (date: 06.06.2022, no: 2022/326). Clinical trial was registered under NCT05496478. The study was conducted in accordance with the principles of the Declaration of Helsinki.

**Patient Consent for Publication:** A written informed consent was obtained from each patient.

**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Author Contributions:** Idea/concept, analysis and/or interpretation: Ç.Y.G., B.M.Y.; Design: B.C.M., G.K.; Control/supervision: Ç.Y.G., Y.K.; Data collection and/or processing: C.İ., S.B., B.C.M.; Literature review: C.İ., Ç.Y.G.; Writing the article: Ç.Y.G., B.C.M.; Critical review: B.M.Y., G.K.; References and fundings: S.B., B.C.M.; Materials: Y.K., G.K.

**Conflict of Interest:** The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

**Funding:** The authors received no financial support for the research and/or authorship of this article.

## REFERENCES

1. Abbott TEF, Fowler AJ, Dobbs TD, Gibson J, Shahid T, Dias P, et al. Mortality after surgery with SARS-CoV-2 infection in England: A population-wide epidemiological study. *Br J Anaesth* 2021;127:205-14. doi: 10.1016/j.bja.2021.05.018.
2. COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: An international cohort study. *Lancet* 2020;396:27-38. doi: 10.1016/S0140-6736(20)31182-X.
3. COVIDSurg Collaborative; GlobalSurg Collaborative. Timing of surgery following SARS-CoV-2 infection: An international prospective cohort study. *Anaesthesia* 2021;76:748-58. doi: 10.1111/anae.15458.
4. El-Boghdady K, Cook TM, Goodacre T, Kua J, Blake L, Denmark S, et al. SARS-CoV-2 infection, COVID-19 and timing of elective surgery: A multidisciplinary consensus statement on behalf of the Association of Anaesthetists, the Centre for Peri-operative Care, the Federation of Surgical Specialty Associations, the Royal College of Anaesthetists and the Royal College of Surgeons of England. *Anaesthesia* 2021;76:940-6. doi: 10.1111/anae.15464.
5. Rohatgi N, Smilowitz NR, Reejhsinghani R. Perioperative cardiovascular considerations prior to elective noncardiac surgery in patients with a history of COVID-19. *JAMA Surg* 2022;157:187-8. doi: 10.1001/jamasurg.2021.6953.
6. Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine* 2020;21:100331. doi: 10.1016/j.eclinm.2020.100331.
7. Hekimoglu B, Beyoglu MA. Early outcomes of lung resections in non-small cell lung cancer after COVID-19 pneumonia. *Asian J Surg* 2022;45:1553-8. doi: 10.1016/j.asjsur.2022.04.080.
8. Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: A descriptive study. *Lancet Infect Dis* 2020;20:425-34. doi: 10.1016/S1473-3099(20)30086-4.
9. Tuddenham WJ. Glossary of terms for thoracic radiology: Recommendations of the Nomenclature Committee of the Fleischner Society. *AJR Am J Roentgenol* 1984;143:509-17. doi: 10.2214/ajr.143.3.509.
10. Fraser S, Baranowski R, Patrini D, Nandi J, Al-Sahaf M, Smelt J, et al. Maintaining safe lung cancer surgery during the COVID-19 pandemic in a global city. *EClinicalMedicine* 2021;39:101085. doi: 10.1016/j.eclinm.2021.101085.